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The
Complete Farmer:
or
General Dictionary
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Agriculture and Husbandry:

comprehending

The most improved methods of cultivation;

The different modes of raising

Timber fruit-trees and other trees;

and the

Modern Management of

Live — Stock:

with discriptions of the

Most approved implements, machinery

and

Farm — Buildings.

5th Edition

Wholly re-written & Enlarged.

In 2. Volumes.

Vol I from A to Imp

Vol 2 from Imp. to Z

London 1807

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OR,

GENERAL DICTIONARY

OF

AGRICULTURE AND HUSBANDRY.

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LONDON:

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FOR R. BALDWIN; W. J. AND J. RICHARDSON; F. C. AND J. RIVINGTON; J. CUTHELL AND MARTIN; W. LOWNDES; W. OTRIDGE AND SON; LONGMAN, HURST, REES, AND ORME; CADELL AND DAVIES; J. STOCKDALE; LACKINGTON, ALLEN AND CO; B. CROSBY AND CO; CLARKE AND SONS; P. AND W. WYNNE; AND J. BOOKER.

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IMP

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ILES, a provincial term employed in some places to signify the beards of different sorts of grain.—See *Awns*.

ILIAC PASSION, in *farriery*, the spasmodic colic, a disease the seat of which is in the ilium, and in which that gut is twisted, or one part forced to enter the cavity of the part immediately below or above it. Hence it is also sometimes denominated the *volvulus*. It is removed by the use of antispasmodic remedies, such as opium, &c.

IMPLEMENT, a tool, instrument or machine, by which any sort of work is to be performed.

IMPLEMENTS *of husbandry*, the various kinds of tools or implements employed in cultivating land. It is remarked by the author of "Practical Agriculture," that, "in the construction of every sort of tool for the purposes of farming, as the chief objects ought to be the rendering the business of husbandry more complete, easy, and expeditious, and the introduction of a system of œconomy in respect to the labour that necessarily attends it, great care should be taken that they be well adapted to the purpose for which they are intended, and not unnecessarily heavy, while they possess sufficient strength and firmness for the various uses to which they may be applied. It is well observed, he says, in an ingenious and interesting periodical publication, (Anderson's Recreations in Agriculture, &c.) that there are no sort of implements that admit of greater improvement than those of husbandry, on the principle of diminishing weight, without in any degree abating strength." "Every man knows," says the author of that work, "that if a beam of any length be made of equal thickness throughout its whole length, and a weight sufficient laid upon it, it will inevitably break in the middle, and never at either of the ends; yet, unless it be in the poles of a sedan chair, he can scarcely recollect an instance in which weight has been diminished upon this principle. On the contrary, it is not at all unusual, in the construction of such implements, to see the thickness diminished nearly one half at the very weakest place, by means of a mortise cut out in it there, while its thickness in other places is four times greater than would enable it to bear an equal burden. No attention is paid in placing the wood in that position wherein it would be best able to resist the pressure to which it must necessarily be subjected; although it is very well known, that the same quantity of materials may be made to bear in one position above ten times as much as it could do in another. It is well known, that mortises weaken the wood to an astonishing degree when injudiciously placed; yet it is no uncommon thing to see two cross-mortises, each of them twice the size that in any case could have been necessary, made through a beam perhaps at the very weakest parts of it, just as accident may direct, without even an attempt to vary their position, far less to avoid them entirely, which in many cases might be done without the least inconvenience. It is well known that a small brace,

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judiciously applied, may greatly augment the strength without adding to the weight of an implement; yet contrivances of this kind, which are obvious to the merest tyro in mechanics, seem to be totally disregarded; far less do the constructors of such tools think of adopting new devices of this sort, which a very moderate degree of ingenuity might easily suggest. The importance of having every part firm and compact, in an implement that is subjected to jolts and shaking, is universally recognised; yet, from the most trifling considerations, we see this principle departed from, and loads of superfluous materials added, in vain, to supply the defects that are thus produced." He concludes by observing, that "it is not to one implement only that these observations apply, but to almost every common implement of agriculture."

The above principles, Doctor Dickson further remarks, "though extremely plain and obvious in themselves, are circumstances which seem to have been also greatly overlooked by the practical farmer, and too little regarded by those who have been principally employed in making instruments of this nature; as in almost every district of the kingdom, notwithstanding the many useful inventions and improvements which have lately been made, we may still meet with different sorts of implements that are not only exceedingly awkward and inconvenient from their clumsiness, but which are used with much disadvantage, on account of their great weight. Situation, and some other causes, will, however, he thinks, render a difference in regard to strength, and other circumstances necessary; and by them the operator must frequently be guided in the construction of tools for the purposes of husbandry." And that "as most of the implements of this kind are made use of by persons who have but little knowledge of the nature, power, or action of machines, and as they should be generally in the hands of farmers, they ought, he thinks, always to be constructed upon the most plain and simple principles, of such kinds of materials, and in such ways, as that they may be afforded at a cheap rate, nothing having operated more unfavourably to the introduction of new implements among this class of men, than the great expence that attends the procuring of them."

Descriptions of the several different implements that are capable of being made use of with advantage in practical husbandry may be seen under their proper heads.

IMPROVEMENT *of Landed Property*, the rendering it more valuable and beneficial to the proprietor and the public. Mr. Marshall, in his useful work on the Landed Property of England, has well observed, that the possessors of this sort of property "have a double interest, a two-fold motive, to incline them toward the improvement of their estates: namely to augment their personal incomes, and to increase the prosperity of the land they live in." But that "by the political constitution of this country, government have no power, or legal means, of advancing its prosperity, by the improvement of *appropriated territory*; unless by special acts of the legislature. And even these are confined to a few particular objects;—as drainage, inclosure, and the consolidation of intermixed lands; and these, only, where a plurality of interests are concerned. In the mass of improvements here to be brought forward, and in all cases of private property, it is, he says, out of the power of the public to interfere. A proprietor may suffer his estate to lie waste with impunity, provided he thereby injures no other man's private property. And if an estate is permitted to lie partially waste, or under-productive, for the want of due improvement, the loss to the public, though not so large, is of the self-same nature." He conceives that "in the appropriation of a wild uncultivated country, it might be wise in a government to reserve a power of rendering its lands productive; as a wise possessor of an estate reserves the right of keeping his farms in tenantable repair, and husbandlike cultivation, at the expense of the tenant who refuses or neglects to perform his duty." But that as "no such reservation has been made, nor in any way claimed, in this country, the proprietors of its lands are, he thinks, bound, not only by the ties of interest, but by those of honor, to promote their improvement."

It is further considered that the basis or "groundwork of improvement on which a practical man may tread with safety and full effect, is an accurate delineation of the *existing state*, together with a faithful estimate of the *present value* of the lands and other valuable particulars of an estate to be improved. A general map of the appropriated lands, promptly exhibiting the several farms and fields, as they lie, and shewing the existing watercourses, embankments, fences, and buildings, the woodlands, standing waters, morasses, and moory grounds,—the known mines and quarries,—together with the commonable lands (if any) belonging to the estate,—forms a comprehensive and useful subject of study to the practical improver. It is, to him, what the map of a country is to a traveller, or a sea chart to a navigator. If an estate is large, a faithful delineation of it will enable him, in a few hours, to set out with advantages, respecting the connexions and dependancies of the whole and its several parts, with which as many days, weeks, or months could not furnish him, without such scientific assistance. If on the same plan appear the rental value of each field, or parcel of land, and the annual produce of each mine, quarry, woodland, and productive water, *in its present state*, the preparatory information which science is capable of furnishing, may be considered as complete. And it remains with the artist to study, with persevering attention, the subject itself; in order to discover the species of *improvements* of which it is susceptible; and the suitable means of carrying them into effect" or execution.

He considers the *species of improvements* that are incident to landed property as very numerous. They may, however, he thinks, be classed under the following heads. 1. Reclaiming watery lands. 2. The appropriation of commonable lands. 3. Consolidating appropriated lands. 4. Laying out estates. 5. Laying out farm lands. 6. Laying out farms. 7. Improving farm lands. 8. Improving woodlands.

9. Improving waters. 10. Improving mines, quarries, &c.

The first may be accomplished by proper embanking and draining, the second by inclosure, the third by exchange, purchase, or sale, and all the others by the different methods that will be described under the particular head to which they immediately belong. See *Embanking*, *Draining*, *Commonable Lands*, *&c. &c.*

IMPOSTHUME, in *farriery*, a sort of swelling, or collection of matter or pus in any part of the body of an animal, caused either from an obstruction of the fluids in the part, which induces their change into such matter, or from a translation of it from some other part of the body. See *Abscess*.

INCISORES, the fore or cutting teeth of animals. See *Age of Animals*.

INCLINED PLANE, that kind of plane which forms an oblique angle with the horizon. Carriage-ways for the conveyance of heavy loads up steep hills, or other elevations, are generally formed on such planes, and have been found highly advantageous in enabling great weights to be drawn up them, by a small power of draught. In collieries, and other similar places, roads formed on this plan are frequently useful. Mr. Marshall well observes, that though this sort of convenience has hitherto been confined chiefly to coal-works or mines of other kinds, the time is at length arrived, "when carriages moving on level surfaces, or on gently inclining planes with little friction and without obstructions, are fast spreading over the face of the country." There are many situations and circumstances in which they may be applied with the greatest utility and advantage, besides their application in the above manner, but in which they have not yet been attended to. See *Rail-ways*.

INCLOSURE, a portion of ground fenced in, in some way or other, so as to be protected from being indiscriminately made use of. Inclosures or fields should always be proportioned to the nature of the soil, the situation and the extent of the farm to which they belong.

The kind or system of husbandry which is most proper must likewise, Mr. Marshall thinks, be taken into consideration. Though it is always convenient to have a few inclosures in the state of grass about the house or homestal, the general mowing grounds, and those of the pasture kind for store cattle and sheep, may be conveniently laid out at a distance, while those of the arable kind should be near at hand, that as little time as possible may be lost in the travelling of the teams and the cartage of the various produce. The number and size of inclosures of this sort must be regulated by the nature of the management that is the most proper to be pursued, and the extent and quality of the lands. Where there are sufficient lands that are of opposite qualities, as those that are retentive of moisture, and such as are porous and absorbent, there may be two sets of inclosures, in order that the business of tillage and putting in the seed may suffer the least possible interruption by rain, and the live stock be provided with pasturage under all circumstances of season, whether wet or dry.

And where the soils of extensive farms are generally absorbent or open, and of course suited to the turnip husbandry, it is also often convenient to have more than one set of arable inclosures, in order to have the power of guarding the more effectually against the great expence and trouble of distant conveyance of the produce.

But where the lands are rich, and the soil retentive, in situations that have the command of extraneous manure, or where they are connected with meadow or marsh lands, that furnish a due proportion of hay and pasturage, independent of those under grain, one set of arable inclosures, in proportion to the extent of the farm, may be fully sufficient: where, however, a great number of live stock for the purpose of making manure are to be supported by the arable, more variety will be requisite and useful, in order that they may be allowed to remain a sufficient length of time in the state of cultivated herbage, between the courses of arable crops in proportion to their kind, and the length of time they take up; regard being had to the convenience of procuring lime, or other extraneous manures. The size of inclosures may in some degree depend on the number, but in exposed situations where a great number of live stock are to be kept, the divisions should be smaller, not only for the benefit of shelter, while they remain in the state of cultivated herbage, but for the convenience of shifting and separating the stock.

The shape of the inclosures should, in some measure be directed by the form of the farm, and the direction of the roads and water-courses that may pass through it, as well as the nature of the grounds, the surface, and the aspect or exposure. The square or long square are always desirable forms where they can be had, but crooked and irregular forms should always be avoided. The two sides should lie parallel to each other, but an uniformity of soil in the same field should constantly be attended to, as being equally, or more necessary.

The direction of the inclosures should be the same as that in which the land can be most conveniently ploughed for crops, where it is compatible with the form of the farm. On a level or gently inclining surface, where the land is retentive, and requires to be laid up in rounded ridges, it should be nearly north and south, in order that the crop on the different sides may have equally the influence of the sun, and of course ripen more regularly.

But where the surface is steep, and the soil of the same quality as the above, the direction of the ridges must be regulated by the nature or face of the slope, winding to the right when standing on the brink of it, for the purpose of more easy ploughing them. Where the slope is very steep, and the soil absorbent or porous, it should be turned downwards of the declivity.

In the laying out of grass grounds, as the pastures and grazing lands, great attention should be had to water, and wherever it can be found or

brought in sufficient quantity with ease, they may be directed in the best way of containing them.

The watered meadows, where there are situations for them, must be laid out according to the nature of the situation, so as to have at all times the greatest command of water.

In the business of forming inclosures, much attention should likewise, Mr. Marshall says, be had to the roads and driftways that may pass through farms, directing them in such a manner as that they may open into them as much as possible, especially those at a distance, and thus the poaching and cutting up of the interior parts by live stock or cartage be prevented. Private roads, though necessary where there are not public ones passing through them, are always expensive in the increased number of fences that are requisite, and their keeping in repair, of course should be avoided as much as possible. See *Inclosing of Land.*

INCLOSING *of Land*, the act, operation, or business of taking in and dividing grounds by means of fences. The advantages that necessarily result from the inclosure of land, whether in a state of waste or common, or otherwise, are extremely numerous, and of the most material consequence to the community. The author of "Practical Agriculture" has observed, that "in addition to those of ascertaining and securing the property, it holds out, not only the most ready and certain means of improvement in the cultivation of the former, but in such as have been long under the plough, or any other system of management; being equally useful in its tendency to bring them into the most perfect and advantageous states of culture. Without inclosing, he conceives, however, much attention may have been paid, or expence incurred, in carrying on the various processes that are requisite in preparing land for the reception and growth of good crops; whether of the grain, root, or grass kinds, it is obvious that they can neither be conducted under the most beneficial management, nor yield the full advantage they are capable of, while they continue in a free and open state. Where the land is in a state of arable cultivation without inclosure, the crops, of whatever sort they may be, must constantly be exposed to depredations of various kinds; and if in the state of grass or pasture, injuries of the most prejudicial nature must frequently be unavoidably sustained. The great advantage and importance of inclosing land are still more fully demonstrated in the differences which may be observed, in respect to the quantity and value of the produce, in such as have been thus divided, over that which is cultivated in the state of open or common field." And Mr. Donaldson, in a practical work on the Present State of British Husbandry, has well remarked, that "in proportion as a field or a country is bleak, naked, and exposed to chilling blasts and winter storms, in the same proportion will it be unproductive, compared with lands more favourably situated. Inclosing is a mean of obtaining, by art, a certain degree of that genial warmth so essential to the production of valuable crops, but which nature is not always pleased to bestow. Every day's experience," he thinks, "proves that where grounds are sheltered from the violence of storms, as by garden walls, or by plantations of forest trees, they are more productive, and vegetation is earlier than in others similar in every respect, unless in regard to exposure. How many instances," continues he, "occur to establish this fact, in respect to large fields, as well as to gardens, orchards, &c. Let the observant farmer, who possesses an inclosed farm, examine that part of a field where, owing to the decay of the fence, the wind enjoys a free passage, and he will be satisfied of the benefit of inclosing, from the superiority of the crop in the other part of the field, over that which is within the influence of this additional exposure. While, on the other hand, the possessor of an open field farm, by examining the superior verdure that takes place in any part of an open field, that is by some accidental circumstances sheltered in a remarkable degree, may satisfy himself, that were the whole equally sheltered, the produce would be more abundant."

The author of the Mid-Lothian Report likewise states, that "as the warmest air lies nearest the surface of the earth, being that portion of the atmosphere which, like a blanket, nature spreads over the soil and its productions, fences of all kinds tend more or less to prevent such a valuable covering from being blown off by the winds."

By judicious fencing in, or inclosing of land, there can be no doubt but that warmth and shelter is afforded to cattle of various kinds. Under these circumstances, animals are invariably found not only to advance in flesh much more rapidly, but to be freer from disorders, than when kept in situations or exposures that are bleak, and which cannot afford warmth or shelter to them. "If," says Mr. Donaldson, "any person entertain doubts respecting the inclosed pastures being better adapted for rearing and fattening live stock than open fields, he may easily satisfy himself, by comparing the live stock in an inclosed parish with that of one in the open-field state. He is much mistaken," he conceives, "if he will not find them, in the latter, not only fewer in number, but each animal, on an average, thirty or forty per cent. inferior in value. In short, inclosing," he thinks, "may be denominated the first step towards effecting improvements in the breeds of the different species of live stock. And on the whole, this," he imagines, "is reasoning on plain established facts, and on such as afford the most indubitable evidence of the superiority of inclosed fields, whether for tillage or pasturage. Were farther proof necessary, the additional rent that is every where paid for inclosed land, beyond that paid for land of an equal quality in the open field state, is sufficient," he thinks, "to place the matter beyond all possibility of doubt."

The value of the land in most situations, is considerably improved by the practice of inclosing. The proportion of increase that may be produced in this way, whether the lands inclosed be in a

state of lease, or in the occupation of the proprietor, must, however, necessarily depend greatly on the nature of the soil, and the system of management that is afterwards pursued. The author of Modern Agriculture has remarked, that "lands of a middling quality, good turnip soil for instance, are probably benefited to a greater degree by inclosing, than those of superior or inferior quality. Lands of this description, in the open field state, may, he contends, be considered as rented to the full at fifteen shillings per acre; whereas there are few instances where such lands, when inclosed, are rented under twenty shillings; an advance so great as to afford the proprietor a handsome profit, after paying the interest of the money expended. Thus," says he, "does inclosing not only increase the quantity and quality of the produce, so as to enable the farmer to pay his landlord a higher rent, and to contribute a larger share to the revenues of the state, but from so many people being constantly employed in making and repairing the fences, inclosing, in this view, must also be considered as beneficial."

It must, however, be allowed, that there are in many districts of this kingdom, extensive, barren, and mountainous tracts of ground that are not capable of ever being inclosed with the least chance of advantage; or which, if they could be inclosed, could never derive any amelioration or improvement from it, the only methods in which they can be bettered, is by being rendered in some situations more free from injurious surface moisture, by judicious drainage, or the introduction of better breeds of the several kinds of domestic animals, which may be turned upon them. In other situations, where the lands are capable of being cultivated almost constantly under the grain system, inclosing, at least with any kind of high fences, may, in a great measure, if not wholly, be unnecessary. But, in common, where lands are proper for being cultivated under a system of husbandry, such as that of alternating grass or other kinds of green crops with those of grain or root crops, and in that way having the means of combining improvements in the breed of live stock with that of the cultivation of grain, the practice of inclosing must always be necessary and advantageous in a high degree.

But, however advantageous in these different points of view the benefits resulting from the inclosing of lands may be, the practice is far from being so much promoted and attended to as its importance seems to deserve.

It is probable that this may in some measure have proceeded from the great difficulty that necessarily attends the business in almost every instance, and particularly where waste or common field lands are to be inclosed on account of the great diversity of claims upon them, as well as sometimes from the improper management of the persons who have the direction of the business. Where inclosures of this sort are to be made, the circumstances that are chiefly to be regarded are those of the rights of the different classes of claimants, without any distinctions, the ascertaining fully the nature and extent of the land to be inclosed, the provision of proper cottages for the poor, in the acts of inclosure, and the appointment of commissioners duly qualified for the execution of the business. See *Commonable Lands—Common Field Lands, and Waste Lands.*

It is remarked by Mr. Somerville, in a paper on the different modes of forming inclosures, contained in the second volume of Communications to the Board of Agriculture, that inclosing has long been considered, and very justly, not only as a certain means of improving waste and uncultivated lands, but also as an essential requisite to the completion of improvements upon the best soils, and such as have been long under tillage. For whatever care or expence may have been employed in clearing, draining, tilling, manuring, weeding, &c. the whole of the benefits resulting from these can never be completely united, while the soil remains in an open uninclosed state. When the fields are in grass, they cannot be pastured to advantage without fences; and when they are in tillage, the crops, of whatever kind they may be, are exposed to every injury that can be suffered from the encroachments of sheep, cattle, or other animals. In many of the counties throughout Great Britain, the features of this improvement are, he says, strongly marked, and the ideas of shelter, ornament, and increased produce, are visible to even the most superficial observer, and afford a very just comparative estimate of the advantages to be derived from inclosing, by contrasting the value of lands that are inclosed with others of the same quality that still remain in an openfield state; the saving in point of labour, the perfect security to the crop while the lands are under tillage, together with the warmth and shelter afforded to the stock and herbage, when the fields are in pasture, form a striking contrast, when compared with the open, unsheltered, unprotected, and unproductive state of uninclosed fields. Obvious as these advantages are, it is to be regretted, he thinks, that the system of inclosing has, in too many instances, met with much opposition; and even in those cases where its benefits are clearly ascertained, much difference of opinion still exists, with regard to the nature of the fences requisite for different situations, the materials or plants that should be used, the best mode of executing them, and the season of the year most suitable for doing the work. The opposition so often made to bills of inclosure brought into parliament is a very striking proof, he observes, of the former; and the little judgment that is shewn in accommodating the fence to the natural circumstances of the fields to be inclosed is conclusive as to the latter. It too often happens, that proprietors and farmers, without duly considering either the nature of their soil, or its local situation, resolve upon and adopt a mode of inclosing which they have seen successful in other places, without once considering that the soil, climate, and other circumstances, which combined to render the plan successful in the situations they wished to copy, are totally

wanting in theirs. Owing to this, he says, much money is often expended, and many attempts prove abortive; the system of inclosing falls into discredit, and is considered as impracticable in many cases, where good and lasting fences might be reared at the same, perhaps less expence, than such as have failed. The reason commonly assigned is the rigour of the climate, while the true and only cause is, the ignorance or want of discernment in the persons who make these unsuccessful attempts.

It is further remarked, that the mistakes committed in this way are innumerable. Sometimes live fences are planted in situations and upon soils where it is impossible they can grow, far less arrive at perfection; and where substantial stone fences could be made, not only at little expence, but the building of which, by collecting the stones, would rid the adjoining surface of a nuisance, and remove an incumbrance which too often constitutes a material bar to its cultivation. The discernment necessary to discover this is not great; notwithstanding which, we too frequently have occasion to observe large fields inclosed, either with dwarf, crabbed, ill-grown hedges, and rotten decayed palings, or with turf or earthen mounds, obtained by paring off the best part of the surface soil; while the fields, thus wretchedly inclosed by fences which, on account of their inutility and perishable nature, must one day be abandoned, are covered with numerous large stones, the removal of which is an essential requisite to their improvement. The same circumstance often happens where live fences might be reared, which, in every instance where they can be brought to perfection, are to be considered as preferable to any other. In place of making the hedge with such plants as are suited to the soil and climate, they are often directly opposite,—dwarf, stinted, white-thorn hedges being very frequently seen upon cold wet lands, and in bleak exposed situations; upon which, if beech, black-thorns, or crabs, had been planted, they would have grown readily, and made complete fences in a very short time. In other instances the fence fails, or becomes faulty, from circumstances which the planter may be disposed to consider as immaterial. For example, in inclosing a large field, a great part of the outline of which is wet, if white-thorns are planted in the ordinary way upon the common surface, they will never make a good fence; whereas by planting them in the face of the bank of earth thrown out of the ditch, being thus raised above the level of the field, and placed upon a dry bed, they thrive, and soon establish themselves; while upon very dry lands, with open bottoms that possess little capacity for retaining moisture, the hedge very often dies from an opposite cause. When the plants are set upon the mound raised above the common surface, if the season is but commonly dry, their growth is considerably impeded from the want of moisture; and in severe winters, from the porous nature of the soil, the frost gets access to the roots, and either kills whole rows or lines of hedges in a few weeks, or so far hurts them as to check their future growth and improvement.

It is stated, that, in perusing the different County Reports, the whole of the surveyors concur in opinion as to the utility of inclosures; but that it is mentioned by several of them, in terms of regret, that the obstacles thrown in the way of this valuable improvement, by ignorance and obstinacy, are great and manifold. In some cases they speak in terms of the highest panegyric of the utility, cheapness, and durability of certain fences, such as quicks, beeches, crabs, &c. when they are planted upon the soils to which they are respectively the best adapted; while in others they mention, in pointed terms, the perishable nature and transitory value of many of the fences employed, the annual expence required to keep certain descriptions of them in repair, (the dead hedges and palings) and the great extent of valuable ground that is occupied by the others, especially the inclosures made by double ditches with a bank between them and a hedge on each side, and of the common hedge and ditch, and hedge and bank, which, at the same time that they occupy a considerable space of ground, are very seldom good fences, in some instances covering thrice, and in others four times the space that a fence of a different kind would do, if properly kept. Great contrariety of opinion also prevails in regard to making trees a part of the inclosure, either in hedge-rows or belts of planting. From such diversity and opposition of sentiment it is, he thinks, difficult to form any fixed or certain opinion upon the subject. See *Fence*.

The various points to which the proprietor or occupier ought to pay particular attention, before he commences any plan of inclosure, are, he says, the following.

1st. The nature of the soil.

2d. Its present worth, and the increase of value expected from inclosing it.

3d. The objects to be attended to in making inclosures; and whether the greatest value of the fences is expected to arise from their simply confining their stock, or from their affording shelter to both stock and crop, or from the union of shelter and inclosure.

4th. The modes of inclosure suited to the natural circumstances of the soil, climate, &c.

5th. The materials for making the fences, and the means of obtaining them.

The expence, another important point to be considered, must, he observes, depend upon so many local circumstances, that it is impossible to form any estimates that could be of much service. In regard to the durability of fences, and the shelter they respectfully afford, some observations will be given when the several sorts of fences are described. See *Fence*.

In respect to the first, or the nature of the soil, a careful inquiry seems to be one of those requisites essential to the success of every plan of inclosure; for though there are, comparatively speaking, few situations, however elevated above the level of the ocean, and scarce any description of soil, where a good live fence may not be reared, with one sort of

plant or another, yet it is an object of the first importance to know the plants best suited to every variety of soil, as, by a judicious choice of these, much loss and difficulty is avoided, and good substantial fences are made in a short time, and in many situations where, from a mistake as to the plants employed, the fence has languished for years, and ultimately perished, notwithstanding every care that could be bestowed upon it. In some instances, we have known twenty years' experience barely sufficient to undeceive those who had made mistakes of this kind. In the few cases, however, where this obstinacy has given way to common sense and observation, and where the plants of which the hedge was originally made have been taken up, and others better adapted to the soil substituted in their room, these last have, without much trouble, made a good fence in a very short space of time.

The white-thorns, or quicks, as they are commonly called, are reared with great ease, and, under proper management, soon make useful and handsome fences upon all dry soils, provided the situation is not too high and exposed. In such places, though the plants do not perish entirely, they never attain the strength or vigour necessary to make a good fence. In cases where the natural surface of the ground is rather too moist for white-thorn, the excess of damp may be carried off by a ditch on one side of the plants in the usual way. In marshy situations, where a ditch on one side would be insufficient to lay the soil dry enough for the success of white-thorns, it ought to have a drain on each side of the bank on which the thorns grow, and which would be particularly favourable for the growth of ash-poles.

In every case where thorns are planted upon the common surface without a ditch, and upon dry ground that has been previously prepared by dung, lime, &c. they grow better than where ditches are used, because the ditches serve as open drains to carry off the moisture—a circumstance which in dry seasons is often very detrimental to the growth of the hedge. Except weeding, the thorns should not be touched for the first four or five years of their growth, unless it be to crop the most luxuriant of the lateral shoots; at the end of that time they should be completely trimmed, and put into shape, leaving the top shoots untouched, till the hedge attains the necessary height; when this stem ought also to be cut over, and its farther growth upwards prevented by regular yearly cuttings.

Black-thorns, crabs, and briars, may frequently be treated in nearly the same manner as the white-thorn. There is, however, one remarkable difference between them, which is, that both the crabs and black-thorns will thrive, and become good fences, in situations where the white-thorn would perish: upon *tills*, and cold clays, for example, many fields of that description are completely inclosed with them, which could never have been rendered fencible if white-thorns had been employed.

The holly, when properly attended to, forms a thick and beautiful fence, and has an advantage over most others, in affording the same degree of shelter at all seasons. It grows well upon all soils, but particularly upon deep and moderately dry loams. Its progress is, however, slow, even in the most fortunate situations, which renders it unfit for common use; unless in pleasure-grounds, or places where taste or fancy require it.

The use of beech, for the purpose of fences, have not hitherto been very common; they are, however, fast coming into use, and perhaps will soon be the only kind employed in the uplands, or upon the cold wet soils in the lower districts of the kingdom; for these situations, so far as the experience of several parts of Scotland can ascertain that point, they are, it is said, remarkably adapted. In East Lothian there are several tracts of land, the soil of which is of a very inferior quality, that have had their value greatly increased, by inclosing them with beech hedges, upon which thorns were formerly tried without success, and much trouble and expence incurred in the attempt; while the beeches, which originally cost no more than the thorns, without any trouble, very soon become good fences. Along with their growing so readily in these unfavourable situations, they possess a property well suited to a cold or exposed country; namely, that of preserving their leaves through the winter, and indeed till an advanced period in the spring; by which they afford shelter to the grazing stock, and also to the pasture in the early part of the season, when it is apt to be hurt by the cold, nipping, frosty winds. The birch is peculiarly adapted to cold clays, where it seldom fails to thrive, and form a good fence; some caution, however, is necessary as to the management of it. It is also said to be the only plant which succeeds in the sandy rabbit-warrens of St. Leonard's forest, Sussex. In all cases where it is intended to cut or plash it, the operation should be done about the end of Autumn, as the juices are at that time retiring to the root, and long before the circulation is again renewed the wounds are healed: whereas, when the cutting is deferred till the spring, or beginning of summer, when the circulation is going on, the juices flow out by the wound, and continue to run off in that way during the whole of summer; by which means the plants are so weakened and exhausted, that many of them die—a misfortune which is entirely prevented by cutting about the end of autumn, or during the winter.

Willows, alders, and poplars, upon all wet or marshy grounds, thrive and are extremely useful, in completing inclosures in many situations, where other plants would either perish entirely, or remain in a dwarf stinted state. In Huntingdonshire, and several of the fenny parts of England, these plants, in conjunction with the alder, form almost the only description of live fences that are met with: their value in those parts is well known; and in every similar situation throughout the kingdom, if proper trials were made, they would be found equally useful. Hedges made with willows have an advantage over almost every other, as, after the hedge has arrived at a certain height, and is properly laid down

and bound together the young shoots may be annually taken off, and sold to basket-makers for a considerable sum of money. They have another obvious advantage, viz. the ease with which they are propagated—being raised from simple cuttings, without any other trouble than that of merely sticking them into the earth. Where this is practised, and in most situations it may be done with great ease, the farmer or proprietor will not only have his fields inclosed, but the fence will be converted into a source of revenue, by the sale of the young shoots yearly. Where the Huntingdon willow is used, a farther emolument may arise to the proprietor, by allowing a certain proportion of the plants to run up into trees; with very little care they soon arrive at a great size, and are of considerable value; the wood is soft, easily wrought into any form, takes a fine polish, and can be stained of any colour. The use of willows, poplars, &c. is not confined solely to wet or marshy grounds, they thrive upon almost every soil, and, indeed, make more progress upon such as are moderately dry than upon wet lands; upon the latter, however, they grow better than any other plant, and on that account deserve a preference.

The hazel, elder, &c. are plants which grow well upon all dry soils, and, if properly managed, by laying, wattling, &c. produce wood enough to form a very sufficient fence; but their want of prickles render them less eligible than thorns. The elder possesses a property which, along with the beauty of its flowers, will give it a preference to most other plants in many situations; namely, that of its being propagated from cuttings, with as much ease as the common willow.

Where the hazel is used for inclosing with, and the proprietor is disposed to take the necessary trouble, it may be rendered very useful, by cutting the hedge within four feet of the surface, every second or third year, and selling what is cut off to coopers or basket-makers: hazels are well known to make the best and most durable hoops, and generally bring a high price for that purpose.

The larch has not hitherto been much used as a hedge plant: from its growing so readily, however, and bearing the operation of clipping so well, it seems very much adapted for that purpose. In exposed situations, where thorns would fail, the larch would be found an excellent substitute, and many fields may be inclosed with it that would otherwise remain open. Where it is intended to inclose a field with larches, the plants made use of should be at least seven years old, and the strongest that can be obtained of that age. They should be taken up in the most careful manner, preserving the whole of the roots, and planted in a trench where a considerable quantity of dung or compost has been put. The most proper season for this operation is about the end of November, or in the early part of January; at either of which periods, if they are carefully lifted, and replanted without any destruction of the roots, they will, it is observed, suffer no check whatever, and grow readily and vigorously in the spring. It is worthy of notice that the tops ought never to be allowed to exceed the height of six feet; because after they pass that height, the wind has so great an effect upon them as to destroy any binding that may be made with their lower branches; cutting the tops has also another beneficial effect, namely, that of making them push out more vigorously below. Larches have, however, one defect, in common with hazels and some other plants, viz. the want of prickles, which certainly impairs the value of any fence made with them; as neither sheep nor cattle are disposed to respect any hedge so much as those that are made with prickly plants.

The whin, or furze, is a plant that is known to grow spontaneously, and attain a great size upon soils and in climates where scarce any other would live. In all cases where whins are found growing naturally, and of any considerable size, hedges of them may with safety be attempted: but as the whin seldom grows to any considerable height, hedges are not often made with it. This material, however, forms a good fence when a sufficient number of plants can be reared and brought to perfection; and, from its numerous prickles, very effectually prevents both horses, sheep, and cattle, from attempting to break through it. It has, however, one defect, and that is considerable; being raised a good deal above the common surface, the plants are exposed to many accidents, arising from drought, frost, &c.; accordingly it often happens in severe winters, that whole lines of whin hedges are killed at once.

In regard to the bramble, it has been recommended by many, as the plants grow well in almost any soil, to mix them with hedge plants, with a view to render the hedge thicker and stronger: but this method is highly objectionable; for though the bramble sends out numerous long shoots every year, these shoots seldom live above two, or at most three years. In a hedge, therefore, where brambles are numerous, and have their branches interwoven with other plants, by the yearly decay of a certain part of their shoots, they soon fill the hedge with dead wood, which has not only an ugly appearance, but is also hurtful to the other plants, of which the fence consists. Besides the leaves of the bramble are so broad and numerous, as nearly to deprive every other plant with which they are mixed of the benefit both of the sun and of the atmosphere. This, it is observed, is not opinion merely: it is confirmed by facts, as in almost every case, where there are brambles in hedges, they establish themselves at the expence, and in general the utter ruin, of every other plant.

The mulberry is known to grow and thrive in this climate, though hitherto it has been but little cultivated for any purpose; but there is great reason to believe that the general use of it for fences might prove highly beneficial, not only for inclosing the lands, but for food to cattle, &c. who are known to be uncommonly fond of the leaves, and also for the sustenance of silk-worms.

Under certain circumstances the smaller kinds of

fruit-trees or shrubs may be employed, not only as a means of inclosure, but as a valuable source of produce. For instance, few plants yet known grow more readily, or seem better adapted for hedges, than the gooseberry; some varieties of which rise to a considerable height, grow very thick, and, by the strength and number of their prickles, very effectually prevent any animal from attempting to break through them. In the lower districts of the kingdom, where the soil is deep and of a good quality, and where it is intended simply to inclose the field, very good hedges may be made with gooseberries; which, at the same time that they answered every purpose of a fence, would be valuable on account of the fruit, which might be converted to many useful purposes. See *Hedges*.

With regard to the second point, or the present value of the soil, and probable increase from inclosing it, it is observed, that in every plan of improvement, whether by inclosing or otherwise, it is very material to ascertain the present worth of the estate, and the probable increase of value that may be expected from the undertaking; for, unless this point is judiciously weighed, the operations will proceed at random, and much labour and expence may be incurred without any adequate advantage resulting therefrom. For much and justly as the advantages of inclosing are extolled, (and they are unquestionably great) there are certain circumstances of soil and local situation that bid complete defiance to this and every other attempt at improvement. For example, in high rocky situations, where the soil is not only thin, but of a bad quality, where the lands can never be subjected to the plough, and where the herbage is not likely to be much ameliorated by shelter, little benefit will be derived from inclosing. The only advantage resulting from the practice in such cases seems to arise from the saving of a shepherd's wages, which, when the stock are pastured in an inclosed field, is rendered unnecessary; but which, if accompanied with no other advantage, will be found a paltry equivalent for the expence of inclosing the soil. On the contrary, however high or exposed the situation may be, if the soil is of a good quality, and a species of plants can be met with of a nature so hardy as to bear the climate, the value of the property will be so far improved by the shelter arising from the fence, as amply to compensate the expence incurred in making it. In many of the bleakest and most exposed situations in Britain, the soil, though greatly elevated above the level of the ocean, is equal in quality to what is met with even in the most favoured situations, and for the most part requires nothing but shelter and judicious culture to render it highly valuable. In detailing the different kinds of fences, especially that known by the name of hedge and belt of planting, an opportunity will be taken of pointing out several instances, where the mode of inclosing has benefited the property so inclosed, in a tenfold proportion, in a very few years. Upon this point it remains only to hint, that every person, whether proprietor or farmer, should, before he commences his operations, pay very particular attention to the present value of the property in an uninclosed state, and the extent to which it may be improved by inclosing; as without such previous knowledge, in place of being repaid by the pleasure arising from seeing the property ornamented and improved in proportion to the trouble and outlay of money, large sums will often, he supposes, be expended, without adding to the general appearance of the country, or materially contributing to augment the value of the soil.

In what relates to the third point, or the objects to be attended to in making inclosures, it is remarked, that, in some situations, all that is required is merely the confinement of the stock; in others, shelter to the stock and herbage is the principal object: but in a great majority of cases, the union of both is necessary to complete the system of inclosing. In wild low situations perhaps a stone wall, or a low thorn fence, will answer every purpose required, and produce every benefit that could be expected from the inclosure; yet these fences would be found totally incompetent to the purposes of inclosure in the hilly and upland parts of the country; for, though confining the stock might be completely answered by either, the important requisite of shelter would be entirely wanting. Other matters of equal importance ought to enter into the consideration of persons inclosing. The separation of the soils inclosed, so as to render that of each field as nearly as possible of an uniform quality, the separation of stock as may be thought most advisable, together with the securing a sufficient supply of good water, are requisites so essential to the success of the undertaking as to entitle them to a high degree of attention.

It is remarked by Mr. Donaldson, in his Modern Agriculture, in speaking of inclosures, that the old fences were planned with a view chiefly to inclose soils as similar as possible within each division: beauty or regularity does not, he says, seem to have attracted much of the proprietor's or farmer's attention; utility, it would appear, they kept principally in view. Our modern improvers, on the other hand, he observes, in too many instances at least, shew an evident disposition to sacrifice utility to taste and regularity in appearance. Hence, it is not uncommon, he says, in a new inclosed parish in England, or even in an estate in Scotland, where the proprietor has the sole power of management, to see several different sorts of soils in the same inclosure, which, with proper attention, and a little sacrifice of taste, might have been included in the adjoining fields with much greater propriety. Thus, in place of forming the fences in such directions as that the greatest advantage might have been derived, by not only inclosing and subdividing the estate, but also by separating, in every possible case, soils of different and opposite qualities, it not unfrequently happens, that the sands of Norfolk and the clays of Lincolnshire are, as it were, inclosed within the same fence; than which it is impossible to figure any management more improper. If a

regular rotation of cropping be adopted on a farm where each inclosure contains a variety of soils, it will of course be suited to that sort which most prevails. When the most prevalent soil is of a light and sandy nature, the portions of better soil contained in each inclosure must be cultivated under a system, in regard to cropping, not the best calculated to produce the greatest returns. On the other hand, when the predominant soil is deep and fertile, that of a lighter nature must be exhausted, were a mode of cropping pursued calculated only for the soil of superior quality. Whereas, had a judicious arrangement been made in regard to the form of the inclosures, the good and bad soils might, in many cases, have been kept separate; and, as often happens, two rotations of cropping adopted on the same farm with equal propriety. Perhaps also fences in straight lines, in place of curves, might be disputed on the score of taste; but that is a question foreign to the object of the present investigation, which has utility only in view.

The new inclosures, says he, differ as much from the old in regard to size as in form. The old inclosures generally contain from three or four to six or eight acres; few of such as can be properly denominated old exceed ten; while those that have been formed in later times extend from ten to twenty, sometimes to forty or fifty. This difference in the size of inclosures is greatly, if not entirely, he says, owing to the change of opinion in regard to what was and what now is considered by individuals as the proper size of farms. In the same, or nearly the same proportion as farms were enlarged, so were the dimensions of the new inclosures. The more ancient inclosures, such as those in several parts of Essex, Kent, Suffolk, &c. are evidently, he thinks, too small, while those in many other districts are too large. There is a medium in regard to the size of inclosures, as well as in other things; and to discover and adhere to it, as nearly as circumstances will allow, is certainly for the interest of the proprietors, the tenants, and the public. Where the inclosures do not exceed three or four acres, the quantity of land taken up in erecting the fences is, he says, a very heavy *per centage*, viewing the inclosure as a part of the farm, of the estate, or of the national territory. A free circulation of air is also prevented, especially if there be hedge-row trees, to such a degree, that it may be difficult to say whether the crops are more benefited or injured by the fences, when so closely placed. As one of the most important advantages that can be derived from inclosing is shelter, large inclosures must, on the other hand, be equally improper. When a tract of thirty or forty acres is included within one fence, it would be absurd, he says, to suppose that the fence can afford the same degree of shelter as if these thirty or forty acres had been subdivided into three or four fields. When the inclosures are made so large, the advantage of fencing, in so far as regards shelter, must be merely a secondary object with the person who erects the fences.

Having pointed out the loss and inconvenience arising from too small and from too large inclosures, it may, he thinks, be necessary to suggest what, upon the whole, ought to be considered the best size. This he proposes to do on the authority of Mr. Bakewell, from whom, he thinks, the British farmer might have learned many useful lessons on subjects connected with husbandry. Besides what related more especially to the improvement of the different species of live-stock, it was the opinion of that expert farmer, that fifty acres of pasture, divided into five inclosures, would go as far in grazing cattle as sixty acres all in one field. If there was a man in the island that exceeded another in knowledge as a breeder and grazier, it was, he says, Mr. Bakewell; his opinion, therefore, founded on the experience of many years, may be considered as conclusive in regard to the proper size of inclosures, in so far as the breeder or grazier is concerned; and from what is above stated, it appears that from eight to twelve acre fields are best calculated for either of these purposes. Mr. Marshall also, in corroboration of this, hints, in his Rural Œconomy of Gloucestershire, that the most experienced dairy farmers in that district consider what he calls a suit of pastures as a more profitable mode of pasturing cows than one large inclosure. As no farm can be kept constantly in tillage with advantage, and as the best mode of cropping that can possibly be adopted for the generality of soils is, in his apprehension, that by which nearly the one half of the farm is in tillage, and the other in pasture, it is necessary, in determining the proper size of inclosures, to have regard to the two great branches of husbandry, viz. grain and grass. In regard to the latter, so far as the practice of the two counties most remarkable for grazing and dairying can go, the matter seems determined; and in respect to corn husbandry, as middle-sized inclosures enjoy the advantage of shelter to greater degree than those of larger size, and a more free circulation of air than those of small dimensions, there can be no reason to hesitate in determining, that the size of inclosures best suited for the breeder, the grazier, and the dairyman's purposes, will also best answer those of the cultivator of grain.

Respecting the fourth point, or the modes of inclosing suited to the natural circumstances of the soil, it is stated, by Mr. Somerville, in the work mentioned above, that this matter has been in some degree discussed in the preceding article. There cannot, however, remain a doubt that the success of every attempt that is made in the way of inclosing must in a great measure depend upon the discernment of the person who undertakes it. A material consideration in such cases is, he says, to determine whether live or dead fences are the most eligible or best suited to the natural circumstances of the soil. The former comprehends every fence made with growing plants; the latter includes not only the different kinds of wall or dike made with dry stone, stone and lime, stone and clay, turf, &c. but also the different kinds of dead hedges and palings. Into this estimate ought also to enter the compara-

tive usefulness and durability of each, together with the first cost. In general, the first class, viz. live fences, where the plants are properly chosen, and well adapted to the soil, are uniform in this respect, that under proper management their value is yearly increasing: while that of even the best-constructed dead fences is annually growing less. Where they consist of dead hedges or palings, their decay is certain, and commonly rapid; and even when they are constructed with stone and lime, which are by far the most durable of that class, though they make perfect fences at once, and the proprietor or occupier enters into immediate possession of every advantage that can arise from them, yet from the hour they are built their decay commences, and, after the first few years, a regular and progressive expense is incurred to keep them in repair.

It is asserted, that in all upland situations, the first class of fences will be found the best: of that class, however, the beech hedge, and hedge with a belt of planting, deserve a preference, as they unite in the highest degree the important requisites of shelter, ornament, and inclosure. The beech, under proper management, attains a great size even upon the poorest soils, and soon forms a useful fence, in situations where thorns and other kinds of hedge plants would either perish or remain in a dwarfish state; with this additional material advantage, that by keeping its leaves during the winter, it affords shelter to the stock and pasture at the most inclement season, and when it is most wanted. But that in low situations, where little is to be apprehended from the want of shelter, thorn hedges kept low, or any of the different kinds of stone walls, will answer every purpose; and as the soil in these low situations is for the most part of very great value, those fences, from the little space they occupy, will be found preferable to every other kind. Concerning the nature of the materials for making fences, in the foregoing observations upon the modes of inclosing suited to the natural circumstances of the soil, it has, he says, been pointed out what appeared the best, upon the supposition that the materials could be readily obtained at a reasonable price. In many situations, however, the scarcity and apparent want of many of these materials form an almost insuperable obstacle to inclosing upon the plan above hinted at. For instance, in the remote parts of the kingdom, where the different kinds of trees and hedge plants are either very scarce, or not attainable but at an enormous price, it will often be found necessary, in the inclosing of upland districts, to surround the fields with stone walls in place of hedge, or hedge and belt of planting; and in not a few situations in the low lands, where stone walls would be the most eligible fence, from the scarcity of that article, hedges, or hedge and ditch, are had recourse to. Under such circumstances, necessity is the law, and the person inclosing must accommodate his plans to his resources. It will, however, frequently happen, that the materials wanted will be met with upon the spot, not only without expence, but with much advantage to the property; as in cases where the fields are infested with stones, their removal will at once facilitate the improvement of the field, and furnish good materials for inclosing it. But even where the resources are less visible, and there are no stones upon the surface, by a careful examination of the sub-stratum plenty may be met with; or, in defect of these, clay for making either bricks or mud-walls may be had, merely for the trouble of digging or getting it up.

In regard to the other kinds of dead fences, such as palings, dead hedges, &c. materials for constructing them may, he says, be procured in almost any situation, from the thinnings of young plantations, from coppices, and the cutting down of old hedges; even the deficiency of hedge plants and young trees might be, in a great measure, if not entirely, got the better of, if every proprietor were to have a small nursery for raising them for his own use, and that of his tenants. To the convenience and saving of expence with which this practice would be attended, we have, he says, to notice an unspeakable advantage, viz. that arising from the use of plants propagated in, and inured to, the climate where they are afterwards to grow. It must require little knowledge of the subject to convince any one, that plants of whatever kind, reared in the upland and hilly parts of the kingdom, will thrive better than such as have been reared in the warmest and most sheltered spots. To what, says he, are we to ascribe the amazing size, and luxuriant growth of many trees in the Highlands of Scotland, or even in Norway and North America, but to the circumstance of their having come into existence in the climate and situation where they were afterwards destined to grow; and by being thus early inured to the climate, became, to all intents and purposes, indigenous.

With respect to suiting plants to the soil, it is remarked, that it is not the least important consideration with persons inclosing, after having determined whether live or dead fences should be used, to make choice of the plants best suited to the soil. In the flat low parts of the country, where the soil is loamy or gravelly, and at the same time moderately dry, and not greatly exposed to any prevailing winds, whitethorns will be found both the cheapest and the best. Hazel, elder, and a multitude of others, might be used for that purpose in these situations; but they are liable to objections which the thorn is not. If in these low situations it is meant to plant trees along with the fence, either in hedge-rows or belts, the dry soils should, he says, be planted with oak, ash, elm, plane-tree, chestnut, beech, &c. and the moist parts with poplars, and the different kinds of willows; by such means the whole will thrive, and in a short time become valuable to the proprietor. In the upland and hilly parts of the country, unless the soil is wet indeed, the hedge plants should consist either entirely of beeches, or a mixture of beech and larch; the last is known to answer well in these exposed situations, and not only endures planting and clipping without injury, but thrives remarkably under these operations; where the soil,

however, is wet or spongy, a different description of plants should be used; willows of different kinds, poplars, birch, or *allar*, will then, he thinks, be found the best, and ought, in preference to every other, to be made use of. By thus adapting the plants to the soil and climate, few plans of inclosure will prove abortive in any situation.

Having premised these general observations, he proceeds to consider the present state of Great Britain in regard to inclosures. From the perusal of the different surveys now in possession of the Board of Agriculture, it appears, he says, that, in almost every county throughout the kingdom, considerable tracts of the soil are inclosed; and that many plans of additional inclosures, to a very considerable extent, are now in contemplation. The surveyors appointed by the Board are unanimous in their approbation of the system, which they represent as so beneficial in its consequences, that in many cases the value of the property has been thereby increased in a fourfold proportion, and in some well-authenticated instances, considerably more. The fences at present in use are of great variety; and a part of them, particularly such as have been made of late years, executed, he remarks, in a handsome substantial manner, uniting at once the important points of shelter, inclosure, and ornament. The appearance of these, owing to the judicious manner in which they are managed, convey to the mind the strongest ideas of permanent and valuable improvement. The different kinds of stone walls, by having a broad foundation sunk deep enough in the earth to place them beyond the reach of frost, tapering gradually upwards, and secured at top with a proper coping, are found to last many years, with but very slight repairs. The hedges, from the circumstance of their being planted at a proper season, the plants made use of adapted to the nature of the soil, and afterwards kept in order by regular weeding and trimming, are of immense value, and form the most beautiful and lasting fences that can be imagined. Many other descriptions of fences are equally perfect and valuable; but though these circumstances are mentioned with much satisfaction, and must give pleasure to every person who feels, or has the smallest interest in the improvement or welfare of his country, it is with pain, he remarks, that in too many instances the system of inclosing is extremely defective; and much less solicitude has been shewn to secure and unite the whole of the benefit to be derived from it, than the importance of the subject deserves. To confine the stock seems, he says, in too many instances, to have been the sole object; while the weightier matters of shelter, both for the stock and pasture, separation of soils, separation of stock, and many other points of equal importance, have been entirely overlooked. In too many instances, no attention has been paid to the natural circumstances of the soil intended to be inclosed. High inaccessible walls, belts of planting, and hedge rows of trees, being very often met with in the lowest and warmest situations, where little or no shelter is necessary; while in the hills and uplands, and along the sea-coast, where shelter is indispensable, both for the stock and pasture, and where its advantages are incalculable, the fence very often consists of a naked stone wall, which, though it may, and indeed does answer the purpose of confining the stock, possesses no other advantage; and many tracts of immense extent, the value of which might be improved in a tenfold proportion by hedges and belts of planting, exhibit a naked bleak appearance, and continue exposed to every blast. The loss and disadvantage attending this injudicious mode of inclosing are, he thinks, strikingly obvious. In the low warm parts of the country, where the land is of immense value, much of it is occupied by fences which the nature of the situation does not require, while in the more elevated and exposed parts, where shelter is the *sine qua non* of improvement, and where the land occupied by the fence is, comparatively speaking, of small value, the fence, in place of affording the necessary shelter both to the stock and pasture, is barely adequate to the purpose of inclosing the field. Under such circumstances, the pasture will for the most part be scanty; and neither a breeding nor a feeding stock will make half the progress upon it that they usually do in cases where they enjoy the benefit of complete shelter. A defect equally injurious to the proprietor or occupier, and highly inimical to permanent improvement, seems also, he says, to prevail in the choice of the materials of which inclosures are generally made. In every instance where circumstances will admit of it, present use ought, if possible, to be united with durability, in the formation of every fence; an attention to this is, however, too often totally wanting, both with proprietors and farmers. Provided the present purpose is answered, future consequences are disregarded; and neither a knowledge of the perishable nature of the materials made use of which daily experience presents to their view, nor the frequent and heavy expences to which they are put for repairs, have been sufficient to make them alter their system. Amongst these perishable fences are to be ranked the different kinds of earthen and mud walls, of turf, of turf and stone, together with the whole of the wooden fences, comprehending the different kinds of paling and dead hedges.

It is farther observed, that the ancient custom of inclosing fields with high earthen banks or mounds, sometimes with and sometimes without a paling on the top, which prevailed formerly in many parts of England, and which is now pursued in the north of Scotland, though it did very well as a rude essay in the way of improvement, when other modes of inclosing were either unknown or imperfectly understood, and might for a time answer the purpose, either of confining the grazing stock while the field was in pasture, or protecting the corn crops when it was under tillage, is perhaps the worst and most perishable of all fences. After being reared with much labour, and committing a theft upon the adjoining surface, which is pared off to a considerable distance on each side, it remains but a very few months, or even weeks in a perfect state: indeed,

from the moment it is made it begins to decay; and the operation of the weather upon it, for a few years renders it useless as a fence. Accordingly in many parts of the island, we meet, he says, with the remnants of such fences, which, though they were originally of considerable height, and to appearance strong and formidable, are now so completely beat down and levelled by the action of the weather, as to render it in some cases a matter of difficulty for the curious to trace their foundations, or the direction in which they formerly ran. The case is the same with walls formed entirely of turf, or a mixture of turf and stone. These, though made at considerable expence, and, as has been already noticed, by robbing the neighbouring surface, are equally perishable as the simple earthen mound. Upon whole farms, and even estates, that were formerly inclosed with turf, or stone and turf walls, nothing now remains, he says, but their vestiges, which, while they exhibit a striking proof of their perishable nature, afford at the same time a salutary lesson to proprietors and others, to beware of such temporary expedients; as, however cheap such fences may be in the first instance, in their best state they are but imperfect, and in the end are the worst and most expensive of any. An equal defect, it is asserted, prevails in many instances where the fence is entirely of stone. Where the walls, in place of having a good foundation sufficiently removed beyond the reach of frost, broad at bottom, tapering gradually upwards, and finished at top with a substantial coping of flag-stones and lime or turf, so formed as to prevent the decay of the building, are in many instances built upon the plain surface, with scarce any taper towards the top, and without any coping at all, except perhaps a slight one of turf, which soon moulders away, and, if the wall is built with lime or clay, permits the moisture to soak down and destroy it. The same improvidence and want of judgment, he says, discovers itself in carrying these walls through every kind of soil, wet as well as dry. In the formation of extensive inclosures, it very often happens that a part of the line in which the fence is to run is wet and spouty; in place of paying attention to that circumstance, discontinuing the wall where the dry land terminates, and either attempting to lay the spouty parts dry by draining, or plant a hedge of willows, poplars, or other plants adapted to wet soils upon the surface, the wall is too frequently continued through the whole. The consequence (as may very naturally be expected) is, that the wall, for want of a solid dry foundation, soon tumbles down or is continually needing repairs. Along with this inattention to the shape of walls, considerable loss arises from building them with round, or what are termed land-stones. These, from their shape, are incapable of presenting a sufficient extent of surface to each other to bind them, or give stability to the building, by which means it seldom lasts long, though clay, or even lime is made use of. The practice of mixing clay is particularly inexpedient, as in general the first winter's frost, or a long continued series of wet weather, saturates the clay so completely, that the wall swells, bursts, and is thrown down. And it is remarked, that the practice of inclosing with the different kinds of dead hedges and palings is productive of equal loss both to individuals, and the community. Were these fences made to answer only a temporary purpose, such as protecting a young hedge, &c. &c. the loss would not be great, as their original value is small, and, long before they were totally decayed, the hedges they were meant to protect would be so far advanced, as to make good fences without their assistance. From the perusal of the different reports, however, it appears, he says, that in many of the English counties they are resorted to in cases where permanent plans of inclosing are intended, and are the only fence made use of. The surveyors who have noticed the practice are unanimous in their disapprobation of it, and represent the fences as perishable and in the highest degree expensive. In several whole districts, dead hedges of different kinds form the only fence, and occasion an annual expence upon the property so inclosed, amounting from a fifth to a tenth part of the rent. Nearly an equal loss and expence is, he says, incurred in inclosing with paling; and what adds to the regret that arises from the observation of this ruinous practice is, the soil and climate in most cases where it prevails are well calculated for the growth of live fences. It is evident, he thinks, that what is said above will be considered by the public at large as a reproach, and will be felt as such by those concerned. We admit that the feelings of individuals ought, in every instance where it is compatible with the public welfare, to be respected; but where either their opinions or practices are hurtful to the country, or hostile to its improvement, they are justly reprehensible. Forbearance in such cases is, he says, vice; and though exposing their faults may, in some instances, cover them with shame, yet the task is necessary; and by fixing the attention of the public upon the subject, has very often the effect of preventing the most serious, abuses and bringing about valuable improvements. If any thing that is now mentioned is conducive, in the smallest degree, to correct the faults in the system of inclosing above enumerated, or to change the perishable dead fences for good quick hedges, the purpose of these observations will, he says, be fully answered.

Where wet ditches constitute the fence, either in their simple state, or as making a component part of another fence, such as ditch and hedge, &c. due attention has in very few instances, it is observed, been paid to secure every advantage that might be derived from their use. Proceeding without judgment, the ditches in many counties are made equally deep and wide upon wet and dry lands, from an erroneous opinion, that the drainage of the field, and the future prosperity of the hedge, require a ditch of certain dimensions. In place of laying off the field in such a style as to make the ditches subservient to the purposes of drainage as well as inclo-

sure, they are frequently, he says, dug at random, of an uncommon depth and width, with a high bank or mound of earth on the side next the field, so strong and thick that no water can find its way through it. In that way the ditch, in place of acting as an open drain for carrying off the water from the adjacent fields, acts as a kind of barrier to prevent it from getting away; while, from the want of a proper level and outlet, when once filled it becomes a kind of reservoir; and, by continuing filled with water three parts of the year, chills the roots of the hedge plants so much, that they either perish entirely, or remain small, stinted, and diseased. In this place it may be necessary to observe, he says, that the use of ditches as open drains has in many instances been completely misunderstood. In most of the old inclosures they were thought valuable only in proportion to the quantity of water they were capable of containing, without considering whether they were so situated as to convey that water to a proper outlet. In the valuable and judicious Reports from the counties of Ayr and Stirling, these deep and wide ditches are, he says, described, and their defects noticed: in the former county they are from six to eight feet wide, and of a proportionable depth; and in the latter, they are in many cases upwards of twelve feet wide. The quantity of valuable ground occupied in that way, over such extensive districts, must be immense; and when to this is added the injury done to the hedges from their roots being chilled, and the inconvenience arising from having a tract of country so much cut and intersected by these canals during winter, which prevents all passage through them, and the danger of weak horses or cattle, or even unfortunate travellers, who mistake their road in the dark, falling into them (circumstances which, he says, unfortunately too often occur), together with the expence of making such deep excavations, it will readily appear that the practice is bad, and that every purpose both of drainage and inclosure might be answered, at perhaps a fourth part of the expence, and without any of the risks or inconveniences we have mentioned. In speaking of ditches as fences, notice will be taken of the proper mode of forming them, so as to render them subservient both to the purposes of drainage and inclosure, with the least possible expence. See *Ditch Fence*.

In respect to hedges, it is remarked, that in many parts the defective method of rearing and managing them is no less striking. In place of making the whole hedge of one kind of plants, suited to the nature of the soil, and such as, when arrived at a certain age, are capable of making a good fence, the inclosure is frequently surrounded with a motley mixture of shrubs, many of which, even in their most perfect state, are unfit for making a fence; while others, though they might have answered that purpose pretty well if the whole fence had been made with them, yet, from the circumstance of their being mixed with others, which not only come into leaf, but also shake their leaves at a different season, both hurt each other's growth, are offensive to the eye, and take from the general appearance of the country. Such, however, are the fences, he says, in some parts of the finest counties in England, where, upon the top of a high bank that has been raised by robbing the adjoining ground of its soil, a motley hedge, consisting of various plants, is met with, full of gaps filled up with stones or dead wood, forming a very insufficient fence, either for the purpose of confining the stock while the field is in pasture, or of protecting the crops while it is under tillage. In other cases, where the plants of which the hedge consists are of one kind, it too often happens, that they are by no means suited to the nature of the soil. For example, in inclosing a large field, where a part of the line of fence is perfectly dry, and a part of it wet and swampy, in place of planting quicks or white-thorns upon the dry spaces, and willows, poplars, birches, or such plants as thrive in damp situations upon the wet parts, the whole field is often surrounded with thorns, greatly to the hurt of the proprietor and occupier; as upon the dry land the thorns thrive, and in a few years make a good fence, while upon the wet parts they either fail entirely or are good for nothing; whereas, with a little judgment in accommodating the plants to the soil, planting quicks upon the dry land, and willows, poplars, &c. upon the spouty and swampy parts, the whole would thrive, and there would be no defect in the line of inclosure. To this mistake (a want of judgment in accommodating the plants to the soil) is, he says, to be added the defects which commonly take place in the after-management and training of hedges. It is now well known, that the whole or the greatest part of the plants of which hedges are made, if left to themselves, without pruning or weeding, run up to a considerable height, grow broad and bushy at top, and become open and naked at bottom. To prevent this, there is no remedy known, but that of cutting over the main stems of the plants of which the hedge consists, after they have attained a certain height, and pruning or trimming the lateral branches in such a way as to preserve the hedge thick and broad at the bottom, and give it a gradual taper towards the top. But in place of this management, the hedge, in most instances, after being planted, is abandoned to its fate, and neither weeding, pruning, nor indeed any other attention bestowed upon it: in that way, a number of the plants are either choked by weeds, or remain in a dwarf stunted state; and such as survive this usage are allowed to shoot up at random, and soon attain a great height without being useful as a fence, and, by the spreading of their branches at top, not only become naked and open below, but cover three times the space of ground that hedges differently kept usually do. The detailed accounts of the different fences at present in use, the modes of making them, together with their respective advantages and defects, may be seen under the heads *Fence*, *Hedge*, and *Wall*.

Besides the various advantages that have been

mentioned, the inclosing of land enables the farmer to act as is the most suitable and convenient in respect to the cultivation of his different crops.

When farms are to be inclosed, it will be advantageous to begin with having a survey and plan made, that he may thereby divide and portion it out with greater propriety and precision, so as to render it pleasing to the eye, and convenient to the farmer; and if there be a place of residence upon it, the whole may be made to become ornamental to that residence, by a judicious disposition of the hedges and plantations. Where there are different farms, they should be so divided, that the dwelling of each tenant may be as contiguous to his land as conveniency will admit of, in order to prevent length of carriage, and to facilitate attendance.

INERT VEGETABLE MATTER, that sort of vegetable matter, which, according to lord Dundonald, by long and frequent exposure, has been so saturated and combined with the oxygen or pure air of the atmosphere, as to be rendered in a great degree insoluble. The surface of peat mosses, and the mould of such soils as have been much exposed to the action of pure air, by fallowing, are supposed to be rendered inert. See *Peat.*

INFIRMARY, in *farriery*, a place fitted up for the purpose of taking in diseased horses, or other animals, in order to be cured. Infirmaries for horses are at present become common in many of the large towns in this kingdom. The VETERINARY COLLEGE in London has an infirmary, to which the subscribers have the privilege of sending their sick horses, only paying for their keep during the time they remain in it.

INFLAMMABLE AIR. See *Hydrogenæ.*

INFLAMMATION, in *farriery*, is a disease or affection consisting in an increased circulation in any part of an animal arising from irrritation, external or internal, local or universal. There are various causes which may induce it, but in animals, the chief are wounds, bruises, and sudden or excessive cold, and the application of heat afterwards.

Its *principal symptoms or effects* are, heat in the part, or over the whole system, pain, swelling, redness, an accelerated pulse, a dryness of the skin, and an itching. The first is excited by the reciprocal action and reaction of the solids and fluids. The irritation on the fibres increases the action of the vessels; the velocity of the fluids is thereby quickened through them, and thus heat is excited, The *pain* is excited by the distension of the vessels in a part already become preternaturally sensible. The *swelling* is not caused by obstructed blood, but by the excess of heat distending the cellular membrane; though a swelling is not essential to an inflammation. The *redness* proceeds from the quantity of blood brought to the part; but is not always to be distinguished in brutes. The *quickened pulse* proceeds from that law in nature, by which the heart always increases its efforts to free its subservient vessels from any injury they sustain from accidental or preternatural irritation. The *dryness of the skin* arises from the stricture of the capillary vessels, whose use is nearly abolished by the irritation on them. The *itching* is but the beginning of what ends in pain by its increase; the latter, however, cannot be ascertained in dumb animals, though it may be presumed on the ground of analogy

In this affection the prognostics are more or less favourable in proportion to the immediate importance of the part affected, the state of the animal, the intenseness of the symptoms, and its complication with other disorders. In a part that is of a firm texture, and that has but few vessels, such as the ligaments, glands, &c. the treatment is often tedious, and a proper cure not always effected.

An inflammation sometimes soon goes off, at others it is removed with difficulty, and it frequently terminates in other diseases. In the horse, and in most other large quadrupeds, its progress is exceedingly rapid; for which reason the most decisive and speedy remedies are called for, especially in all *internal* inflammations. It can only be terminated by a removal of its immediate cause. The general terminations of inflammation are in *resolution*, *suppuration*, *gangrene*, and *scirrhus;* though upon the last, practitioners are not perfectly agreed.

With respect to its removal, there is only one general method, which is, that of lessening or removing the irritation, and diminishing the increased afflux of the humours. But at the same time, regard should be had to the structure, situation, and connection of the parts, the antecedent causes of the disorder, and the state of the animal.

In order *to remove the irritating cause*, all that can continue the morbid irritation should be obviated. Where spasms are the cause, opium is the properest remedy; and when a stimulating fluid is secreted on a sensible membrane, its action may be obviated by the application of oily, unctuous, or mucilaginous matters. The morbid acrimony may be destroyed by proper alteratives, as mercury, &c. The destroying or lessening the irritability of the part may be effected by means of bark internally, and preparations of lead externally. And the distension of the internal vessels may be removed by restoring the circulation on the external surface of the body, or by giving internally medicines to relax the small vessels throughout the system, by their action on the stomach; such as nitre, sal ammoniac, all the neutral salts, antimonial preparations, cold water, external applications, &c. The *increased determination of the humours* may be abated by bleeding, by purging with neutral salts, by the application of sedatives to the stomach, and narcotics given at proper intervals; by topical sedatives, such as the preparations of lead, &c.; and by inflammation excited on the skin near the part originally affected (except the skin itself is the part inflamed). To this end friction with the spirit of turpentine, which powerfully stimulates the skin in brutes, though it has little effect on the human skin, the volatile liniment, blisters, or even the actual cautery may be applied. In the mean time a cooling diet should be pursued, such as copious draughts of water-gruel, bran-infusion, or barley-water.

Where an external inflammation is to be removed without a suppuration, emolients should never be applied; as they increase every degree of tumour, by adding to the quantity of fluids in the part. The increased action of the vessels should be allayed, and the sensibility of the part abated, by such sedatives as neither increase the tumour, pain, heat, or tension. In this view, saturine topics, or in their stead, the simple astringents and stimulants in common use, such as the usual mixture of vinous spirit with vinegar, often possess the desired effect.

The following is also often useful: take of alum, half an ounce; vinegar, one pint. Mix and form them into a wash; it will often stop the progress of external inflammation. Where the seat of the inflammation is a lax glandular part, applications that are strongly stimulant, are sometimes the most safe and advantageous. And where there is but little sensibility in the parts, as in tumours of the lymphatic glands, blisters exceed all other remedies of the topical kind.

The belly of the animal should be kept lax in all kinds of inflammations, and internal ones are much relieved by the frequent use of clysters.

Vapours and fomentations often contribute much in affording relief, by lessening the irritation of the fibres, and by the motion of the blood being thereby rendered more equable in the part. The different particular kinds of inflammation are treated of under the several heads of disease to which they belong.

INFLAMMATION *of the Lungs.* See *Peripneumony.*

INFLATION, in *farriery*, a blowing up, stretching or filling up any part with air. Thus the lungs of animals are inflated when air is drawn into them in respiration, or the act of breathing.

INFLUENZA, in *farriery*, a sort of catarrhous affection, arising from atmospheric contagion. It is generally, but sometimes without reason, supposed infectious, or communicable from one horse or other animal to another. But of this, Mr. John Lawrence entertains doubts; though he properly recommends the separating infected horses from those that are yet unattacked by the disease. The treatment he advises is that usual in catarrh, but with peculiar attention to warmth about the head and throat, and to cleanliness in respect to the discharge from the nose, which may be very copious. He recommends, that "care be taken, in case of syringing the nostrils, that the membrane be not abraded with sharp and stimulating injections, that may induce purulent ulcerations, of worse consequence than the original disease. Should the fever be considerable, attended with little or no discharge from the nose, or retention of urine, and nature seem much oppressed, and unable to throw off the load at any outlet, antimonials and powerful diaphoretics, he thinks, are indicated. When the disease has taken this turn, the fever will sometimes run so high, that the flesh of the horse will feel burning hot, and he will refuse all sustenance, nor attempt to lie down until a critical discharge shall happen somewhere. This crisis may come in the form of hot watery eruptions or blisters in tumours under the elbow or hock, or collections of water along the belly, near the inguinal glands, which farriers, he says, who usually confound cause and effect, denominate the water-farcy." Under these circumstances, he recommends the practitioner merely to assist the efforts of nature by administering cooling diuretics, and, as occasion may require, opening clysters. Every fact relating to this disease in the horse, seems to countenance this method of treatment. See *Epidemic.*

ING, a provincial term, employed to signify a common pasture or meadow which lies low or wet.

INLAND NAVIGATION, a sort of water conveyance that may in many cases be rendered useful to agriculture; but Mr. Marshall has not, he says, met with an instance in which it has been applied exclusively to a lime work, or other source of manure, though that substance is sometimes carried to a great distance by sea. He, however, conceives that there are many cases in which *narrow canals* may be made at a trifling expence, to shorten the distance of land carriage. See *Canal* and *Lime.*

INOCULATION, an operation in the management of fruit trees, which is likewise sometimes called budding. It is a kind of grafting practised in the summer months on various sorts of trees and plants, and which often succeeds better than the common method of grafting. It is performed in the following manner. Being provided with a sharp knife, with a flat haft made for the purpose, as also with the cuttings of the tree intended to be propagated, make choice of a smooth part of the stock intended to be inoculated; if designed to be dwarf, five or six inches from the ground; but if a standard, it should be budded at the height of five and a half, or six feet; then, with the knife make an horizontal cut across the rind of the stock, and from the middle of that cut make a slit downwards about two inches in length, being careful not to cut deeper than the thickness of the bark, lest the stock be wounded: then having the cutting ready, cut off the leaf from the bud, leaving the foot-stalk remaining; and cut the bud off lengthways somewhat longer than the slit in the stock, with part of the wood to it; this done, with the knife slip the wood from the bark by a sudden jirk and observe whether the eye of the bud is left or not, as those buds which lose their eyes in stripping are useless: afterwards with the handle of the knife gently raise the bark on each side of the slit in the stock, and insert the bud therein, taking care to place it smooth between the rind and the wood of the stock, cutting off that part of the rind of the bud which may happen to be too long for the slit made in the stock; and, having thus exactly fitted the bud to the stock, tie them closely round with wetted strong bass, being careful not to bind round the eye of the bud, which should be left open. In about three weeks or a month the buds will require to be loosened of the bandage, and which, if not done in time, will be injurious to them; but they should not be entirely divested of

the binding, as it is not amiss to tie them slightly again, which will prevent the bark of the stock from flying open, as sometimes happens, whereby the bud is frequently much injured, if not entirely destroyed.

The March following, the stock should be cut off about three inches above the place of inoculation, sloping it the contrary way to the bud; this length is of use to fasten the shoot to, which proceeds from the bud, and which otherwise might be blown out by strong winds; but the autumn following it should be cut close just above the bud, that the place of amputation may the more readily be barked over. The time for inoculation is from the middle of June to the latter end of August, according to the season and the forwardness of the different sorts of trees intended to be budded, which is known by trying if the buds will separate from the wood easily. The first sort of fruit commonly inoculated is the apricot, and the last the orange: although the orange is commonly budded in August, it is very proper to try the operation in July, and those stocks which miscarry may be budded the succeeding month or even in September; but whenever it is done, it is proper to place them in a gentle heat, giving them plenty of water, by which means there will be no danger of their success. Moist cloudy weather is the best for performing this sort of business. The farmer has often recourse to this method for raising apple-trees.

INOM, *Barley*, a term applied to such barley as is sown the second crop after the ground has been fallowed.

INSECT, a general name for an extensive class of small animals, many of which are highly destructive to different sorts of crops and vegetable productions. They differ from the higher classes of animals by their bodies being covered with a hard crust or scale, by their having feelers or *antennæ* arising from their heads, and many of them breathing the air through lateral pores. In the shape of their bodies, they are well adapted to their manner of life. The base of their bodies is not formed of bone, as in many other animals; but they have a hard external covering which serves them for skin and bone at the same time. Their feelers, beside the use of cleaning their eyes, are a guard to them in their walks or flights. Their legs and wings are well fitted for their intended service; but the latter vary so much in different insects, that from them naturalists have given names to the several orders of the class into which they are divided. Thus;

The 1st, *Coleoptera*, or beetle tribe, have a crustaceous *elytra* or shell, that shuts together, and forms a longitudinal suture down their back.

The 2d, *Hæmiptera*, as the cimex, cockroach, bug, &c. have the upper wings half crustaceous and half membranaceous; not divided by a longitudinal suture, but incumbent on each other.

The 3d, *Lepidoptera*, as the butterfly, have four wings, covered with fine scales in the form of powder.

The 4th, *Neuroptera*, as the dragon-fly, spring-fly, &c. have four membranaceous transparent naked wings, generally reticulated.

The 5th, *Hymenoptera*, as wasps, bees, &c. have four membranaceous wings, and a tail furnished with a sting.

The 6th, *Diptera*, as the common house-fly, have only two wings.

And the 7th, *Aptera*, as the lobster, crab, scorpion, spider, &c. have no wings at all.

In many insects the structure of the eye is highly curious. The outer part is remarkably hard, to guard against injuries, and has commonly a reticular appearance, or the whole may be looked upon as an assemblage of smaller eyes; but whether they see objects multiplied before them has not yet been determined. Some naturalists have denied the existence of a brain in these creatures, but it is certain, that at least a number of the larger kinds, as the lobster, crab, &c. have a soft substance similar to the brain, from which the optic and other nerves take their rise; besides, when this substance is irritated, the animal is thrown into convulsions: hence it may be concluded that insects have a brain as well as the other classes, although it be smaller in proportion to their bodies.

With regard to the ear, it has been lately discovered to be placed at the root of their *antennæ* or feelers, and can be distinctly seen in some of the larger kinds, as the lobster.

They have likewise a stomach, and other organs of digestion; and it is curious that in some, as the lobster, the teeth are found to be situated in the stomach.

And as they have a heart and blood-vessels, the circulation is carried on in them somewhat as in the higher classes of animals; but the blood is without red globules, or, is colourless. In the lobster and others of the larger kinds, when a piece of shell is broken, the pulsation of the heart may be seen distinctly, and that sometimes for several hours after it has been exposed to view.

Some have denied the existence of lungs: but later experiments and further observation has shewn that no species want them, or at least something similar to them; and that in many insects, they are larger in proportion than in other animals: in most of them they lie in or near the surface of the body, and send out lateral pores or *tracheæ*, by which, if the animal is besmeared with oil, it is instantly suffocated and destroyed.

In respect to *generation*, the same difference of sex exists in insects as in other animals, and they even appear more disposed to increase their species; many of them, when become perfect, seeming to be created for no other purpose but to propagate their like. Thus the silk-worm, when it arrives at its perfect moth-state, is incapable of eating, and can hardly fly; it endeavours only to propagate its species: after which the male immediately dies, and the female also as soon as she has deposited her eggs.

But besides those of the male and female, a third sex exists in some insects, which is termed *neuter*. As these have not the distinguishing parts of either sex, they may be considered as *eunuchs* or *infertile*.

There are no instances of this kind in any other known class of animals; and it is only found among insects which form themselves into societies, as bees, wasps, and ants; and in which these *eunuchs* are real slaves, as on them lies the whole business of the economy. There have been no hermaphrodites yet discovered among insect tribes.

It was formerly supposed by many, that the generality of insects were merely the production of putrefaction, because they have been observed to arise from putrefied substances: but a contrary opinion is now more generally adopted; and it is quite certain, that, if putrid bodies be shut up in a close vessel, no insects are ever generated, unless their ova had been originally deposited there. They are oviparous animals, which deposit their eggs in places the most convenient for the nourishment of their young; some in water, others in flesh; some in fruit and leaves, while others make nests in the earth or in wood, and sometimes even in the hardest stone. The egg in all insects first becomes a *larva* caterpillar, or maggot; from which the next change is into *pupa* a chrysalis, or aurelia, so named from its being inclosed in a case; and this dying, or seeming to die, the *imago* fly, or butterfly, or perfect state, succeeds; and, during each of these changes the appearance differs in a very curious and extraordinary manner. It is observed by Dr. Darwin, that insects may be advantageously propagated, with a view to their being converted into manure.

INSTEP, in *farriery*, a name given to that part of a horse's hinder leg, which reaches from the ham to the pastern-joint. It should be flat and in a perpendicular line to the ground, in the natural posture of standing in the animal.

INSURANCE, the mean of security against fire. The farmer being constantly surrounded by much combustible matter, should never omit rendering himself safe by insuring his stock of every kind, in some public office, instituted for this purpose.

INTERMIXED *Lands*, such as lie blended with those of another farm. They are often subject to much altercation and dispute, and should as soon as possible be consolidated into one property. See *Land*.

INTESTINAL CALCULI, in *farriery*, are such solid or stony accumulations as are found in the intestines, producing masses, generally of an uniform shape, except where more than one are formed, and lie in contact with each other. They have mostly a laminated structure. See *Calculus*.

INTROSUSCEPTION, in *farriery*, is a preternatural ingress of one portion of an intestine into another, or a reduplication of an intestine, or gut.

INTUMESENCE, in *farriery*, a sort of soft tumour or swelling; or a disease attended with a puffiness, or with a swelling of the body of an animal, or of a considerable part of it.

INUNDATION, a flood, or large collection of water overflowing lands. The manner of guarding against the injurious effects of inundations are described under the head Embankment. See *Embankment*.

INVENTORY, a detailed account taken of any thing upon a farm. Inventories of the various kinds of farming stock should be taken annually, at the close of the year, in order that the full amount of the property may be ascertained. See *Farm Accounts*.

IRRIGATION, the art of covering meadow or grass lands with water, so as to render them more highly productive.

There are two methods of effecting improvements on lands by covering them with water; one of which is by applying it so as to cover the surface when in the state of grass or sward; the other by communicating it to the soil of such grounds as have been broken by means of cultivation. The first is the method that has been principally introduced into practice in this kingdom, and which Mr. Marshall has termed the "*European practice of Irrigation.*" Though the history or origin of this means of improvement is involved in much difficulty, and not capable of being easily traced, it was probably introduced at a very early period from eastern countries, where the practice of covering the lands with water in order to protect them from the injurious effects of excessive heat has prevailed for ages. But by some it is thought to have been brought to the attention of the farmer, in this country, in another way, for "the benefit of natural floods, to the grass lands they occasionally overflowed, being evident, and in some instances great, the means of producing artificial floods, and of spreading them over lands, not liable, in their natural situation, to be overflowed, would become, of course, Mr. Marshall supposes, a desirable object. And that as the most obvious effect of floods, or the overflowings of rivers and brooks on the lands over which they spread, is that of depositing their feculent particles; thereby operating, as a vehicle of manure; it is likewise, he conceives, evident to common observation, that foul waters, as those of floods, let fall their feeculencies, most freely, in a *stagnant state*. And that it is also equally evident, that the state of stagnation of the waters of floods, or a state that approaches it, is caused by some obstruction of the current, below the place of stagnation." And that from "these circumstances being seen, and they could not, he thinks, well be missed by any one who gave the subject a second thought, the means of manuring lands with water, artificially, were given: in situations he means, which would admit of the requisite obstructions." And it is further suggested that "the bottoms, dips or vallies which abound, more or less, in every part of the kingdom, would naturally be the most apt subjects for flooding, artificially, with foul waters, on the principle of manuring the land with their sediment." For on "a bank, or dam, being made across the valley, below the part to be manured, the rivulet, which generally accompanies a valley of this kind, especially after heavy rains, the only time when flooding on this principle could be practised, would of course be obstructed; and its waters, fouled, perhaps, with the richest

particles of arable lands, be spread over the bottom of the valley, to an extent proportioned to the height of the bank, and its own flatness: a valve or flood gate being fixed in the bed of the rivulet, to let off the waters, when the *whole* of their foulnesses were deposited: thus gaining a principal advantage over natural flooding; in which the grosser particles only are let fall; the finer, and perhaps most valuable escaping to the river, and thence to the sea, before they be precipitated or let fall upon the land. He conceives that on these principles, it is evident, some of the meadow lands of the midland districts have formerly been flooded:" and "that it is not probable, that so evident a method of improving meadow lands, should have been confined to a particular district; but may have been common to other parts of the island."

It is further stated by the same intelligent and able writer, that "the *ancient* method of meliorating grass lands, by the means of *stagnant* water, could no longer prevail, than until the superior effects of *running* water, on such lands, were discovered and ascertained." And that "this important discovery must have been made, by *observation*, on the comparative effects of running and standing water, in the natural or artificial flooding, spoken of above; and must have been ascertained by a long course of *experience*:" as "it is not likely that *reason* should have had any share in striking out the modern method of improving grass lands, by running water. For even now, when the reality of the improvement appears to be fully established, there seems to be no full or satisfactory *theory* to account for it. Though many of the effects thus produced have lately been more clearly explained and better understood, as will be seen below. The *warmth*, communicated by running water, to the grass it flows over, is one great reason adduced for the good effect of running water, on this sort of land. But, even after this discovery was made, and the effect fully established, it would, he thinks, be some length of time, before the art arrived at its present high degree of perfection. As it may, in its present state, be safely deemed the most useful and scientific operation, that has entered into the common practice of husbandry. And he justly observes that "the memory of the inventor, or inventors," deserves the highest praise.

It is well remarked by the author of the "Practical Agriculture," that "the great degree of verdure and luxuriance which almost immediately succeeds the occasional covering of grass lands with water, sufficiently demonstrate the power which it possesses in promoting vegetation." And that "it is a means of fertility that has been employed for ages in more warm climates, with the most beneficial consequences in increasing the quantity of vegetable produce. But that although it has been long in use in other countries, and of late more particularly attended to in this, the principle on which it produces its effects" are not yet fully explained. In considering manure as the nourishment or food of plants, some of the properties of water that may be beneficial in the vegetable economy when absorbed or taken up by the fibrous roots of plants have been mentioned; and there are other ways in which it may be advantageous in forwarding the growth of grass herbage, when applied over the surface.

It is conceived that "in climates where the heat is considerable, it may be of much utility, not only by keeping the fine fibrous roots of the grass or other plants in a moist patulous state, the most proper for the purposes of absorption, but in such a temperature or state of heat, from the cooling effect produced by the constant evaporation that is taking place near the surface of the ground, as is the most suitable for their healthy and vigorous growth. It is probably in this way, he thinks, that garden plants are principally benefited by the application of water in the hot summer seasons in our own climate; as when the waterings are not constantly kept up, injury rather than good is mostly experienced."

"But another and more beneficial way in which grass produce may be immediately increased, and the fertility of the lands more permanently improved in this country by the floating or covering them with water, is from the waters of the rivers or brooks that are turned upon them containing, either in the state of solution or diffusion, a variety of different sorts of enriching materials which they gradually and evenly deposit upon the surface while they rest upon or slowly flow over it. This must, he imagines, be the case in all those instances where the rivers or streamlets either arise in, or in their course flow through or over, beds of chalk, marl, or other calcareous strata; as in their passage they become highly impregnated with the fine particles of these different substances. And where they are fed by the small runlets which receive the waters that proceed from the higher and more elevated lands, they must often, especially after heavy rain, be loaded with a large proportion of fine rich materials of the animal, vegetable, or other kinds, which they deposit in a regular manner in their tardy trickling course over the surfaces of the fields."

"But it would appear, he says, that waters thus impregnated produce the most beneficial effects, particularly when not in flood, upon the lands that are the nearest to the sources whence they become principally impregnated with their fertilizing principles; as when they have flowed to some distance they have, in a great measure, deposited and let fall such enriching substances, and are become too pure for affording advantage in the way of deposition. It is only in the time of floods that they can produce much utility in this way at any great distance. It was found, he remarks, by an able philosophical writer, Doctor Darwin, that the water of the Darwent, though it flows for several miles near Matlock, through calcareous strata, contained no impregnation of this sort on its reaching Derby, although the springs in that neighbourhood had a large proportion of it in their composition."

And he adds that "the same author has ingeniously suggested another mode in which water may prove serviceable in floating grounds in this climate,

which is that already stated of protecting the grass or other plants from the too severe effects of cold during the winter or early spring season. In this view it is observed, that the water of strong springs, which in this country have constantly the temperature of forty-eight degrees of Fahrenheit's thermometer, is to be preferred to that of rivers, where it can be procured in a sufficient proportion, as the degree of cold in these is in the same ratio with that of the atmosphere till it declines to the freezing point, or that of thirty-two. Though both, when spread out, forming a thin sheet of ice on the surface of the land, are beneficial in defending the roots of the grass plants from too intense degrees of cold, and of thus preserving them in a more healthy condition; and it is added, that those of some sorts of grasses are supposed even to vegetate beneath the ice, as the rein-deer in Siberia mostly vegetates beneath the snow, in a degree of heat of about forty, which is the medium between that of the inferior surface of the dissolving snow, or that of thirty-two, and that of the common heat of the internal parts of the earth, which is forty-eight; and in this manner the grass produce in this cold country be considerably increased, so as, under proper management, to nearly double the usual annual quantity under other circumstances."

"In illustration of these principles, Doctor Dickson, says, it may be observed, that the water issuing from springs where they abound with the particles of gravel, or a slaty mouldering kind of rock containing a large proportion of calcareous earth, are known from experience to be better adapted to the purpose than that which arises from others that do not contain such materials. The difference in the effects, often so visibly produced, has been accounted for, from watering one field from a spring issuing out of a chalky soil over those which take their rise in another, similar in every respect and management, except that the water applied arises in, or flows through, a swamp or morass, composed chiefly of peat earth, or proceeds from situations known to contain none of these substances."

"The fact is unquestionably established, he adds, that the water of rivers which run through comparatively level and fertile countries is not only better than that of such as have their courses through mountainous, unproductive tracts, but superior to all others, as every different streamlet adds a new accession of fertilizing materials, which, being dispersed over the surface of the meadows in their fine and attenuated state, cannot avoid adding considerable degree of improvement to the lands."

It is conceived by Mr. Marshall that if the art, as it now stands, were struck out on principle, it must have been on that of animal circulation; to which the operation of meliorating grass lands with water, through the means of floats and drains, is perfectly analogous. The floats are arteries, conveying the circulating fluid to every part of the subject, imbuing every atom: the drains, veins, collecting the scattered fluid, and conveying it back to its natural channel." But that, "in less figurative language, the floats" may be considered as "trenches, receiving, by the means of floodgates, as occasion requires, the water of a river, brook, or rivulet, and conveying it along the upper margin, and upon the tops of the natural or artificial swells of the field of improvement:——the drains, counter trenches, stretching along the lower margin, and winding in the dips and hollows, to receive the waters spread over the surface by the floats.

Each set of trenches, whether of floats or drains, bears more or less resemblance to a tree, with its trunk and branches: the branches of the floats increasing in number, and diminishing in size, as they proceed from the river or other source; those of the drains, on the contrary, diminishing in number and increasing in size, as they approach the receptacle," or place where the water is to be taken off at.

It is further remarked, that, when the water is at "work," as it is properly enough termed, "the entire surface, supposing the operation to be perfect, is covered with one continued sheet of living *water;* purling slowly and evenly over every part, an inch or more deep. If the grass be very short, the water is seen, and has a beautiful as well as a profitable effect: if not, it steals, unseen, among the herbage; or shews itself, partially: it being impossible, in practice, to render the sheet, throughout, of a uniform depth or thickness," as it must naturally pass off quicker in some situations than others.

It is fully shewn "from this general idea of the method of watering grass lands, on the modern principle, that a dead flat, a perfect level, is, of all others, the least adapted to the practice. A perfect level, however, seldom occurs in nature; inequalities, sufficiently to promote a circulation of water on turf, may generally be discovered, if judiciously sought." In the midland counties, Mr. Marshall has seen, "in the practice of a superior manager, a beautifully simple expedient practised, to find out the inequalities of a piece of ground nearly flat:" which is "that of covering it with water; and preserving the level by the means of "levelling pegs:" stumps or piles driven down, in various parts, to a level with the surface of the water; so that after the water was let off, the level still remained. The parts last covered were, of course, the proper ground for the floats; the parts last freed, for the drains: art being used, where wanted, to give additional advantage to the natural inequalities" which may be present. But situations, in general (water-formed lands excepted), abound, he thinks, sufficiently with inequalities of surface: either natural, as the swells and hollows of lands, lying out of the way of floods, and having never been ploughed: or artificial, as those which have been raised, by the plough, into ridge and furrow: in this case, the ridges receive the floats, the furrows the drains: in that, the plummet is the guide to the floats; the water they throw out, to the drains" or cuts.

The same writer adds, that, in the above district, he has "seen the side of a hill watered with rain water, from a road running along the top of it:

the same trench, in this case, acting as float and drain, running, a zigzag, along the face of the slope; the lower folds catching the water spread out by the upper." And that he has "likewise observed several instances of ridges and furrows being watered from similar sources. In these cases, whether the natural descent of the lands was little or great, the floats were opened upon the ridges, with clods of turf, cut out of the trenches, placed at distances proportioned to the descent, to check the current sufficiently, to force the water out of the trench above, yet leaving it a sufficient passage, to suffer it to carry down a supply to the parts below." He has also "met with one or more instances, in which ridges and furrows have been levelled, at an excessive cost, by paring off the turf, throwing down the ridges, by hand and replacing the turf; giving the surface one regular gentle descent: and this, notwithstanding, it is allowed, by those who may be styled masters in the art, that the quicker the circulation, the more beneficial the effect." He thinks that "upon the whole, it appears pretty evidently, that the operation, though scientific, can seldom be rendered mechanical. Straight lines and plain surfaces can seldom be had, but at a great and, frequently, an unnecessary expence. The given situation of the ground should be consulted and maturely studied, before the work be set about. Every site may be said to require a different arrangement of trenches. Of course, no man ought to set about a work of so difficult a nature, until he has studied its principles, and made himself master of its theory: nor, then, without the assistance of practice, in himself or others" whom he can employ for the purpose. It is conceived that "to expatiate on the utility of watering grass lands would be a waste of words. In situations where a sufficient supply of water, of a fertilizing quality, can be commanded, at all seasons, it ranks indubitably among the highest class of improvements. Much, however, Mr. Marshall thinks, depends on the quality of the water: not on its colour or clearness, but the specific quality of the suspended particles. Waters in their natural state (not purified by distillation), more especially spring waters, though perfectly transparent, and pure to the eye, are as various in quality as soils, owing to earthy and other particles being suspended in them imperceptible to the eye, requiring the aid of chemistry to detect them. Hence, hard water, soft water, wholesome waters, and medicinal waters." The effects of clear spring water have been found strikingly evident in various cases of this sort of management.

Mr. Marshall, however, justly remarks, that "although very much depends on the quality of water, for the purpose of meliorating grass lands, much also depends on the quantity: on having a sufficient supply at all seasons. With this, he thinks, there are, perhaps, few waters which might not be rendered beneficial to grass land, if thrown over it at proper seasons, and in proper quantity: without it, the benefit, it is possible, may not be adequate to the expence. The most obvious advantage, of watering grass lands he conceives, arises, in a dry season; and if the supply fail, in such seasons, as frequently happens in many situations, the intention is, in part, frustrated: the winter and early spring waterings being, in this case, all that can be commanded for the purpose." This is given, however, "by way of caution: not as a discouragement to the practice. There are, the same author well observes, in this island, situations innumerable, in which the advantages arising from the practice, properly conducted, would far exceed the expence of obtaining them: and to ascertain them is an object of the first magnitude, to the owners and occupiers of grass lands," and in many instances probably also in those of the arable kind.

It may from these statements be safely concluded, that this mode of improving grass, or other lands, when it can be had recourse to, is of the greatest importance, and of the most valuable kind: and it is probably capable of being applied in a greatly more extensive manner, than has yet been the case, by the persons employed in conducting the business, fully availing themselves of the various occasional falls of rivers, streams, and in particular seasons of canals, as in this way water may often be provided, for the purpose of distributing over extensive tracts of land, that have hitherto been thought incapable of admitting of such means of amelioration and improvement. In other circumstances and situations, by having recourse to damming up the water, and the occasional use of wooden pipes in the conveying it where necessary, it may be easily raised to heights sufficient for conducting it over many elevated lands, and by such means promote their vegetation and produce to a degree, that cannot be easily calculated.

From what has been already done in this way, it is evident that, on heathy moors, and other mountainous tracts, it may often be applied with the prospect of great advantage. In traversing such hills, instances are daily occurring of little rivulets or rills, which are insufficient to form a regular course, spreading their waters on particular parts, and thus providing a most beautiful verdure; which affords sufficient proof of what may be effected by the judicious application of water in such situations.

It has been remarked, that, "the same principles may be applied, in many situations, in conveying the rich liquors collected in ponds and reservoirs about the farm-yards and buildings, that are too frequently wasted, by evaporation or other means, over the adjoining fields, as has been practised by Mr. Fenna, in Cheshire, and described in the second volume of Communications to the Board of Agriculture."

The main objection to this system of improving grass lands, is, the first expence of the work; but, if it be conducted in a judicious manner, and by persons acquainted with the business, this will seldom be so considerable as is commonly supposed, or form any material impediment, as the increase of produce, which is almost immediately the consequence, will amply repay the improver. It has been objected

to by some, on the ground of cutting the land, but this is of little consequence, if additional supplies of food be thereby afforded, for the support of live stock, and the gradual improvement of the soil at the same time effected.

It may be observed, that winter and spring are the two seasons when grounds of the grass kind are usually irrigated or watered, as from the month of November till the beginning of March: the experience of the operator must in a great measure regulate this proceeding as to the length of time they should remain under water. In some districts it is the practice to allow the water to flow over the fields for several weeks together, with only the interval of a day or two occasionally; while in others the custom is to cover them alternately, each other week. When frosts set in, the work is usually suspended; but it has been remarked, that in such cases the succeeding crop of grass, is less plentiful. As the spring season advances, much less floating is found to be requisite. However in every case where floating is performed to advantage, the land should be laid dry between every time of covering it with water.

In this business Mr. Marshall advises the beginning to lay the water on in the early part of November, suffering it to overflow from ten to fourteen days, and then taken off; repeating the same process, in the two following months; giving in February also, two waterings, of from five to seven days each, and in March three, of from three to five days each, according to the state of the weather, constantly permitting the water to continue longer upon the land in cool, than warm weather.

It is likewise generally advised, that on the sandy, gravelly, and drier kinds of lands, the water should not remain so long at a time upon them as in those of the heavier kinds. And in the latter sorts, Mr. Wright considers three weeks as long enough; but Mr. Boswell thinks it may continue on a month, or even six weeks, in the first waterings, about November, and a something shorter time, for those of the former sort of lands. Mr. Wright also recommends, in December and February, the land to be let dry, for the purpose of air for a few days, and in February he thinks particular attention necessary, not to permit the water to flow over the ground many days together, without being taken off, as there may be danger from white scum being formed; and by the land being left exposed to frost in its wet state, it may be injured in that way. These inconveniences, it is supposed by Mr. Wright, may be avoided by taking the water off in the day, and turning it upon the lands only during the night time. But Mr. Boswell, who has had extensive experience in this sort of business, does not seem to apprehend any danger in this way to the land.

On the approach of the spring, as about March, and sometimes sooner, there is mostly a sufficient bite of grass to admit the lands to be fed by stock: the water should in this case be turned off for a fortnight or more, in order to give it a sufficient degree of firmness before the animals are turned upon it. During the following months, it is observed the grass may be eaten close, but not later; as continuing it even for a few days in May would greatly injure the hay produce which is to be obtained both in quantity and quality. In this month, when the grass has been fed down, the water should, according to Mr. Wright, be again turned over the lands for a few days, by which they are so moistened as to produce a full crop of hay. It is not improbable but that with less close feeding two crops of hay might frequently be taken with benefit. It is remarked by the above writer, that the first crop of hay from watered lands, when cut sufficiently early, is equally good with that of most other sorts, but that when let stand too long, it becomes coarse and unfit for the purpose of fodder.

It has been well observed by a philosophical writer, that "where, the flooding of lands is continued some time, the water should only be suffered to trickle or flow over it gently from the higher parts, and not stagnate upon it; as in the latter case the grass roots are soon destroyed in the spring, and that when such materials begin to decay underneath the water, a white scum arises in consequence of the air set at liberty by the beginning putrefaction, which has been suspected as prejudicial to the grass, but is rather the effect than the cause of the mischief, and demonstrates that the water has remained too long in a stagnant state upon the ground and requires to be removed or to have a fresh supply from the stream; but the former is probably the better. "The necessity of continuing the irrigation or watering of land, after it has been once begun in hot climates and seasons, has been shewn above; and it is suggested that there may be injury done to the grass plants by the sudden application of much water under such circumstances."

It is strongly inculcated by Mr. Marshall, in his valuable Treatise on the Landed Property of England, that, before any serious expence is incurred in works of this kind, the nature and effects of the water that is to be employed should be fully ascertained by the establishment of *trial* grounds, which if it be proper and beneficial for the purpose, it will be shewn by the superiority in the growth, verdure, and general appearance of the grass toward the latter end of March, or the beginning of the following month. The quantity of water and extent of ground that can be covered by it must likewise be jointly taken into consideration before any improvement of this sort can with propriety be undertaken. And in every instance he advises due estimates; and a calculation of profit be formed on the following principles. First calculating the probable advantages that may arise every year, from hay and pasturage, and an annually increasing supply of manure or dung; then taking the interest at six per centum on the estimated cost of the works that may be requisite to produce them, together with the amount of the estimated annual expence of labour, and necessary repairs.

Various interesting instances of successful irrigation, or application of water over lands, in the midland districts, are stated by Mr. Marshall. And in this

case, as in many others, Mr. Bakewell, he says, stands first, as an improver of grass lands. It is observed that, "formerly, a suit of meadows, lying by the banks of the Soar, received considerable benefit from the water of the river being spread over them judiciously, in the times of floods. But now not only these meadows, but near an hundred acres, he believes, of higher land lying entirely out of the way of natural floods, are watered on the modern principle."

He remarks that the ingenious improver just mentioned, "like a man of experience in business, before he set about this great work, studied the art, in the principal scene of practice, the west of England, where he spent some days with the ingenious Mr. Boswell, who, not many years ago, published a treatise on the subject." And that the great stroke of management, in this department of his practice, which marks his genius in strong characters, is that of diverting to his purpose a rivulet or small brook, whose natural channel skirts the farthest boundary of his farm; falling, with a considerable descent, down a narrow valley; in which its utility, as a source of improvement to land, was confined. This rivulet, being turned, at the highest place that could be commanded, and carried, in the canal manner, round the point of a swell, which lies between its natural bed and the farmery: by the execution of this admirable thought, not only commanding the skirts of the hill, as a site of improvement by watering; but supplying, by this artificial brook, the house, and farm offices, with water: filling, from it, a drinking pool, for horses and cattle; a wash pool, for sheep; and converting it to a multitude of other purposes: acquisitions which Mr. Marshall says, many other situations in the island are capable of affording. One of these purposes is worthy of being mentioned as deserving the attention of the practical farmer. After endeavouring to invent a flat-bottomed boat, or barge, to navigate upon this canal; for the purpose, most particularly, of conveying his turnips from the field to the cattle sheds; and finding it not easily practicable, his great mind struck out, or rather caught, the beautifully simple idea of launching the turnips themselves into the water; and letting them float down singly with the current. "We throw them in," says he, "and bid them meet us at the barn's end!" in which situation he was then (October, 1789) contriving a reservoir, or dry dock, for them to fall into: with a grate, at the bottom, to let out the water; and retain the turnips; which will there be laid up, clean washed, and freight-free, as a supply in frosty weather!"

The improvements effected in this department of rural affairs, by this able improver, are, Mr. Marshall says, not only extensive, but high; and are rendered the more striking, by "proof pieces" (a good term for experimental patches) "left in each site of improvement."

In the science or rather art of irrigating, or watering grass lands, on the modern principle, Mr. Paget of Ibstock is also mentioned. "He cuts a considerable quantity of hay, Mr. Marshall observes, annually, from lands which have received no other manure than water, during the last forty years. A striking instance, in his opinion, that water is not merely a stimulus or force, as some men conceive it to be, but communicates some real nutriment to the herbage or grass plants." In the practice of this improver, one circumstance occurred which ought to be mentioned, by way of caution. He found that in watering an orchard with the washings of the street and yards of a neighbouring village (a desirable species of water) the fruit trees were greatly injured. A similar circumstance also took place in the practice of Mr. Bakewell. It is well known that surface water is in all circumstances highly injurious to fruit trees of the apple-kind.

Near Appleby, in Yorkshire, Mr. Moor has also executed a considerable work, of this kind, in a judicious manner, Mr. Marshall observes; cutting a fresh channel, on one side of the site of improvement, for a rivulet which wound through its middle; in order to prevent its overflowing at an improper season; and converting the old channel (partially filled up) into a main float; an expedient which may, he thinks, be frequently practised with good effect, in different situations.

The same species of improvement, has been carried on with much spirit and success by Mr. Wilks of Meesham, in the same district.

And in others, the practice has not been attended with less success, though under different circumstances.

In Devonshire, according to the Agricultural Survey of that district, Mr. Templer, of Stover, has experienced from this method of husbandry very considerable beneficial effects on a tract of marshy land on the borders of his canal—It had formerly produced from five to ten shillings an acre. After having it drained and levelled, by forming conductors for the overplus water of the canal during the winter floods, and distributing it by well arranged sluices, so as to throw the enriching particles upon the surface, he converted these marshes into valuable verdant meadow-land.

The method that was adopted in constructing the distributing sluices was by having a number of trunks placed at various distances, to each of which a plug was fitted; and when the flood swelled the canal above the level requisite for navigation, the plugs were taken out, and the water immediately overflowed the surface of the meadow-lands, being at any time capable of being easily restrained by replacing the plugs: similar success is likewise asserted to have attended a like process on lands in the upper line of the canal.

In Yorkshire, Cheshire, Wales, and the more northern parts of Scotland, as well as the different districts in which the practice of irrigation has been long common, various improvements have been effected by the application of water to the surface of grass lands, which will be particularly noticed under the proper head, and also the most approved methods of accomplishing the business under

different circumstances of soil and situation. See *Watering of Land.*

ISCHURIA, in *farriery*, is a stoppage of urine, proceeding from any cause whatever.

ITCH, in *farriery*, a cutaneous disease. See *Mange.*

IVES, in *farriery*, a disease which has a near affinity to the strangles. It is a slight inflammation and enlargement of the glands under the ears of horses, which seldom come to suppuration, but wear off gradually by keeping the parts warm, and protected from the external cold. When the swellings of these glands continue for a week or a fortnight, and at last spread downward under the throat, they terminate in the strangles, and require to be treated as that disease.

This disease, as in the strangles, is most incident to young horses, and usually proceeds from the same causes, as their catching cold, being over-heated, or in any degree over-worked about the time of shedding their teeth, &c. A horse that has the ives, coughs rather more and oftener than one that has only the strangles, and has not less difficulty in swallowing, occasioned by the pain and tenderness of the glands, which in some is so sensible, that they can scarcely bear to be touched about the neck and throat; and in others, the eyes appear swollen, tender, and watery. A fever, for the most part, also attends, which is often of the malignant kind. Some horses in this disease appear to be extremely sick, and for a short time, refuse all manner of food. When it happens at the time of shedding their teeth, the gums will appear red and tumified all round their sockets. The lampas generally rise at the same time to a great degree, and reach beyond the edges of the upper teeth; all which concomitant symptoms excite pain, and make the horse very uneasy. When the disease takes place in a horse that is old or full-aged, Gibson considers it as a sign of great malignity, and often of inward decay, which for the most part proves dangerous, and ought of course to be treated as other diseases of the malignant kind. But when it occurs in young horses, it requires a more simple treatment. The usual method of cure is, in the first place, to anoint the glands with ointment of marsh-mallows, and to cover the horse's head and neck with warm clothing. At the same time it is proper to bleed in proportion to the horse's strength, and repeat the bleeding in a day or two in a smaller quantity, if the fever continue violent; but if the glands inflame and swell, suppuration is to be promoted by frequent embrocations, and keeping the parts warm with poultices. When the swelling proceeds downwards under the jaws, it must be treated as advised above.

Internally, the same method should be pursued as in colds, and the same opening diet used till the horse recovers his appetite. Drinking water-gruel plentifully is of great use in all such cases, with scalded bran as a mash; in the bran sulphur and honey may be given with good effect, an ounce of nitre being mixed with it once a-day. As soon as the horse gets flesh, and has recovered his strength, it may also be proper to give him one or two mild purges.

IVY, a small well-known creeping or climbing kind of plant. From its property of spreading rapidly over a surface, it has been recommended by Dr. Anderson as proper for protecting the faces of earthen-dikes.

J

JACK, a machine employed for the purpose of raising heavy weights. There are several different kinds of these machines, according to the purposes which they are intended to serve. See *Machine.*

Wood-JACK, a kind of stool used for sawing or cutting wood upon.

JANNOCK, bread made from oatmeal. In some places it is called *Jamock.*

JANUARY, the first month of the year. In this month the farmer is in general much less engaged than in most of the others, yet there is in it a portion of business that must not by any means be neglected.

Thrashing may be conveniently performed at this season. In almost every part of the country this labour is executed according either to standing custom, or the particular inclination of the farmer; that is, by the labourer working by the day, or by measure. Whichever method may be adopted, where a thrashing machine is not employed, the eye of the master, or some individual of his own family, or of a faithful bailiff, is required, to constantly watch the conduct of the thrashers; to ascertain, if they work by measure, that they make clean work; or if by the day, that they not only clear the straw perfectly, but that they do not lose their time. It is observed in the New Farmer's Calendar, that it scarcely need be repeated, of what great consequence this attention is, whether in a private or public view; and that it is too generally neglected, any person may be satisfied by an examination of the straw sold in different markets. A dishonest thrasher, either from motives of interest or indolence, will employ himself chiefly, it is said, with the largest heads of the corn, which yield most freely, slighting and hurrying over that part which requires more labour and is less productive: such a one may also commit considerable depredations in a length of time, by concealing and carrying away the corn in small quantities; therefore, in order to prove good, as well as bad characters, and to prevent the dangers of temptation, the conduct of all labourers, without exception, in the barn, the granary, the stable, and in all situations of trust, should, it is thought, be sedulously watched, both early and late. Care should always be taken to keep the poultry from the barn, in the casual absence of the thrashers, either by closing the doors, or watching them carefully.

All sorts of cattle at this precarious season require great attention, but more especially such as are trusted to shift abroad should have at least daily inspection, to prevent or relieve accidents; and the utmost care should be taken, that such as lie at home be well and plentifully supplied with proper kinds of fodder, and also comfortable dry lodging; for, without this last, the cattle will never look thrifty and well, even though they may have good and suitable food; the fattening beasts should also be carefully attended to, in regard to food, cleanliness, and warmth; likewise the working beasts. Watchful notice should be taken of the time when the ewes may be expected to lamb, or the cows to calve; and some weeks previous to this critical period, they ought to have the best food the farm will afford them, with dry and comfortable shelter from the effects of the weather.

The work mentioned above also states, that one of the most useful applications of the leisure afforded by the winter season is making good the fences upon a farm: and that, when the importance of this business is considered, the constant losses which must surely accrue from its neglect, together with its disreputable appearance, it is not a little wonderful, that, in a country with such high pretensions to cultivation, it should be so often seen in a state of great neglect. There is another species of neglect no less prevalent in many parts, that of suffering improper stock to run at large without a keeper; these will break through the best fences, and are doing constant mischief both to their owner and his neighbour. The example of a spirited farmer, who will suffer no trespasses of this kind, without requiring ample amends, and who has a strict regard both to the state of his fences, and to the keeping his cattle within bounds, is, it is conceived, of real utility in a parish, in the way of setting an example.

The business of draining may often be conveniently performed at this period both by the spade and the plough. And, when the vast and immediate benefit of it is considered, it seems strange to behold any land that is in a wet and unproductive state, in the occupation of a man of property. Meadow land in particular is neglected, and frequently suffered to remain in a state of swamp or bog, overrun with flags, rushes, and all kinds of sour and useless rubbish, to the immense loss of the infatuated

owner, and of the public at large, which, properly drained, seeded, and kept clean, would produce abundant crops of the most valuable herbage; and the far greater part of that arable land, which is a mere puddle of water during all the wet season, or, being partially relieved by surface drainings, remains in a cold, unwholesome, perishing state all winter, to produce a crop of corn at harvest, which barely pays expences, would return in one year the expence of draining, and continue during a long lease, in a sound and healthy state. On wet and difficult clays, or boggy grounds, which the tenant has not property or leisure to drain, it would probably, it is supposed, be highly to the advantage of both landlord and tenant, were the former to advance the necessary sums, on proper security being given him.

It is advised that, at the commencement of every new year, the intelligent careful farmer should always have before him a correct statement of his stock, its condition and value, with a general prospect of the present, and probable future situation of his concern, taken at the close of the preceding year. From such certain documents he will be able to proceed on his business in a more regular and methodical way, and consequently, with greater assurance of success, than if every thing, as is too frequently the case, were left to custom, chance, or the exertion of the moment. By such means he will have a clear view of his funds, and how far they may be equal to any eligible improvements; he will combine his own convenience with the actual and probable state of the markets, in order to an advantageous disposal of his corn and cattle, and will determine from experience, and reflection, upon the propriety of continuing or varying his course of crops, or of making any changes in the quantity or quality of the live stock which he may keep. It is recommended by Mr. Young, that the evenings at this season, be employed in arranging all sorts of work for the following day, whether fine or rainy, and that the farm-books be made up for the transactions of the past day. "Besides these, the farmer should, he thinks, have another book, for miscellaneous observations, queries, speculations, and calculations, for turning and comparing different ways of effecting the same object, for estimates of the different kinds of food he may have it in his power to give the same cattle; with all such inquiries, doubts, or propositions, worth attention, as he may have heard in conversation. Loose pieces of paper are generally lost after a time, so that when a man wants to turn to them to examine a subject formerly estimated or discussed, he loses more time in searching for a memorandum, than would be sufficient for making half a dozen new ones; but when such matters are entered in a book, he easily finds what he wants, and his knowledge will be in a much clearer progression, by recurring to former ideas and experience. Formerly farmers never read books of husbandry: many read them now; and there are few that will not furnish very valuable hints. These should be noted, that when an occasion offers, use may be made of them. Such an employment of a winter evening, is a very different one from spending it at a public house, in the same company over and over again, which, after a time, becomes a pump that yields no water."

When the weather at this season is suitable, the important business of marling, claying, and chalking, may be carried on through the whole month. See *Marling*, *Claying*, and *Chalking*.

Mazagan beans may in some cases be sown at this season, and likewise oats. See *Beans* and *Oats*.

JARDON, in *farriery*, a hard swelling on the outside of the ham in horses. It mostly proceeds from blows or contusions, and should at first be treated by mild discutient applications, such as those of the saturnine camphorated kind. When very hard and insensible, blisters or other more stimulant topical remedies may be required.

JAUNDICE, in *farriery*, a disease in horses, proceeding from obstructions in the biliary ducts, or a diseased state of the liver. It is produced from causes which are often the same as induce other complaints among horses, as violent colds, which are not unfrequently accompanied with fevers of the bilious kind. Full feeding and want of sufficient exercise or evacuations, at proper periods; costiveness; violent exercise, which occasions too great a derivation of blood to the liver; unwholesome food; old surfeits or chronic affections, inducing a bad habit of body, &c. And on account of the structure and mechanism of a horse's liver, having no gall-bladder, but only a pretty large duct, with two or three smaller ones that open into it, it may not be unreasonably conjectured, that he may be more subject to bilious disorders, than those animals that have a proper receptacle for the gall, or bile.

The signs of the disease in horses, are a dusky yellowness of the eyes; the inside of the mouth and lips, the tongue and bars of the roof of the mouth, have also a yellow appearance. Besides these the horse is dull, and refuses all manner of food, and the fever begins slowly, but both it and the yellowness soon increase and proceed together. His dung is often hard, dry, and of a pale yellow, or light pale green. The urine is commonly of a dark dirty brown colour, and, when it has settled some time on the pavement, it looks red like blood. He also stales with some pain and difficulty; and if the disease be not soon checked, all the symptoms increase, and he soon grows delirious.

In young horses this disease is seldom dangerous. When it is caused by high feeding, and want of sufficient exercise, it is more easily removed, than where it is brought on by those causes which induce a morbid state of the liver. In old horses, when the liver has been long diseased, the cure is scarcely practicable. Where a horse has been a considerable while dull, heavy, and inactive, with a diseased appearance; appearing always aukward, and loth to turn short, or twist his body, especially to the near side; the off-side of his belly hard, and somewhat distended; and the yellowness of the mouth and eyes appears at the same time, a diseased liver may

be suspected, and probably a schirrous state of it.

In the cure of the disease Mr. Ryding objects, as a general rule, to let blood; for "bleeding," he thinks, "by producing great debility, and promoting absorption, must evidently have a tendency to increase the disease."

"Brisk purges, joined with calomel, will, he says, be found of the greatest benefit in removing the obstructions to the free passage of the bile."

In young horses Mr. Denny advises this plan:

Take of Aloes, in powder, one ounce;
Calomel, one drachm;
Castile soap, half an ounce.
Make them into a ball with a sufficient quantity of treacle.

And give the second morning afterwards, the following ball:

Take of Nitre, Resin,
Castile soap, of each half an ounce;
Honey, enough to make a ball.

Where the yellowness continues in the eyes and mouth, he advises the repetition of it after an interval of four days; during which, mashes and warm water are to comprise the whole of the animal's diet. Warm clothing should be allowed, and exercise daily given.

JAWS *of a Horse*, the principal bones of the head of that animal. See *Horse*.

JAW-KNOTTED, in *farriery*, a term used to denote glandular swellings beneath the jaw of the horse or other animals.

JAW-SET, in *farriery*, a vulgar name used to signify the spasmodic affection termed the locked-jaw. See *Locked-Jaw*.

JERUSALEM-ARTICHOKE, a tuberose-rooted plant sometimes cultivated by the farmer; and which is described in the Bath Papers, as usually raised by planting pieces or cuttings of the old roots, or tubers, with an eye or bud in each, either in autumn or spring season, in nearly the same manner as the potatoe.

JOBBING, a term used by farmers for a petty kind of buying and selling or dealing in cattle or any other sort of farming stock.

JOURNEY, in *husbandry*, signifies a yoaking or as much ground as can be ploughed over in a day, though it is not applied in the same way in all districts, or has the same signification, as in some, it is used to express a much less proportion of labour. See *Team*.

JULY, the seventh month of the year.

The business of harrowing and hoeing the broadcast turnip crops must now be well regarded by the farmer, to see that they be well executed. The harrowing should be first performed in an effectual manner. The hoeing is to be afterwards practised with nine-inch hoes made very sharp, striking them freely into the mould about the plants, which they leave, which should be the strongest and healthiest ones. They are thus set out to the distance of twelve inches. The work should be executed in a bold manner, the weeds being deeply cut up.

This operation should be repeated in about a fortnight afterwards. Where the practice is not well understood, it is best performed by the day; but in other cases it is usually done by the acre at five or six shillings for the first and four for the second hoeing.

But in the row culture of turnip crops, this sort of work is done by horse-hoes between the rows, hand labour being only employed in thinning the plants in the rows; which should be left at from nine to twelve inches according to soil, &c.

Soot may likewise now be sown over the young turnip crops to protect them from the fly.

The sowing of cole should at this time be performed for a principal crop. It may also be done where turnips have failed.

Cabbage crops should be attended to and kept clean; the mould being well laid up to them.

This is the season for pulling weld, which should be done by women, and be bound up into small sheaves.

Carrots should have another hoeing this month in dry weather.

The horse-hoed beans should be now again attended to, by using a proper fixture at the end of the hoe beam to keep up the whipple-tree from doing mischief to the beans.

The fattening cattle should be carefully looked to this month. And those under the practice of soiling in the stalls or yards be carefully supplied with abundance of food of the crops employed in succession.

The sheep fold should be diligently continued through this month; on lands for wheat, and seeds, folding those first which are to be first sown.

The lambs should be weaned towards the end of the month, being put on the clovers and saintfoin rouen, or on early sown turnips, or fresh common grass. By this means the ewes may be got more forward.

Continue the soiling of the horse and ox teams during the whole of the month with the crops mentioned in the preceding month, having water and plenty of litter.

The hogs during this season may be kept on the clovers, chicory, and lucern. Lettuces will also be ready for the sows and weaned pigs on the early lands. Also green beans. The dairy wash should be suffered to accumulate for future use.

The cutting of the early crops of peas, barley, wheat, buck, and rye may sometimes be necessary in the latter part of this month, though the following is the proper season.

Mildewed wheat should be well attended to, to have it immediately reaped.

The digging and carting of manures should be actively continued through the whole month, with the different sorts noticed in the preceding month.

The teams may likewise be employed in laying new floors of earthy materials in the foddering yards, where the old ones have been removed.

The lucern crops may now be cut again, the intervals being kept clean by horse-hoeing, and the rows by hand-weeding.

The crops of burnet left for seeding will now be ready to mow, which should be carefully done to prevent shedding, being threshed out upon a cloth in the field.

The rouens should towards the close of the month be shut up, for the use of ewes and lambs in winter and early spring, when they will be highly beneficial to the farmer.

Pigeons should be continued to be fed in this month.

JUNE, the sixth month of the year. This is the principal season for putting in the turnip crops, as later sown crops seldom succeed well. The sowings should always be made about the middle of the month, but not much later. See *Turnip*.

A second or third sowing of the Swedish turnip may likewise be now made, and where former sown crops have been destroyed, the land may be resown after being well scuffled over.

Cabbages may now be planted, if it has not been done before, especially on the lands where turnips have failed, which may often be done without a fresh ploughing, and the importance of green winter food is well known.

But where turnips fail and cabbages are not sown, it is best to lay up the land in winter for barley and clover sown with it, which may be more beneficial than putting in wheat.

In the preparation of cabbage fallows, where the land proves too cloddy in this month, the drill or clod roller may be found highly beneficial in reducing the land to a suitable state of pulverization.

The carrot crops should now have another hoeing, so as to fully destroy all weeds, and set out the remaining plants that may have escaped to proper distances, the ground being left very fine.

The concluding hoeings should likewise be given to the potatoe crops, the mould being well laid up to the rows.

Another careful hand-hoeing may also be given to the madder crops, six or eight inch hoes being employed in the work, and the breaking of these brittle plants guarded against as much as possible. In the latter end of the month the first horse-hoeing should be given, turning a furrow on each side *from* the plants so as to form a ridge in the middle, in which state they should be left till the ensuing month.

The liquorice plantations likewise require a second hoeing now.

The tying the hop bines to the poles should be finished in the beginning of this month.

The flax crops must likewise be carefully hand-weeded, as much depends on their being kept clean.

The drilled crops of peas and beans should now be horse-hoed, without carrying the hoes too near the roots of the plants.

The drilled lucerne crops should be well hand-hoed and cleared from weeds by picking them out, in the early part of the month: but the horse-hoe need not be used the first year.

The old crops are now ready for cutting and being used in soiling animals.

The saintfoin and clover crops may be mown and made into hay in the latter part of the month. See *Saintfoin* and *Clover*.

Attention should now be had to stir the lands under fallow; this is probably better done by the skim or scufflers than the plough, working them till near the commencement of harvest, and then giving the earth which will be highly effectual.

Buck-wheat may now be sown after the tares or other crops of the same kind have been removed.

The rape or cole crops should likewise be sown through the whole of the month when intended for sheep food.

The sowing of spring tares in mixture with cole seed should at this period be practised in order to provide a nutritious feed for weaned lambs in the autumnal season.

The hoeing of the bean crops should be well attended to during the whole of the month, and the weeds be eaten by sheep.

This is a proper season for ploughing in all sorts of green crops which whether rye, tares, or buck wheat should be executed with the skim coulter plough; being done some time before the crops are sown.

The warping of arable lands may be practised this month. See *Warping of Land*.

The wheat and other grain crops should be well attended to, and the thistling of them concluded in a careful and exact manner. The thistles should also be removed from the pasture lands.

Great attention is likewise necessary to different kinds of live stock, to see that they proceed in a proper manner. The pastures should be duly charged with the fattening and dairy stock; and the store stock be made to follow so as to consume the produce in the least wasteful manner.

The cheese dairying mostly begins with this month, as when entered upon sooner, the cheeses are liable to hove or swell, and be spoiled.

The fattening sheep to be sold from turnips or cabbages the following winter, should be well kept in this month, in order that they may get properly forward.

The fly should now be attentively guarded against by frequent examination, especially in inclosed districts.

The business of washing and shearing sheep must now be performed. See *Sheep*.

Where folding is practised it may be now had recourse to on the cabbage and turnip grounds with much advantage.

The stock of swine may now be kept on the clovers or chicory, or be soiled with them in their yards or sties.

The teams should through this month be carefully soiled and littered, so that a large supply of dung may be raised, lucerne, tare, clover, and chicory crops may be employed this way.

This is the time for castrating or *twitching* colt foals, and also the chief season for swarming bees.

Carting of compost, manure, marling, claying, and chalking may go on in this month in districts where such manures are employed. The lime-kilns may also be kept to close work. And likewise the process of paring and burning, as well as the emptying of ponds, rivers, and ditches.

This is also the proper season for planting out holly for hedges, &c.

JUNET, a term applied to the earth-nut.

K

KIB

KALI the name of a plant which is also some times called *salsola*, *salicornia*, *alga marina*, salt-wort, and snail-seeded glass-wort. There are numerous species.

It has spreading, reddish, pretty thick branches; oblong, narrow, pointed, fleshy leaves, like those of houseleek. The flowers are imperfect in the bosoms of the leaves, are followed each by one seed spirally curled, and inclosed in the cup. It is an annual plant, and grows wild on the sea-coasts in the southern parts of Europe, particularly of the Mediterranean, and affords much alkaline saline matter in its decomposition, which, when manufactured, is sometimes termed kelp.

And from the *quercus marina*, also called *fucus vesiculosus*, *fucus maritimus*, *alga marina*, *sea-oak*, *sea-wrack*, or *sea-tang*, much alkaline salt is obtained by incineration; the juice of its vesicles, left to putrefy, yields on evaporation a portion of acrid pungent salt. It is made use of as a manure in many places with vast advantage. See *Sea-weed*.

KEEVE, a provincial term used to signify a vat in which beer is worked or fermented.

KELL, a web, or kind of bag, in which insects are bred.

KELP, a term applied to the mineral alkali in its most impure state; the kelp of commerce contains the ashes of the plant that affords it. See *Kali*.

KENNEL, in rural economy, a habitation for dogs, especially those of the hound kind: it should be situated a good distance from the house.

KIBED-HEELS, in *farriery*, are chinks and sores on the inside of the hind-pasterns and in the heels of horses, caused by travelling in deep sandy lanes, or from natural causes in the part; but mostly from want of care in washing and keeping them clean after exercise. These sores are often so painful as to cause a horse to lose his appetite, and go lame and stiff for some time after setting out. The method of cure is the same with that of the grease. If the sores be dry, it is the best practice to keep the heels supple with currier's dubbing, which is made of oil and tallow. This will keep the skin from cracking, and prevent kibes, if used before exercise, and after washing the heels with warm water when the horse comes into the stable after being wrought. See *Grease*.

KID

KICKER, a term applied to such horses as have the habit of kicking: this should be particularly guarded against in the rearing and managing of young horses. See *Horse*.

KID, a name applied to the young of the goat kind.

KID, a small faggot of under, or brush-wood.

KIDED, a term provincially applied to the pods of beans.

KIDEROW, provincially, a term that signifies a place for keeping a sucking calf.

KIDNEYS, the glandular bodies by which the urine is secreted in animals. They are generally situated about the lumbar region. In horses the kidneys are extremely liable to be affected; the signs of which are, a weakness of the back and loins, difficulty of staling, faintness, loss of appetite, and deadness in the eyes; the urine is thick, foul, and sometimes bloody, especially after a violent strain. A horse diseased in his kidneys can seldom back, that is, move straight backwards, without pain, which is visible as often as he is put to the trial: the same thing is observable indeed in horses whose backs have been wrenched, but with this difference, that in the latter there is seldom any defect or alteration in the urine, except that it is higher coloured.

Bleeding in the beginning is the best remedy, and that plentifully, in order to prevent inflammation; and the more so if a fever attends a difficulty in staling, as then it may be suspected that the kidneys are inflamed. A rowel in the belly has been found useful; and the following balls may be given twice or thrice a-day, with a quart of marshmallow decoction, in which an ounce or two of gum-arabic, with an ounce of honey, have been dissolved.

> Take of Lucatelli's balsam, one ounce; of spermaceti, six drachms; of sal prunellæ, half an ounce: mix them into a ball with honey: if the urine is bloody, add half an ounce of Japan earth.

Should the fever continue, bleed largely, give emollient clysters, and cooling opening drinks, till it abate.

If the urine passes with difficulty and pain, notwithstanding these means, give the following ball, and repeat it twice or thrice a-day till the horse stales freer and without pain, his urine becomes of a

right appearance, and is free from any mucous settlement.

Take of balsam of capivi, or Strasbourg turpentine, and of Venice soap, each one ounce; of nitre six drachms; of myrrh, powdered, two drachms: make them into a ball with honey, and wash it down with marshmallow decoction.

But if this method should not be successful, and the urine continues turbid, grows coffee-coloured or fœtid, the horse loosing his appetite and flesh, it is a sure sign of ulceration in the kidney; which, if the above remedies do not soon remove, you may apprehend consumption, and an incurable disease.

As a suppression of urine arises sometimes from an inflammation of the kidneys; so at others, from a paralytic disorder disabling them in their office of separating the urine from the blood; in this latter case the bladder is usually empty, so that a horse will make no motions to stale; and if he continues a few days in this condition, his body will swell to a great degree, breaking out in blotches all over, and death soon closes the scene.

In this case, if inflammation be present, bleed largely, and treat the horse as above recommended; but if not, give stimulating clysters, and strong diuretics, such as the following balls, once in four hours; for if a horse stales not in thirty hours his danger must be great.

Take of juniper berries, powdered, one ounce; of sal prunellæ, six drachms; of æthereal oil of turpentine, half an ounce; of camphor, one drachm; of oil of juniper, two drachms: make them into a ball with honey, and give after it three or four horns-full of the marshmallow decoction and honey.—Or,

Take of squills, powdered, two or three drachms; nitre half an ounce, or six drachms: make into a ball with honey.—Or,

The following, which is still more forcing, and should be given with caution.

Take of cantharides well dried, from one scruple to half a drachm; of camphor dissolved in oil of almonds, from one drachm to two; of nitre and Venice soap, of each an ounce: mix them into a ball with syrup of marshmallows.

When this last ball is given, the horse should be made to drink plentifully of water with gum-arabic dissolved in it; the following clyster may also be given at the same time:

Take of Barbadoes aloes, two ounces; the same quantity of Venice turpentine, beat up with the yolks of two eggs; jalap, powdered, two drachms; juniper and bay berries, each a handful, bruised and boiled in two quarts of a decoction of mallows; strain off, and mix by degrees with the above, to which add a pint of linseed oil.

If the complaint is not removed by these means, rub the horse's reins well with two parts of oil of turpentine, and one of oil of amber; and apply a poultice of garlic, horse radish, mustard seed, camphor, and green soap, spread on thick cloth over them. Give the horse also two drachms of calomel over night, and a moderate purge next morning. These perhaps are the chief and best remedies that can be given in this generally fatal disorder.

When the stranguary in a horse does not arise from pressure on the neck of the bladder, the cause is generally from inflammation, or too long a retention of the urine. Such horses make frequent motions to stale, stand wide and straddling, are full, and have their flanks distended. In this case bleed largely, and give the following drink, repeating it every two hours, for two or three times, till the horse is relieved.

Take of Venice turpentine triturated with the yolk of an egg, one ounce; of nitre or sal prunellæ, six drachms; of sweet oil, half a pint; and of white wine, a pint.

If this should not have the desired effect, the diuretic ball prescribed above may be given in the same manner, omitting the myrrh. Give the horse plenty of the marshmallow decoction, in a quart of which dissolve an ounce of nitre and gum-arabic, and two of honey.

Horses that are subject to a diabetes, or profuse staling, if old or of weak constitutions, are seldom cured; they soon lose their flesh and appetite, grow feeble, their coat staring, and they die rotten. Of a young horse there are more hopes, but he must not be indulged with too much water, or moist food. Let him have the following:

Take of jesuit's-bark, four ounces; of bistort and tormental root, each two ounces: boil them in two gallons of lime-water to the consumption of half, and give a pint three times a day.

Let the horse drink two or three quarts a day of lime water, and if these medicines should not succeed, give a quart of strong alum posset, three or four times a day. This method is proper also for a horse which stales blood, or the following ball may be given for that purpose, if the bleeding is profuse:

Take of red bole one ounce; of Japan earth, half an ounce; of roch allum, two drachms: make them into a ball with conserve of roses, and give it every six hours.

As this disorder generally proceeds from too violent exercise, over-straining, &c. repeated bleedings in small quantities are at first absolutely necessary.

KILN, a kind of oven or stove for admitting heat, in order to dry substances of various kinds, as corn, malt, hops, &c. It also signifies a fabric or building constructed for the purpose of burning lime-stone, chalk, and other calcareous stones, into lime. Kilns are of different kinds, and formed in different ways, according to the purposes for which they are designed.

Hop KILN, a stove or kiln constructed for the purpose of drying or stoving hops. See *Oast*.

Lime KILN, a sort of kiln constructed for the purpose of burning various kinds of calcareous substances, such as lime-stone, chalk, shells, &c. into

lime. They are built of different forms or shapes, according to the manner in which they are to be wrought and the kinds of fuel which are to be employed. It is remarked by Mr. Marshall, in his work on landed property, that in places where materials are dear, from their being fetched from a distance, and where the fuel is coals, and also expensive, the form of a kiln is mostly that of an inverted cone, a form which has its inconveniences: but in districts where the art of burning lime is practised with superior attention and correctness, the form has of late years been gradually changing from conical to eliptical.

In his opinion, "the best form of a lime furnace, in the established practice of the present day, is, that of the egg placed upon its narrower end, having part of its broader end struck off, and its sides somewhat compressed; especially towards the lower extremity: the ground plot or bottom of the kiln being nearly an oval; with an *eye*, or draft hole, toward each end of it." He supposes that, "two advantages are gained, by this form, over that of the cone. By the upper part of the kiln being contracted, the heat does not fly off so freely as it does out of a spreading cone. On the contrary, it thereby receives a degree of reverberation, which adds to its intensity." But "the other, and still more valuable effect is, he says, this: when the cooled lime is drawn out, at the bottom of the furnace, the ignited mass, in the upper parts of it settles down, freely and evenly, into the central parts of the kiln. Whereas, in a conical furnace, the regular contraction of its width, in the upper as well as the lower parts of it, prevents the burning materials from settling uniformly, and levelling downward. They "hang" upon the sides of the kiln; and either form a dome, at the bottom of the burning mass, with a void space beneath it, thereby endangering the structure, if not the workmen employed; or breaking down in the centre, form a funnel, down which the under-burnt stones find their way to the draft holes."

And "the contraction of the lower part of the kiln has not the same effect. For, after the fuel is exhausted, the adhesion ceases, the mass loosens, and as the lime cools the less room it requires. It therefore runs down freely to the draft holes; notwithstanding the quick contraction of the bottom of the kiln or furnace."

And lastly, that "with respect to the lime furnace (which is, he thinks, entitled to the most sedulous attention of agricultural chemistry) the fire requires to be furnished with a regular supply of air. When a kiln is first lighted, the draft holes afford the required supply. But after the fire becomes stationary, in the middle, or towards the upper part of the kiln (especially of a tall kiln) while the space below is occupied by burnt lime, the supply from ordinary draft holes becomes insufficient. If the walls of the kiln have been carried up dry or without mortar, the air finds its way through them to the fire. In large deep kilns that are built with air-tight walls, it is common to form air holes in their sides, especially in front, over the draft holes. But these convey the air in partial currents, to one side of the kiln only: whereas that which is admitted at the draft holes passes regularly upward, to the center as well as to every side of the burning mass; and moreover tends to cool the burnt lime, in its passage downward; thereby contributing to the ease and health of the workmen. Hence he is of opinion that the size of the draft holes ought to be proportionate to that of the kiln, and the size of the stones taken jointly (air passing more freely among large than among small stones) and that the required supply of air should be wholly admitted at the draft holes. By a sliding or a shifting valve, the supply might be regulated; and the degree of heat be encreased or diminished, at pleasure," according to circumstances.

The most ancient kind of lime-kiln is probably that which is made by excavating the earth in the form of a cone, of such a size as may be necessary, and afterwards building up the sides or not, according to the circumstances of the case; the materials being then laid in, in alternate layers of fuel and stone, properly broken, until the whole is filled up. The top is then covered with sods, in order that the heat may be prevented from escaping, and the fire lighted at the bottom, and the whole of the contents burnt in a greater or less space of time, in proportion to the nature of the stone, and the quantity that is contained in the kiln. From the circumstance of the top parts of these kilns in some districts being covered over and sometimes built up with sods, they are termed *Sod-kilns*.

When the whole of the contents of such kilns are grown cold, they are drawn or taken out from the bottom, and the kiln again filled, if necessary. These kilns are obviously intended for burning only one kiln full at a time. But as the burning of lime in this way is tedious and uneconomical, other methods and forms of kilns have been had recourse to. Where lime is much wanted, either for agriculture or other purposes, they therefore use perpetual kilns, or what are more generally known by the name of *draw-kilns*. These, as all lime-kilns ought to be, are, Mr. Donaldson says, situated by the side of a rising bank, or sheltered by an artificial mound of earth. They are generally built either of stone or brick; but the latter, as being better adapted to stand excessive degrees of heat, is considered as preferable. The outside form of such kilns is sometimes cylindrical, but more generally square. The inside should be formed in the shape of a hogshead, or an egg, opened a little at both ends, and set on the smallest; being small in circumference at the bottom, gradually wider towards the middle, and then contracting again towards the top. In kilns constructed in this way, it is observed, fewer coals are necessary in consequence of the great degree of reverberation which is created above that which takes place in kilns formed in the shape of a sugar-loaf reversed. Near the bottom, in large kilns, two or more apertures are made; these are small at the inside of the kiln, but are sloped wider, both at the sides and the

top, as they extend towards the outside of the building. The uses of these apertures are, for admitting the air necessary for supplying the fire, and also for permitting the labourers to approach with a drag and shovel to draw out the calcined lime. From the bottom of the kiln within, in some cases, a small building called a horse is raised in the form of a wedge, and so constructed as to accelerate the operation of drawing out the burned lime-stone, by forcing it to fall into the apertures which have been mentioned above. In other kilns of this kind, in place of this building there is an iron gate near the bottom, which comes close to the inside wall, except at the apertures where the lime is drawn out. When the kiln is to be filled, a parcel of furze or faggots is laid at the bottom, over this a layer of coals, then a layer of lime-stone (which is previously broken into pieces, about the size of a man's fist), and so on alternately, ending with a layer of coals, which is sometimes, though seldom, covered with sods or turf, in order to keep the heat as intense as possible. The fire is then lighted in the apertures; and when the lime-stone towards the bottom is completely calcined, the fuel being considerably exhausted, the lime-stone at the top subsides. The labourers then put in an addition of lime-stone and coal at top and draw out at bottom as much as they find thoroughly burned; and thus go on, till any quantity required be calcined. When lime-stone is burned with coals from $2\frac{1}{2}$ to $3\frac{1}{2}$ bushels, on a medium 3 bushels of calcined lime-stone are produced for every bushel of coals used.

In the sixth Essay of Count Rumford, a lime-kiln of this sort is described, which is in possession of the Dublin Society, as well as the principal objects that ought to be had in view in constructing of the kiln pointed out; the first of which is "to cause the fuel to burn in such a manner as to consume the smoke, which was done by obliging the smoke to descend and pass through the fire, in order that as much heat as possible might be generated.—Secondly, to cause the flame and hot vapour which rise from the fire to come into contact with the lime-stone by a very large surface, in order to economise the heat, and prevent its going off into the atmosphere; which was done by making the body of the kiln in the form of a hollow truncated cone, and very high in proportion to its diameter; and by filling it quite up to the top with lime-stone, the fire being made to enter near the bottom of the cone.

"Thirdly, to make the process of burning lime perpetual, in order to prevent the waste of heat which unavoidably attends the cooling of the kiln in emptying and filling it, when, to perform that operation, it is necessary to put out the fire.

"And, fourthly, to contrive matters so that the lime in which the process of burning is just finished, and which of course is still intensely hot, may, in cooling, be made to give off its heat in such a manner as to assist in heating the fresh quantity of cold lime-stone with which the kiln is replenished as often as a portion of lime is taken out of it.

"To effectuate these purposes, the fuel is not mixed with the lime-stone, but is burned in a close fire-place, which opens into one side of the kiln, some distance above the bottom of it. For large lime-kilns on these principles there may be several fire places all opening into the same cone, and situated on different sides of it; which fire-places may be constructed and regulated like the fire-places of the furnaces used for burning porcelaine.

"At the bottom of the kiln there is a door, which is occasionally opened to take out the lime.

"When, in consequence of a portion of lime being drawn out of the kiln, its contents settle down or subside, the empty space in the upper part of the kiln, which is occasioned by this substraction of the burned lime, is immediately filled up with fresh lime-stone.

"As soon as a portion of lime is taken away, the door by which it is removed must be immediately shut, and the joinings well closed with moist clay, to prevent a draft of cold air through the kiln. A small opening, however, must be left, for reasons which are explained below.

"As the fire enters the kiln at some distance from the bottom of it, and as the flame rises as soon as it comes into this cavity, the lower part of the kiln (that below the level of the bottom of the fire-place) is occupied by lime already burned; and as this lime is intensely hot, when, on a portion of lime from below being removed, it descends into this part of the kiln, and as the air in the kiln, to which it communicates its heat, must arise upwards in consequence of its being heated, and pass off through the top of the kiln, this lime, in cooling, is, by this contrivance, made to assist in heating the fresh portion of cold lime-stone with which the kiln is charged. To facilitate this communication of heat from the red-hot lime just burned to the lime-stone above in the upper part of the kiln, a gentle draft of air through the kiln from the bottom to the top of it must be established by leaving an opening in the door below, by which the cold air from without may be suffered to enter the kiln. This opening (which should be furnished with some kind of a register) must be very small, otherwise it will occasion too strong a draft of cold air into the kiln, and do more harm than good; and it will probably be found best to close it entirely, after the lime in the lower part of the kiln has parted with a certain proportion of its heat.

The height of the kiln represented in *pl.* I. *fig.* 1. is on a scale of fifteen feet; its internal diameter below, two feet; and above, nine inches. In order more effectually to confine the heat, its walls, which are of brick, and very thin, are double, and the cavity between them is filled with dry wood-ashes. To give greater strength to the fabric, these two walls are connected in different places by horizontal layers of bricks, which unite them firmly.

a is the opening by which the fuel is put into the fire-place. Through this opening the air descends which feeds the fire. The fire-place is represented nearly full of coals, and the flame pass-

ing off laterally into the cavity of the kiln, by an opening made for that purpose at the bottom of the fire-place. The opening above, by which the fuel is introduced into the fire-place, is covered by a plate of iron, moveable on hinges; which plate, by being lifted up more or less by means of a chain, serves as a register for regulating the fire. A section of this plate, and of the chain by which it is supported, are shewn in the figure.

b is an opening in the front wall of the fire-place, which serves occasionally for cleaning out the fire-place, and the opening by which the flame passes from the fire-place into the kiln. This opening, which must never be quite closed, serves likewise for admitting a small quantity of air to pass horizontally into the fire-place. A small proportion of air admitted in this manner has been found to be useful and even necessary in fire-places in which, in order to consume the smoke, the flame is made to descend. Several small holes for this purpose, fitted with conical stoppers, may be made in different parts of the front wall of the fire-place.

The bottom of the fire-place is a grate constructed of bricks placed edgewise, and under this grate there is an ash-pit; but as no air must be permitted to pass up through this grate into the fire-place, the ash pit door, *c*, is kept constantly closed, being only opened occasionally to remove the ashes.

d is the opening by which the lime is taken out of the kiln; which opening must be kept well closed, in order to prevent a draught of cold air through the kiln. As only as much lime must be removed at once as is contained in that part of the kiln which lies below the level of the bottom of the fire-place, to be able to ascertain when the proper quantity is taken away, the lime, as it comes out of the kiln, may be directed into a pit sunk into the ground in front of the opening by which the lime is removed; this pit being made of a proper size to serve as a measure.

While the lime is removing from the bottom of the kiln, fresh lime-stone should be put into it above; and during this operation, the fire may be damped by closing the top of the fire-place with its iron plate. Should it be found necessary, the fire, and the distribution of the heat, may, in burning the lime, be further regulated by closing more or less the opening at the top of the lime-kiln with a flat piece of fire-stone, or a plate of cast iron. The double walls of the kiln, and the void space between them, as also the horizontal layers of bricks by which they are united, are clearly and distinctly expressed in the figure.

In some districts it is a common practice to burn lime-stone with furze. The kilns which are made use of in these cases are commonly known by the denomination of *Flame-kilns*, and are built of brick; the walls from four to five feet thick, where they are not supported by a bank or mound of earth. The inside is nearly square, being twelve feet by thirteen, and eleven or twelve feet high. In the front wall there are three arches, each about one foot ten inches wide, by three feet nine inches in height. When the kiln is to be filled, three arches are formed of the largest pieces of lime-stone, the whole breadth of the kiln, and opposite to the arches in the front wall. When these arches are formed, the lime-stone is thrown promiscuously into the kiln to the height of seven or eight feet, over which are frequently laid fifteen or twenty thousand bricks, which are burned at the same time with the lime-stone. When the filling of the kiln is completed, the three arches in the front wall are filled up with bricks almost to the top, room being left in each sufficient only for putting in the furze, which is done in small quantities, the object being to keep up a constant and regular flame. In the space of thirty-six or forty hours, the whole lime-stone, about one hundred and twenty or one hundred and thirty quarters, together with the fifteen or twenty thousand bricks, are thoroughly calcined. Kilns constructed in this way may be seen near Wellingborough, in Northamptonshire, and other places.

In many of the northern counties in Scotland which are situated at a great distance from coal, it is also a common practice, to burn lime-stone with peat; and, considering the rude ill-constructed kilns which are used for the purpose, it is astonishing, Mr. Donaldson says, with what success the operations are performed. In some of these districts, lime-stone is sufficiently calcined with peats, laid *stratum super stratum*, in kilns formed of turf; but, owing to the quantity of ashes which fall from the peat, the quality of the lime is considerably injured; and from the open and exposed situation of many of these kilns, the waste of fuel is immense. But he says that the most common method of burning lime-stone with peat, is in kilns constructed somewhat similar to those in the districts where furze is used as the only fuel. There are in general only two arches, or fire-places, and the peats are thrown into the bottom of these arches, the fronts of which are seldom closed up, by which means the wind has often great influence in retarding the operation, and frequently prevents the complete calcination of the lime-stone. An improvement might, he thinks, be made on these kilns at a very trifling expence:—If an iron gate were laid across the bottom of the arch, with a place below for the ashes to fall down, and the front of the arch closed up by a door made of cast-metal, one third of the fuel might be saved and the operation performed in a shorter time, and with a much greater certainty than by the method now practised.

In the fourth volume of Communications to the Board of Agriculture, Mr. Rawson, an intelligent Irish cultivator, has produced a considerable saving in the burning of lime, by constructing his kiln in the manner represented at *fig.* 7, *pl.* I. "It is made twenty feet in height; at the bottom a metal plate is placed one foot in height, intended to give air to the fire, over this plate the shovel that draws the lime runs. The sloped sides are six feet in height, the breadth at the top of the slope is eight feet, the sides are carried up perpendicular fourteen feet, so as that every part of the inside, for fourteen feet, to the mouth, is exactly of the same dimensions. On the mouth of the kiln a cap is placed, built of

ong stones, and expeditiously contracted, about seven or eight feet high. In the building of the cap, in one side of the slope, the mason is over the centre of the kiln, so that any thing dropping down will fall perpendicularly to the eye beneath. He is here to place an iron door of eighteen inches square, and the remainder of the building of the cap is to be carried up, until the hole at the top be contracted to fourteen inches. The kiln is to be fed through the iron door, and when filled, the door close shut. The outside wall must be three feet at the bottom to batter up to two feet at top, and made at such a distance from the inside wall of the kiln, that two feet of yellow clay may be well packed in between the walls, as every kiln built without this precaution will certainly split, and the strength of the fire be thereby exhausted. At eight feet high from the eye of the kiln, two flues should be carried through the front wall, through the packed clay, and to the opposite sides of the kiln, to give power to the fire;" it is observed, that with this kiln, he has produced one-third more lime from a given quantity of fuel; and stones of bad quality will be here reduced into powder, and may be put into the kiln without the necessity of being broken so small as is usual. As many situations may not admit of building a kiln twenty feet high, while other situations may allow of its being built thirty or even forty feet (for it cannot be made too high), the diameter of the kiln should be proportioned to the height to which it is carried.

It is further stated, that "for several years he has made use of a small kiln in an outside kitchen, the height nine feet, the diameter three feet and a half. In the side of the kiln next the fire, he had three square boilers placed, one of them large, containing half a barrel, with a cock, which supplied the family with constant boiling water; for the two others, he had tin vessels made to fit the inside with close covers, in which meat and vegetables with water were placed and put into the two smaller boilers, which never had any water, but had close covers. The tin boilers were heated sooner than on the strongest fire, and when the meat, &c. were sufficiently dressed, the whole was taken out of the metal boilers. At one side he had an oven placed for roasting and boiling meat; the bottom was metal of twenty-six inches diameter, and one inch and a half thick, a flue from the fire went underneath. Even with the bottom of the oven, a grating nine inches square was placed, which opened a communication between the oven and the hot fire of the kiln. The height of the oven was fourteen inches, shut close by a metal door of eighteen inches square, and the top, level with the mouth of the kiln, was covered by another metal plate of half an inch thick, on which was placed a second oven; the heat which escaped through the half inch plate, though not near the fire, was sufficient to do all small puddings, pies, breakfast cakes, &c. &c. The meat in the large oven was placed on an iron frame which turned on a pivot and stood on a dripping-pan, and was turned by the cook each half hour. And over the kiln he had a tiled stage for drying corn, and a chimney at one side, with a cowl on the top, which carried off all steam and sulphur: a large granary was attached to the building." It is added that the lime, if sold, would more than pay for fuel and attendance; and he has frequently had dinner drest for fifty men, without interfering with his family business. See *Burning of Lime*.

Malt-Kiln, a kiln contrived for drying malt or any kind of grain upon. In the construction of kilns of this sort many improvements have lately been made. In the fifth volume of the Repertory of Arts the description of a kiln by Mr. Pepper, of Newcastle-under-Line, is given, in which *fig.* 2, *pl.* I. is the ground plan, supposed to be twenty feet square, but, if required larger or smaller, by following the same proportion, may be made agreeable to any size or situation. The dark shaded walls rise four feet high, to put the reflector upon over the fire, and also what the side-arches stand upon, the brick piers, that carry the spark-stone, and bearers that the tiles lie upon. Letter *a*, the fire-grate, which lies nine inches below the bottom edge of the reflector; *b*, bottom edge of the reflector; *c c c c*, brick pillars nine inches square that carry the spark-stone; *d d d d d d*, brick pillars nine inches square, that carry the bearers for the floor tiles to lie upon; *e* shews the bottom of the side arches on each side of the kiln; *f* shews the space between the fire place and the side arches, for the man to go round to clean the kiln; *g*, the wall on each side of the kiln, that the side arches stand upon.

Fig. 3 is a section of it; *g* shews the section of the wall which the side arches stand upon; *h*, the door to go to the fire place; *i*, the reflector of cast-iron that covers the fire; *k*, small door in the reflector to feed the fire; *l l*, the ears of the reflector that the iron pipes are fitted upon, which convey the smoke, &c. from the reflector round the kiln, to the chimney; *m*, what is commonly called the spark stone; it prevents the kiln from being too hot in the middle, and assists in spreading the heat to the outsides; *n*, bearers of cast-iron or wood, that carry the kiln-floor; *o o* shew the ends of the ribs that carry the tiles; *p*, the kiln-tiles, that the malt lies upon; *q*, the steam-pipe that conveys the steam from the malt; *c c*, brick pillars nine inches square, that carry the spark-stone; *d d*, brick pillars, nine inches square, that carry the bearers for the floor-tiles to lie upon; *e e* shew the arches on each side the kiln. *u u* shew the situation of the pipes under the floor.

Fig. 4 is a plan of the kiln-floor, and shews the ribs that the kiln-tiles lie upon; *o o*, the cast iron or wood ribs that the tiles lie upon; *n n*, the bearers that carry the ribs; *d d* shew the tops of the brick pillars that carry the bearers, &c. *b*, the reflector that covers the fire, of cast iron, about an inch thick, hollow, and on a semicircular plan, as shewn in the drawings; *r r*, the iron pipes that convey the smoke and heat from the reflector, round the kiln, to the chimney, which lies about three feet under the kiln floor, and about the same distance from the side-walls, which are supported by iron stays

from the side arches ; *s s* shew the ends of the iron pipes that go into the chimney ; *t t*, registers to regulate the draught and heat.

Fig. 5 is a section of the chimney.

In the plate the pillars, bearers, &c. that belong to the same thing, are marked with the same letters in all the figures.

Fig. 6, *pl.* I. also represents another kiln of the same sort, invented by Mr. Joseph Coppinger, of Harbour View, near Cove, Ireland, and which is described in the fifteenth volume of the Repertory of Arts. The inventor says, that it is particularly adapted to the use of farmers, who, in wet seasons, often lose quantities of grain for want of such convenience. The advantages it appears to him to possess above the kilns now in common use, are many : first, it may be erected for one-tenth of the expence, if the value of the separate buildings be taken in, which are are now almost invariably allotted for this purpose : secondly, any kind of fuel may be used without prejudice to the malt or corn to be dried in it: thirdly, the heat (by the construction of the flues) will be more regularly and evenly distributed without any waste, as at present: fourthly, the health of the people attending, will not, as at present, be exposed to certain injury, by always breathing and sleeping in a heated and unwholesome atmosphere, as their beds will be placed in a shed on the outside of the building. This, in his mind, is the most important part of the plan, and highly worthy the attention of every humane and considerate employer in this way: fifthly, this construction of a kiln may be erected on a loft or ground floor. If in the latter situation, sufficient elevation should be given the fire-place, so as not to impede the draught. These are the principal advantages that occur to him. If the experience of others confirm them, he says he will be highly gratified. *a*, the main walls ; *b*, the flues ; *c*, the chimnies ; in each of which may be placed a metal damper to regulate the heat. It is recommended, in the case of a new building, to carry up the flues of the chimnies in the thickness of the walls. In a house already built, they may be carried up either inside or outside the building. *d*, the fire-place, which may be divided or in one, just as desired, by which the half or the whole may be heated.

Kiln-tiles eighteen inches square, and two inches thick in the solid, with a lapping of half an inch broad and one inch deep round the edge of each tile, are proposed for covering the flues, which, if fairly cast, may be laid dry, without mortar. If it should be difficult, or too expensive, to procure tiles of eighteen inches, nine inches can be made to answer. The flues are proposed to be divided by a brick, on edge, so as that every eighteen inch tile will cover two flues. The breadth of the flues may be six inches and a half and ten inches high. This proportion, it is hoped, will be found to answer in most cases ; but it may be varied according to the better judgment of the party erecting. The sides and bottoms of the flues should be plastered. The platform of this kiln should, in all cases, be well rammed with earth, and made perfectly level before laying out the flues. Iron grate-doors are intended to be hung on hinges, in a recess, at the mouth of each flue, to prevent them being choked with large pieces of cinder, or other substances. It is also intended that these doors should shut and open at pleasure, as may be found necessary.

KILN-ASHES, the ashes made in kilns where wood, straw, furze, &c. are burnt. These ashes are useful as manure for almost any kind of soil, but especially such as possess much vegetable matter. In the western districts, the farmers sift them over their corn and grass ; but this must not be done in windy weather, because they are so very light, that they would easily be blown away and lost. They are found to succeed best when laid on just before rain falls. See *Ashes*.

KINNEL, a provincial term sometimes applied to a powdering tub.

KITCHEN-GARDEN, See *Farm, Kitchen-Garden*.

KIT, in some places, a name given to a milking-pail or vessel in the form of a churn, with two ears and a cover used to convey milk in.

KITE, a bird of the hawk kind. Birds of this sort are always ready for chickens, pigeons, pheasants, &c. on which account it is necessary to guard against them, and destroy them as frequently as possible. This last purpose may sometimes be effected by laying such animal substances as have been infused in some sort of liquid with nux vomica, in the places where they come.

KNAPWEED, the same kind of weed with blue-bottle. See *Blue-Bottle*.

KNEE, the joint that connects the fore thigh to the shank in animals. The knee of the horse should be flat and large, without any swelling, roundness, or projection. This part, as is well known, is much exposed to accidents ; the most common of which are strains, which require to be treated after the manner of strains in other parts, and bruises, or what are called *broken knees*. For this last accident, Mr. John Lawrence advises the washing the wound clean from small specks of gravel or earth, with a linen rag and warm soap suds ; and afterwards to wipe the part dry, and apply brandy. Urine and salt are frequently applied. And friar's balsam *(compound tincture of benzoin)*, he supposes will heal broken knees very speedily. Or the farrier may bind upon the parts tow dipped in tincture of myrrh. But where much inflammation supervenes, it will be necessary to poultice ; and as this may happen, it furnishes an argument against the use of the foregoing, or indeed any stimulating remedies, at least when there is much laceration of the skin. A piece of sheet lead, bandaged upon the part, the same writer thinks, might occasion the hair to grow smooth, and in some degree prevent the disgraceful blemish arising from this sort of accident or circumstance.

Sometimes a kind of *hose*, or *boots*, are used to defend the knees and legs of race-horses in travelling. These reach above the knee, and are an useful guard for the protection of that part. "Some kind of guard," Mr. Lawrence supposes, "fastened above and below the knee, would be of great use to post horses, which are worked immediately upon a re-

cent fall, since they are so liable to a repetition of the accident whilst the knee is yet stiff, and the wound being again laid open, the mischief is past remedy." And it is added, that, "the *speedy* cut might as well be prevented by a leather guard, as *knocking*. These wounds should be attended to in time, and require applications of the same kind as broken knees."

And for the same accident, Mr. Ryding recommends the following, which he advises to be "applied over the wound with the hand." "Which" he thinks "will, by its gently stimulating power, brace the parts, promote the cure, and facilitate the *growth of hair*."

Take of Cantharides, in fine powder, one drachm;
Olive oil, one ounce.
Mix, and apply occasionally to the part.

The chief circumstance in these cases is to keep the part affected perfectly clean and free from much inflammation. See *Broken Knees*.

KNOT-GRASS, the same sort of grass as couch-grass. See *Couch Grass*.

KNOLL, a little round elevation or hill.

KNOLLS, a provincial term used in some counties to signify turnips.

KOHLRABI, a sort of turnip cabbage, which is probably capable of being cultivated to advantage as an article of cattle food, though it is not yet much known to the farmers of this kingdom. It has the eatable part or bulb above the ground upon the stem, and there are two varieties, the green and the blue, which are both equally good and hardy.

In the raising of these plants, the seed should be sown at the same period as for the common cabbage, and the plants, when of proper growth, transplanted out in the same manner about the beginning of June, allowing good distances both between the plants and rows. In performing this work, it is advised in the eight volume of the Agricultural Magazine, to cut off about one third of the roots of the plants, care being taken to plant them sufficiently deep in the ground, as by this means the bulb grows to a much larger size without growing tough.

They succeed best on such soils as are not too much disposed to moisture.

It is found to withstand the severity of frosts much better than the *Ruta Baga*, or Swedish turnip. And it is observed by the writer of a paper in the above work, that in the botanical garden at Brompton, some of the plants weighed seven or eight pounds; and that though many of them were notched and hacked on purpose for the experiment, the turnip remained perfectly sound and uninjured, while a bed of Swedish turnip near them was quite rotten. The saccharine quality of it is equally remarkable, and both its leaves and bulb are very useful as kitchen vegetables.

In our own trials, we found it to stand the severity of the winter without the least injury, and to be perfectly well tasted, though the bulbs did not increase to a large size. It has every appearance of being a variety of the turnip cabbage. See *Turnip Cabbage*.

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LABORATORY, a chemical apparatus necessary for the purpose of analyzing and making experiments upon the nature of soils, and other branches of agriculture. Mr. Young, in his Farmer's Calendar, observes, that this is at present of great importance to the farmer, as "the intimate connection between agriculture and chemistry is unquestioned. Let it not," says he, "however, be imagined that I propose a farmer should addict himself to a pursuit which is not only very captivating, but also very expensive; I would merely have him able to analyze in a rough way, his soils, and the fossil manures which may be found under them; for this purpose the apparatus is not formidable: and for a laboratory if he has a small blacksmith's shop and forge (which no large farmer should be without), will serve the purpose very well. It is only providing a cupboard under lock and key, to secure his glasses and the other articles necessary for these experiments. One caution, however, he must premise, if he has no forge, and converts some other room to this purpose, if it be attached to his house or offices, and a fire (from whatever cause) should consume them, the laboratory would vitiate his insurance at a fire-office, unless he enters it, and pays for the whole as *doubly* hazardous, in the language of insuring."

It is stated that the apparatus necessary for this purpose, "consists of the following particulars: a deal table with a drawer, which drawer should be sufficiently short of the full breadth to allow a range of holes in the upper surface for glass jars to stand, free from danger of falling. Half a dozen glass cylindrical jars, nine or ten inches long, and three or four inches diameter; with a few of the same shape, but smaller. One or two others, five or six inches diameter, and eighteen inches long: the contents in ounce measure marked on them with a diamond, beginning at top (when they stand inverted or the mouth downwards) 1, 2, 3, &c. descending. These to receive and measure the air or gas expelled by heat. Two or three old gun-barrels (the touch-hole closed), cut to the length of eighteen inches, and a small bent tube of iron, or of tin, finishing in an iron screw, for screwing to the end of the barrel," mentioned above.

But where, "a forge is not at hand, a cast iron furnace, nine or ten inches diameter, with a circular hole to receive the gun-barrel, and a moveable dome cover to receive the end of a tin pipe six inches diameter, and twelve feet long, and moveable while up the chimney of the room. The fire to be of charcoal. A trough or small tub of water, on legs, adapted in height to the elevation of the gun-barrel when in the furnace, with a perforated shelf in it, on which the jars to stand for receiving the air expelled. A correct pair of scales and weights: and to try whether the gun-barrels or any retorts are really air-tight, an air-pump is very useful, as he has found that blowing in them when under water is not a criterion to be depended on in such cases.

And "an evaporating saucepan; that is, a tin saucepan with a circular fixed frame of tin, four inches high, to receive a glass jar containing the earth to be dried by the boiling heat of the water, as it is necessary in comparisons for all specimens to be of the same degree of dryness, with pint or quart phials with ground stoppers for containing sulphuric acid; muriatic acid; carbonate of pot-ash; solution of pot-ash; ammonia (caustic); muriate of ammonia (the common solution of sal ammoniac). And small phials of various other chemical substances, as tests for the examination of water.

Likewise "a few glass funnels ribbed, for filtrating with blotting paper are necessary, and a hydrostatic balance."

It is supposed, "the whole of this apparatus may cost from ten to twenty pounds."

By this small apparatus, various useful experiments may be made on the quality of soils, manures, and various other matters of importance to the farmer. See *Analysis of Soils*.

LABOUR, in husbandry, the work which is necessary to be performed upon a farm, in order to render it fruitful and productive. It is of various kinds, and for the most part either performed by hired servants or day-labourers.—Where proper attention is paid by the farmer, to see that the labourer understands his business, &c. agricultural labour is probably, in general, best done by the piece, or what in some places is termed task-work. The expence or price of labour varies considerably in different districts, from particular circumstances; such as the situation, the state of manufactures, the

condition of agriculture, the facility of getting employment, and the manner of living. See *Labourer*.

Mr. Middleton, in his Survey of the County of Middlesex, thinks that agriculture may very properly be considered as the art of manufacturing the soil, and unquestionably ranks the highest in the class of manufactures; since it not only makes a greater return for the labour bestowed, than all the rest put together, but it is also of the first necessity, the demands for its products being urgent and irresistible. Any other manufactory, says Mr. Diron, may be laid down at pleasure, but agriculture *must* be supported, as it is the hinge upon which both our lives and actions turn; and the ultimate and only certain resource of the state, both for men and money.

In the above point of view the seed-grain, amounting to about 15*s.* an acre, may be said to constitute, Mr. Middleton observes, the *raw material*. When the corn and straw, produced from this seed, are dressed and sent to market, the greater part of it is then fit for consumption, and may be called *a finished manufacture*. The additional value above 15*s.* is entirely the produce of labour—at least, in conjunction with the assistance of nature, but as not one shilling could be procured for the natural products of the world without the application of labour, the whole may therefore be said to be derived from labour—and amounts to about 9*l.* 5*s.* an acre, or 1233*l.* per cent. on the cost of the raw material. Wheat is still farther manufactured into bread; but, exclusive of the operations of the miller and the baker, this is certainly not above the average for the produce of the arable land of this county; and some parts of Surrey, Kent, and Essex, yield in the same proportion. The raw material, on an average of the arable of the whole of South Britain, amounts, he says, to about 16*s.* per acre, which is increased in value by labour to 5*l.* or 525*l.* per cent. Hence the labour bestowed on fifteen millions three hundred thousand acres produce a return of 64,260,000*l.* sterling.

The cattle and implements may, he thinks, in a manufacturing point of view, be deemed the stock; the amount of which, on the meadow-land in this country is about 4*l.* an acre, and the produce 10*l.* The labour and profits of stock, therefore, are 150 per cent. On a farm purely arable in this county the stock would be 5*l.* and the produce 10*l.* or 100 per cent. There are not any grazing-farms in the county; if there were, their stock would be greater, and they would not yield so large an increase. The farming capital of South Britain is 5*l.* an acre, or 200 millions; and its annual produce is about 130, that is, 65 per cent.

He particularizes the annual produce of the soil in this way:

The arable lands as before stated,	£64,260,000
The hop-gardens make returns to the amount of 30*l.* an acre, for the produce of labour, or about - -	1,000,000
Carried forward	£65,260,000
Brought forward	£65,260,000
Nursery-grounds produce upwards of 65*l.* per acre. Deduct the raw material, and the produce of labour will not be less than 60*l.* on 10,000 acres, is - - - -	600,000
The fruit and kitchen-gardens are the most valuable resources for labour, and make the greatest return, probably to upwards of 100*l.* per acre, on an average of Great Britain; but he only estimates them at that sum on 50,000 acres, is	5,000,000
The grass land and cider counties, cultivated in South Britain, make returns to the amount of 3*l.* on twenty millions of acres, is	60,000,000
The commons, eight millions, at 1*s.* 3*d.* an acre - - - -	500,000
Total - - - -	£131,360,000

He does not presume to offer the foregoing statement as one that either is, or can be, made out with accuracy and precision. But, under all the circumstances of the case, he thinks he may fairly state the annual agricultural produce of South Britain at one hundred and thirty millions; which must be allowed to surpass all other manufactures that can be brought into competition with it, not only as to the gross amount, but also as to its superior usefulness.

Further—if, says he, we suppose that there are two millions and a half of persons employed in agriculture, their average earnings will be, for men, women, and children of all ages, 52*l.* which is a sum so much exceeding their expences, that it is evident this employment must enrich society: and it is equally clear, that it contributes at once its surplus wealth and population to make up the deficiencies of the other departments both in men and money.

LABOURER, in agriculture, a person who performs the manual or most laborious part of the business of a farm. Labourers are mostly such persons as live in cottages, or small houses in the vicinity of farms.

The author of Modern Agriculture, after premising that in all civilized states the great body of the people live by labour—and that, of whatever nature it may be, the wages received must be more than sufficient to maintain the labourer, as, were it otherwise, he could not bring up his family, and consequently this class of men would soon become extinct—observes, that in every country or district, where the useful arts are in a flourishing state, and where those employed in carrying them on are most successful in accumulating riches, the rate of wages, or price of labour, is highest. Luxury is a never-failing attendant on riches, and the number of servants always increases with the means of maintaining them. Therefore an increasing demand for servants or labourers, whether for carrying on agriculture, the purposes of trade, or for administering to the artificial wants created by luxury, naturally tends to advance the

price of labour. The very great recent advance in the rate of wages in some counties in Scotland, as Lanark, Renfrew, Perth, Angus, Fife, &c. amounts he thinks, to the most positive evidence, that commerce, manufactures, and improvements in agriculture have rapidly increased. The still low price of labour in the counties of Carmarthen, Pembroke, Cardigan, &c. in Wales—and Nairn, Inverness, and the other northern counties of Scotland, notwithstanding the great emigrations of labourers to those parts of the island where they are more certain of finding employment, is a sure sign that in these remote districts the arts have scarcely ever been introduced. It shews also, he says, that little attention is bestowed by the proprietors to improve the situation of the peasantry, either by inuring them to habits of industry, or instructing them in the advantages to be derived from a proper division of labour. In those counties where the arts have been introduced, and where the rate of labour has continued for a number of years nearly the same, it will be found that agriculture, commerce, and manufactures, although perhaps formerly in a prosperous state, are at present stationary, and that a national exertion is necessary, in order to set them again in motion.

It is farther remarked, that the wages of farm-servants, and of labourers, who are occasionally engaged in the operations of husbandry, vary nearly as much in the different districts of Great Britain as they do in the several kingdoms of Europe. In the counties in England, where commerce and manufactures are carried on to the greatest extent, as Middlesex, Surrey, Kent, Lancaster, Chester, the West Riding of Yorkshire, &c. the wages of farm-servants and day labourers may, he conceives, be stated as follows:

	Average.
A ploughman by the year, from 9*l.* to 15*l.*	£12 0 0
A female servant ditto, from 4*l.* to 6*l.*	5 0 0
A labourer in summer, from 1*s.* 6*d.* to 2*s.*	0 1 9
A labourer in winter, without board, from 1*s.* to 1*s.* 2*d.*	0 1 1
A mason ditto, from 1*s.* 10*d.* to 2*s.* 2*d.*	0 2 0
A carpenter ditto, from 1*s.* 8*d.* to 2*s.* 4*d.*	0 2 0

Where agriculture is the chief employment of the people, as in Hertford, Buckingham, Rutland, Northampton, Worcester, Northumberland, &c.

	Average.
A ploughman's wages may be stated from 7*l.* to 12*l.*	£9 10 0
A female servant, from 3*l.* 10*s.* to 5*l.*	4 5 0
A labourer in summer, without board, from 1*s.* 4*d.* to 1*s.* 8*d.*	0 1 6
Ditto in winter, ditto, from 1*s.* to 1*s.* 2*d.*	0 1 1
A mason, ditto, from 1*s.* 10*d.* to 2*s.* 2*d.*	0 2 0
A carpenter, ditto, from 1*s.* 8*d.* to 2*s.* 4*d.*	0 2 0

In those counties in Wales where improved modes of husbandry are little practised, and where there are scarcely any commerce or manufactures,

	Average.
A ploughman's wages are from 4*l.* 10*s.* to 7*l.*	£5 15 0
A female servant, from 2*l.* 10*s.* to 4*l.* 4*s.*	3 7 0
A day-labourer in summer, without board, from 8*d.* to 1*s.*	0 0 10
Ditto in winter, ditto, from 6*d.* to 8*d.*	0 0 7
A mason, ditto, from 1*s.* 6*d.* to 2*s.*	0 1 9
A carpenter, ditto, from 1*s.* 4*d.* to 1*s.* 8*d.*	0 1 6

It has been observed, that the rate of wages has advanced very rapidly of late years in many counties in Scotland. In that part of the kingdom, south of the Grampian mountains, the rise in the price of labour has, he says, been general, and is now nearly double what it was twenty years ago.

	Average.
A ploughman's wages is from 7*l.* to 12*l.*	£9 10 0
A female servant, from 3*l.* to 4*l.* 10*s.*	3 15 0
A day-labourer, in summer, without board, from 1*s.* 2*d.* to 1*s.* 6*d.*	0 1 4
Ditto in winter, ditto, from 10*d.* to 1*s.* 2*d.*	0 1 0
A mason, ditto, from 1*s.* 6*d.* to 2*s.* 4*d.*	0 1 11
A carpenter, ditto, from 1*s.* 4*d.* to 2*s.*	0 1 8

In the northern division of the kingdom, where there is little commerce or manufactures, and where improvements in agriculture are only partially introduced,

	Average.
A ploughman receives from 3*l.* to 6*l.*	£. 4 10 0
A female servant, from 2*l.* 2*s.* to 3*l.* 14*s.*	2 18 0
A day-labourer in summer, without board, from 8*d.* to 1*s.*	0 0 10
Ditto in winter, ditto, from 6*d.* to 8*d.*	0 0 7
A mason, ditto, from 1*s.* to 1*s.* 6*d.*	0 1 3
A carpenter, ditto, from 1*s.* to 1*s.* 4*d.*	0 1 2

From the above averages the following table, which may be considered as containing pretty nearly, he says, the medium rate of agricultural labour in these kingdoms, at the present period, is formed:

	General Average.
A ploughman	£7 3 6
A female servant	3 7 0
A day-labourer in summer, without board	0 1 3
Ditto in winter, ditto	0 0 11
A mason, ditto	0 1 10
A carpenter, ditto	0 1 8

In the above statements, the difference in the rate of wages does not, he thinks, appear so considerable (except in Wales, and the north of Scotland, compared with the better cultivated parts of Great Britain), as had it been possible to ascertain the price of labour in each particular county would have been evident; local circumstances frequently operating to augment or depress the rate of wages in particular districts, which is not discernible when numbers are classed together.

The rates of wages or prices of labour have increased in the proportion of, from a quarter to a half, since the period in which the above was written.

The price of labour or rate of wages, is, he conceives, affected by some or all of the following causes, viz. 1st, The increase of commerce and manufactures;

2dly, The depreciation in the value of money, and its present nominal value, compared with the price of the ordinary articles of provisions; 3dly, The general introduction of improvements, and of new modes of cultivation; whereby, although fewer hands are necessary, those possessing superior skill become more in request; 4thly, The ease or difficulty of finding constant or regular employment; 5thly, The mode in which a farm-servant, or labourer maintains his family.

It is observed, in respect to the first, that the increase of the commerce and manufactures of the towns has contributed to the improvement of the country, as well by affording a ready market for the produce of the soil, as by various other means, will not be denied; but that the rapid increase of them within these few years has had a great effect in raising the price of labour is equally evident. The great numbers of people crowded together in large cities and manufacturing towns, are not only against the increase of population, but also against longevity. There are besides several sorts of manufactures, which are well known to be destructive of the human constitution: not to mention the many accidents to which those employed in the various branches of commerce and manufactures are exposed, tending to shorten life, and from which these engaged in the operations of husbandry are exempted. For these reasons, there is a constant demand for people from the country, in order to keep up the population, and to carry on the commerce and manufactures of the towns. The great additional price commonly paid for commercial and manufacturing, beyond that for agricultural labour (except where the influence of the former affects the latter), and the habits of luxury, in which the labouring part of the community live in towns, compared with the generality of their neighbours of the same class in the country (particularly in Scotland), are strong inducements, it is contended, with many of the peasantry, either to remove to the towns, or to send their children thither: while others, in consequence of the too general practice of adding farm to farm, and demolishing cottages, are forced to seek that asylum in towns which is refused them in the country. The demand for labourers from the towns being complied with, the country is thereby, he says, drained of useful hands, and the price of agricultural labour advanced. This must necessarily happen, it is thought, in every kingdom during the period that its commerce and manufactures are on the increase, and more especially in those nations were the legislature turns its attention to support commerce and manufactures at the expence of agriculture.

The second, the depreciation in the value of money, is, it is remarked, also another and a substantial reason for the apparent rise in the price of labour. The increase of commerce and manufactures, which has been gradually taking place in this island ever since the beginning of the reign of queen Elizabeth, and the immense additions which have been made almost every year, to the national debt within the present century, seem to have rendered it necessary, he says, to increase, nominally, by means of bank-notes, promissory-notes, bills, &c. the quantity of money in circulation. That these substitutes for specie have had the effect to reduce the value of money is, he thinks, an obvious fact. If therefore, says he, the value of money has fallen, the labourer of the present day requires of course a greater quantity to carry to market than his predecessors, to purchase even such articles as are considered in the particular district where he resides (whether right or wrong) as indispensably necessary for the maintenance of a peasant's family. Whether the Middlesex labourer goes to market to purchase beef or mutton, or the Aberdeenshire cottager oatmeal, it will, he conceives, be found, that nearly double the sum is required to purchase the same quantity now that it did thirty years ago.

After this he states some facts, in order to shew that, however much the nominal price of labour has increased, its real price, compared with that quantity of provisions which it will purchase, remains all over the island nearly the same, except only where a variety of circumstances combine; such as contiguity to large towns, or extensive manufactories and public works; and the want of due attention to the providing of work, from improved modes of husbandry not being introduced to raise or depress it beyond its ordinary level.

In regard to the third, it is observed, that besides forming canals and turnpike-roads which may be considered equally beneficial to the interests of commerce and manufactures, as to those of agriculture, there have been many improvements introduced in husbandry, which, while they have contributed to advance alike the prosperity of the nation, the proprietors and farmers, have also been the means of bringing about a considerable alteration in the situation of the inhabitants at large, as well as in the price of labour. The immense numbers of people necessary for carrying on the various operations of inclosing, draining, planting, erecting farm buildings, digging marl, quarrying and burning lime-stone, hoeing potatoes, turnips, and other green crops, must first have had the effect of giving full employment to the people in those districts where such improvements were introduced, and gradually to advance the rate of wages, in consequence of the increased demand for labourers. The general introduction of new modes of cultivation, whereby, although fewer people are necessary, those possessing superior skill become more in request, is another reason of the advance in the wages of farm-servants. This observation will be considered as well founded by all those who recollect the period, when ploughing with a man and two horses, without a driver, became common in Scotland. The number of horses or oxen formerly worked in the plough varied in some cases, according to the nature of the soil; but was more frequently regulated either by the custom of the district, or the fancy of the farmer. When, in consequence of the spirited exertions of some individuals in several counties, the practice of ploughing with two horses was pretty generally introduced, the farmers

found themselves thereby relieved of a very great share of the annual expence of cultivation; but as it was then considered a very arduous undertaking to manage a two-horse plough, every farmer selected the best ploughman he could find; and these becoming thereby in request, it was no difficult matter for them to bargain for an augmentation of wages, which the farmers of that period could very well afford, and which many now living will not hesitate to acknowledge they granted on principles of œconomy.

It is remarked, in respect to the fourth, that the case or difficulty which labourers frequently have in finding constant and regular employment; or, in other words, when labourers are only partially employed, the rate of wages must be affected by that circumstance. It has already been observed, that those who live by labour must receive such a compensation as is more than sufficient for their subsistence. When a labourer has constant employment, whatever be the rate of wages, as it must be equal to the price of the ordinary articles of provisions in whatever part of the island he is situated, his incomings and outgoings will be nearly the same. Hence it follows, that when, from the difficulty of finding employment, he can only procure work for three, four, or five days in the week, he must receive the same sum for these three, four, or five days that in the other cases he would do for the labour of six; otherwise his incomings must be less than he is necessarily called to expend. When that happens, labourers are often obliged to remove occasionally to another quarter, or betake themselves to some mechanical employment; and in either case their services are lost to the farming part of the community where they resided. The want of constant employment therefore, he conceives, operates in two ways to raise the price of labour; first, by the necessity the labourer is under while he continues in that capacity of demanding as much for the work of three, four, or five days, as is fully equal to his subsistence for a week; and, secondly, many of them being obliged to betake themselves to other means for providing for themselves and families, the number of labourers becomes greatly diminished, and the remainder of course more in request.

On the last point, it is supposed that the various modes in which farm-servants and labourers maintain their families must necessarily have a very great influence on the expence of agricultural labour in different parts of the island. In a great part of England, butcher's-meat, dumplings or puddings, bread made of fine flour, with beer, ale, and very commonly tea, are reckoned indispensable articles of cottage house-keeping: while in Scotland, oat-meal, cooked in various ways, vegetables, and now and then a little butcher's meat, are the chief articles which constitute the food of the people employed in husbandry, even in the best cultivated parts of the kingdom. This essential difference in the mode of living must, it is conceived, be a great additional expence in the article of labour to the English farmer beyond what those in Scotland are subject to, and might induce such as are not acquainted with the various circumstances connected with the husbandry of both kingdoms, to give a decided preference in favour of Scotland. It should, however, he says, be remembered, that this kind of additional tax paid by the English farmer more properly affects the landlord, and is one of the principal reasons why lands in England ar rented lower than those of the same quality in Scotland; it being an indisputable fact, and which, in Scotland, daily experience proves well founded, that a great proportion of what the farmers save in the article of labour, or by the introduction of more improved and less expensive cultivation, sooner or later finds its way into the landlord's pocket.

It is remarked that a very respectable author, Dr. Smith, in his work on the Nature and Causes of the Wealth of Nations, vol. i. p. 92, observes, that "the difference in the mode of labourers' subsistence is not the cause, but the effect, of the difference in their wages; although (says he), by a strange misapprehension I have frequently heard it represented as the cause." And he adds, "it is not because one man keeps a coach, while his neighbour walks a-foot, that the one is rich and the other poor; but because the one is rich he keeps a coach, and because the other is poor he walks a-foot."

It will be admitted, Mr. Donaldson says, that at the period when a general alteration has taken place for the better in the established mode in which labourers maintain their families (as in the south of Scotland, where the price of labour has nearly doubled within these twenty years), the expence at which a cottager's family is maintained has advanced in the same proportion. They eat better food, wear more expensive clothes, and live in more comfortable dwellings,—all which, he says, no doubt, as Dr. Smith observes, is the effect, not the cause of the recent increase in the price of labour.

But in England, where the mode of maintaining a labourer's family has undergone little alteration for ages, it is presumed, that although the difference in the modes of living was, at first, the effect naturally to be expected from a rise in the price of labour, yet it is now one cause why the rate of wages continues in that kingdom to advance. Those articles which with that class were once deemed the luxuries, are now considered only as the bare necessaries of life, and the prices have advanced in nearly the same proportion as their wages. For instance, those who in that country require labourers, must either pay them such an advance of wages as will enable them to subsist according to the general mode established in the country, whatever the additional price of the ordinary articles of provisions may be, or compel them to make use of the more simple and less expensive kinds of food, which were used by that class of men a century or two ago. As every person who stands in need of labourers will adopt the first of these alternatives, it follows of course, he thinks, that the difference which has long taken place in the mode of maintaining a labourer's family in England, compared to that of ancient times, is now one cause for the advance in the rate of wages.

It has, he says, now become a general complaint

among proprietors, merchants, manufacturers, and farmers, that the price of labour has become too high. That, owing to one or all of the causes before mentioned, it has advanced in many districts to a degree unknown in any former period of the history of these kingdoms, is a fact well known. Those who regret that the price of labour is advanced (provided it is kept within proper bounds, and does not arise from a national neglect of the situation of the peasantry,) ought to comfort themselves, he says, with the reflection, that this never happens in any state which is not increasing in wealth and prosperity. It is owing to that cause, and to no other, that the working people in any nation are more liberally rewarded for their labour; and in place of regret, it ought to give pleasure to every friend to his country, that the great body of the community are enabled, from the fruits of their honest labours, to procure themselves a greater share of the comforts of life. At the same time, says he, let it be observed, that, while those who have occasion to employ labourers ought to pay attention to the advice of the author of the Seasons—

"Be mindful of the rough laborious hand
That sinks you soft in elegance and ease;"

they should also consider, that there are bounds beyond which they ought not, in prudence, to pass.

The mode of maintaining farm-servants in many parts of England is, he thinks, both absurd and expensive in the extreme, and calls as loudly for reform as any error in the whole range of British husbandry. In Northamptonshire, he says, the breakfast consists of cold meat, with cheese, bread, and beer; for dinner, roast or boiled meat, with pudding; and for supper, the same as at breakfast; and besides ale, which is allowed on extraordinary occasions, they have small beer at command at all hours. And Mr. Marshall, in his Rural Œconomy of the Midland Counties, after observing, that the beer and ale are brewed unreasonably strong, and that the quantity allowed to a man is unnecessarily great, states, that, in hay and corn harvest, the customary allowance is a gallon (upwards of five bottles) of beer a man per day; and that, during winter, the quantity of small beer used, is not much less than in harvest.

It is farther noticed, that the increased expence in the mode of maintaining farm-servants, as now too generally practised in England, is attributed to the following causes. Some few farmers in every county, either from a mistaken idea, that the better their servants are fed, the more work they will perform, or from pride, and from a desire to gain popularity among that class of people, lead the way; while their more sensible neighbours, and even those whose situations in life but ill accord with such additional expence, are forced to follow the example; by which means extravagance in the maintenance of servants has arrived at its present height, and seems to be daily gaining ground.

The wages paid for agricultural labour, either to servants by the year, or to labourers by the day, throughout the better cultivated parts of Great Britain, although considerably different, are, it is observed, nevertheless much less so than might have been expected, and appear by no means sufficient to counterbalance the advantages which are derived from superior climate, and more favourable situation in regard to markets. The expensive manner in which the farm servants are maintained in the greatest part of England, when compared with that of the more improved parts of Scotland, creates, he says, a much greater addition to the expence of cultivation in the former kingdom than that arising from the difference in the money price of labour. In forming a just estimate of the difference which takes place in the expence of cultivation in particular districts beyond that in others, it is necessary, it is said, to consider, not only the sum of money paid as wages, and the expence of maintaining servants, but also the quantity of work performed, and the number of men and horses which, according to the practice of particular districts, are considered as necessary to cultivate the same quantity of land. The following statement will, he says, shew at one view the difference of keeping a team by the year, and of ploughing an acre of land, in Gloucestershire, in England, where five horses are commonly used: and in the county of Angus, in Scotland, where only two are considered necessary.

Gloucestershire.

	£.	s.	d.
Ploughman's wages	10	0	0
Board, 6*s.* *per* week	15	12	0
Boy's wages	5	0	0
Board, 4*s.* 6*d.* *per* week	10	8	0
Maintenance of five horses at 15*l.* each	75	0	0
Tear and wear of ditto, and accidents, 2*l.* each *per annum*	10	0	0
	£126	0	0
Annual expence of Angus Farmer,	52	0	0
	£74	0	0

Yearly difference against Gloucestershire farmer.

The County of Angus.

	£	s.	d.
Ploughman's wages	£10	0	0
Board, generally under	8	0	0
Maintenance of two horses at 15*l.* each	30	0	0
Tear and wear of ditto, and accidents, 2*l.* each *per annum*	4	0	0
	£52	0	0

Suppose, says he, these men and horses were employed in ploughing the whole year, and that they plough an acre a-day, they will each have ploughed 313 acres in the course of the year. The expence

to the Gloucestershire farmer would be 8*s.* each acre, while the Angus farmer would have the same extent of labour performed at about 3*s.* 4*d. per* acre. There is also as great a difference in the expence of thrashing grain. Since the introduction of thrashing-machines in Scotland, the grain can be separated from the straw upwards of fifty per cent. cheaper and to better purpose than is done in England by manual labour. This comparison might be made to include other operations, which are more or less expensive to perform, in consequence of the peculiar customs and practices of particular districts. But all that is proposed here is, to give an idea of the proper mode of calculating the expence of agricultural labour and an instance or two of the saving which every farmer has in his power to make, by using well-constructed implements of husbandry, and performing the various operations with as few men and horses as possible.

The scarcity of farm-servants and day-labourers has of late, it is said, been considerably felt in many parts of Great-Britain, and seems to be gradually increasing. The principal causes to which this evil is to be ascribed are, in the opinion of Mr. Donaldson, the inclosure-bills in England; the enlarging or engrossing farms in both kingdoms; and the general increase of commerce and manufactures.

The deficiency of labourers is an evil of so serious a nature (from whatever cause it has originated) as ought, he thinks, to induce proprietors and farmers of all descriptions to adopt such measures as appear most proper for insuring a future and more abundant supply. That which seems to him the most likely to effect this desirable object with the greatest certainty, is the building of cottages on every farm, in numbers proportioned to the extent of hands necessary for its cultivation. Experience, says he, has proved, that cottages are the best nurseries for useful farm-servants and labourers; and while nothing would tend so speedily or so effectually to supply this defect as affording the labouring class of people the means of living comfortably in the country, it would also be the means, in a great degree, of silencing the rising clamour against enlarging or engrossing farms. In this view it is suggested, that a tax on every proprietor and farmer in Great Britain, who had not as many cottages erected and inhabited in a limited time as there were ploughmen required for the cultivation of the farm, or one cottage for every certain number of acres. Such a tax, if imposed for the express purpose of increasing the population of the country, and thereby keeping the price of all kinds of labour moderate, could not fail, in time, he thinks, to have the wished for effect.

He observes that the practice of joining two or three, sometimes half a dozen, small farms in one, and the consequent demolition of cottages, has had the effect of bringing about a great alteration, in many counties, in the description of servants employed in husbandry; as, instead of employing married men living in cottages contiguous to the farm, and paying them partly in necessaries of life, young men brought up in towns or villages are employed, and their wages paid wholly in money, from which many bad consequences proceed. From the advantages to be derived by employing married men, who have families residing on some detached part of the farm, as ploughmen, as well as from the acknowledged scarcity of labourers, may, he thinks, be inferred the propriety, and even necessity, of improving by every proper means the situation of the peasantry. The labourer's situation would, he thinks, be much improved, were his employers to revert to the old practice of paying him a great part of his wages in the necessary articles of provisions; he would then be prevented from the necessity of having recourse for every article he requires to those worse than pawnbrokers, the keepers of the little paltry chandlers shops; a set of people, who, without remorse, appropriate to themselves, under the name of a reasonable profit, a great proportion of the hard-earned wages of the laborious peasant. And next to getting the great article of provisions on reasonable terms, the allowing every cottager the means of keeping a cow, and of planting a reasonable quantity of potatoes and other vegetables, would tend more than any other circumstance, in his opinion, to his happiness and comfort; as it would enable him to procure a considerable share of the sustenance of his family, without the expenditure of money, or the risk of imposition. It would also, he thinks, be a great spring to the industry of the labourer, to set him all his labour by the great, or piece. He would be induced to labour with more stedfastness and perseverance, when he was satisfied that it was in his power to apply the fruits of his extraordinary exertions to the benefit of his family. And, lastly, to encourage, by every proper means, the establishment of friendly societies, among the labouring class of people, as a means of provision against accidents and sickness. See *Farm Servant.*

Mr. Marshall thinks that farm labourers, as being the most valuable class of men that a populous country possesses, should have every comfort provided for them that is compatible with their situation, and conformable to the general interest of the community. That their wages ought to be every where and at all times sufficient for the maintenance of themselves and families while in health, with a surplus to provide against the day of sickness, without their being under the debasing necessity of making application to their neighbours for relief. Persons so essentially useful to society should not merely support existence, but have the comforts of wholesome habitations, with sufficient spaces of ground to furnish them and their families with changes of proper vegetable food without much expence.

LACTARY, a milk house, or place where milk is kept.

LACTOMETER, an instrument for the purpose of ascertaining the different qualities of milk. It was invented by Mr. Dicas, mathematical instrument-maker, in Liverpool; and the following description of it is given by Mr. Holt, in his Survey of the County of Lancaster. This lactometer, says he,

ascertains the richness of milk from its specific gravity compared with water, by its degree of warmth taken by a standard thermometer, on comparing its specific quality with its warmth, on a scale constructed for this particular purpose, and by which, if the principle be right, may be discovered not only the qualities of the milk of different cows, pastures, food, as turnips, potatoes, grains, &c. but also probably which may be the best milk or best pastures for butter, and which for cheese. This instrument, however, is yet, he says, in its infancy. At his own house, he says, he has made a number of varied experiments, upon different milks from different farms.

It is constructed with ten divisions upon the stem (similar to the patent brewing-hydrometer) and with eight weights, which are to be applied only one at a time upon the top, to obtain the weight of the milk: an ivory sliding-rule accompanies the instrument, upon the middle or sliding part of which is laid down the lactometer weight of the milk, going from 0 to 80; and opposite thereto are placed the various strengths of the milk, from water to 160; 100 having previously been fixed upon, from a number of experiments, as the standard of good new milk, and each of the other numbers bearing a proportinate reference thereto. At one end of the sliding-rule the degrees of heat from 40 to 100 are placed with a star opposite, as an index to fix the slide to the temperature of the milk; the whole being graduated to shew the exact strength of the milk as it would appear in the temperature of 55 degrees of heat, although tried in any inferior or superior temperature between 40° and 100°: thus the great inconvenience which would attend bringing the milk at all times to one temperature is avoided, and a simple mechanical method of allowing for the contraction and expansion substituted. And as skimmed milk, being divested of the particles of butter which existed before skimming, appears to have a less degree of affinity with that than the new-milk has, one side of the ivory sliding-rule is adapted to skimmed, and the other to new. It is represented at *fig.* 1. *pl.* III.

General Rule.—First, find the temperature of the milk with the thermometer, and fix the sliding-rule so that the star shall be facing the degree of heat the mercury rises or falls to; then put in the lactometer, and try which of the weights, applied to the top, will sink it to some one division upon the stem; add the number of the weight upon the top, and that of the division together, and opposite the same, formed upon the side, will be shewn the strength of the milk.

Examples of New-milk.—If in the temperature of 72°, the lactometer with the weight 40 sinks to 9 upon the stem, fix the slide so that the star shall be facing 72°; then opposite 49 will be found 100, the strength of the milk.—Again, if in 60° the lactometer with 50 on the top sinks to 6 upon the stem, the slide being fixed for new milk, so that the star shall be at 60° of heat, then facing 56 will be found 110, the strength of this milk in proportion towards the other, provided it is equally replete with cream. To discover which, it becomes requisite these two samples should stand a certain time that the cream may rise, which being taken off, they are to be tried with the lactometer again; and as the cream is evidently the lighter part, the milk will appear by the lactometer denser or better in quality than before. Suppose the milk in the first example to be 57 by the lactometer in 60 degrees of heat, then the strength by the skimmed-milk side of the rule will be 112. And admit the second example of new-milk to be 58 in 64° when skimmed, the strength would be 116.

As a comparison—

Say No. 1. New-milk -	100
Ditto skimmed -	112
Difference -	12
No. 2. New-milk - -	110
When skimmed -	116
Difference -	6

From which it appears that No. 1 has produced a larger quantity of cream than No. 2, and consequently may be deemed the better milk. Some instances have occurred where the strength of new-milk has only been about 80, and when skimmed near 100. Thus it may, without the least impropriety, be called a milk much better adapted for making butter than cheese. And the experiment No. 2, a milk more advantageous for cheese than butter, it being considerably denser, and consequently containing a much larger portion of the curd, or more solid parts, which constitute the basis of cheese; the serum or whey in general being near the same density.

The instances in which the lactometer may be useful are, according to Mr. Holt, in discovering what breeds of cattle are most advantageous;—what food in the winter season, whether carrots, turnips, potatoes, &c. are best;—what the effects of different pastures may be;—how far particular farms are best adapted to making butter or cheese;—how far the inconvenience of large cheeses in some dairies being too rich to stand may be prevented, by discovering when this redundancy of richness exists in the milk;—and in fixing a standard for the sale of this useful article of life.

A standard for skimmed milk may readily be fixed by saying what strength the common saleable skimmed milk shall be by the lactometer, or what its specific gravity shall be in relation to that of water in the temperate degree of heat, and that an easy comparison may be made between the specific gravity of any milk, and its lactometer strength: this instrument is so constructed that one of specific gravity shall exactly correspond with three of strength—that is, the strength of 90 by the lactometer is a milk whose specific gravity is 1030, to common pump-water 1000. From a number of experiments and observations, it is observed, that the common saleable skimmed milk in Liverpool is from 52 to 64 of strength, and that of new milk from 70 to

so; but it would be difficult to fix any standard for the latter, unless some mode could be devised to discover whether it was mixed with old milk or not. The only method would be, he says, after fixing the strength of it, to try by letting it stand, to discover if it produced that quantity of cream which as new milk it might reasonably be expected to do.

LADIES-SMOCK, the name of a perennial weed common in pasture-grounds. The stalk is upright, round, and smooth, the leaves are winged, with the lobes of the lower ones roundish, and those on the stalk oblong. The flowers are large, handsome, and white, or purplish, consisting of four obtuse veined petals. The seeds are contained in erect compressed pods, about an inch in length, divided into two cells, which, when ripe, burst with a touch, and throw out their seed to a considerable distance. It is sometimes called *Cuckow-flower*, or *Canterbury-bells*.

LAIRE, land in a state of grass or sward. See *Lay* and *Layer*.

LAKE-FISHERIES. See *Fish* and *Fish-ponds*.

LAMB, the young of the sheep kind. When lambs come early in the season great care should be taken to keep them dry and warm, as well as to provide a plentiful supply of food for the ewes, and always to let them have the driest pastures, as without due attention to such circumstances much loss will frequently be sustained by their dying, or being long in a weakly state.

Mr. Young says that "there is no business on a farm that demands more care, attention and assiduity," than that of ewes in the lambing season. "As soon as the farmer looks for the ewes beginning to lamb, they ought, he thinks, every night to be folded in the standing littered fold, on one side of which there should be a small cottage-hut, built to be warm, with a chimney, and stove for heating milk, and a bed for the shepherd to lie down upon. Here he is to sleep through the lambing season, that he may be ready to watch, assist, and tend any ewes that he sees very near lambing, and if necessary, to give the lamb some warm cow's milk. Some of the considerble Norfolk farmers have, he observes, these huts on four wheels, to draw about with the flock, wherever they may be; but to have one littered and well sheltered standing-fold, on a moderate farm, and two or three conveniently placed on a large one, to take the flock to, without any distant driving, is, he thinks, far preferable to that method. And he advises that upon inclosed farms, where the reserve of rouen may be supposed to be much greater than is generally possible on flock-farms, the sheep as they drop their lambs should be drawn from the flock of ewes, and put to this food, upon which an entire reliance may be had;" and that it should be remembered that all turnips should be consumed in February, which circumstance proves the vast importance of reserved grass as a substitute. Towards the close of July the lambs of the flock should be weaned; in this business Mr. Young says, they are much earlier in Sussex than in Suffolk. And that "Clover in blossom is, of all other food, the most forcing; sainfoin rouen excellent; and if the farmer has neither, he ought to have made a reserve of a sweet good bite of fresh grass for them;" and that it is essential that due provision should have been made before this period. See *Sheep*.

LAMB-*house*, the place where lambs are fattened. It is sometimes termed *suckle*. A proper rack and trough should be fixed up in it. See *Lamb-suckling*.

LAMB-*suckler*, a person who practises or carries on the business of fattening house-lamb. See *Lamb-suckling*.

LAMB-*Suckling*, the art of fattening house-lamb.

It is observed by the author of the Agricultural Report of the county of Middlesex, that, in the performance of this business, the ewes which begin to lamb about Michaelmas are kept in the close during the day, and in the house during the night, until they have produced twenty or thirty lambs. These lambs are then put into a lamb-house, which is kept constantly well littered with clean wheat straw; and chalk, previously baked in an oven, both in lump and in powder, is provided for them to lick, in order to prevent looseness, and thereby preserve the lambs in health. As a prevention against gnawing the boards, or eating each other's wool, a little wheat straw is placed, with the ears downwards, in a rack within their reach, with which they amuse themselves, and of which they eat a small quantity. In this house they are kept, with great care and attention, until fit for the butcher. The mothers of the lambs are turned every night at eight o'clock, into the lamb-house to their offspring. At six o'clock in the morning these mothers are separated from their lambs, and turned into the pastures; and at eight o'clock such ewes as have lost their own lambs, and those ewes whose lambs are sold, are brought in, and held by the head till the lambs by turns suck them clean: they are then turned into the pasture; and at twelve o'clock the mothers of the lambs are driven from the pasture into the lamb-house for an hour, in the course of which time each lamb is suckled by its mother. At four o'clock all the ewes that have not lambs of their own are again brought to the lamb-house, and held for the lambs to suck; and at eight the mothers of the lambs are brought to them for the night.

If an ewe gives more milk than her lamb will suck, the superabundance, he says, is given to the twins, or to any other lamb whose mother may not be able to furnish it with sufficient food. The shepherd must in this case hold the ewe, or she would not suffer the strange lamb to suck. From their timid nature, it is extremely essential that they should be kept free from every species of unnecessary disturbance. This method of suckling is, it is observed, continued all the year. The breeders select such of the lambs as become fat enough, and of proper age (about eight weeks old) for slaughter, and send them to market during December, and three or four succeeding months, at prices which vary from one guinea to four, and the rest of the year at about two guineas each. This is severe work for the ewes, and some of them die under excess of exhaustion. However, care is taken that they have plenty of food: for, when green

food (viz, turnips, cole, rye, tares, clover, &c.) begins to fail, brewer's grains are given them in troughs, and second-crop hay in racks, as well to support the ewes, as to supply the lambs with plenty of milk; for, if that should not be abundant, the lambs would become stunted, in which case no food could fatten them. It is remarked, that grains were first given to ewes by the late Mr. Naylor, of this county, and that he also was the first person who pulled out all the remaining front teeth of a broken-mouthed ewe; observing that they fed much better without teeth than with the loss of one or two.

The ewes for this purpose should be kept free from the foot-rot and scab; and if they have any pitch-mark on them when they lamb, it must be cut off before the lambs be taken into the house, or they will eat it, and thereby greatly prejudice their future growth. See *Foot-rot* and *Scab*.

The ewes employed for this purpose are always, the author of the Middlesex Report says, without exception, of the Dorsetshire breed; and even of these there is not more than one in three that will lamb sufficiently early for the purpose of house-lamb. The early lambing ewes are sought for by the breeders of this county with great diligence throughout the county of Dorset, and at the fairs where such stock are usually sold. The prices vary from 35*s*. to 42*s*.

Such lambs as can be warranted of a fair complexion after being butchered are held in the highest esteem, which those bought promiscuously in Dorsetshire, or at the fairs, cannot be: this preference induces those breeders and sucklers who are in the secret to select rams which they can depend on for getting lambs whose meat shall be of that quality. The sucklers, salesmen, and butchers of London, he asserts, are aware that such lambs as have sharp barbs on the inside of their lips are certainly of a deep colour after being butchered; and all those whose barbs are naturally blunt do as certainly produce fair meat. This knowledge, he says, has been the occasion of many lambs of the latter kind being kept for rams, and sent into Dorsetshire, expressly for the purpose of improving the colour of the flesh of house-lambs. The issue of such rams can generally be warranted fair, and such meat always sells at a higher price: hence, he thinks, arose the mistaken notion, that Middlesex rams were necessary to procure house-lambs.

It has been further observed that, "In order to conduct this sort of fattening with profit and success, a lamb-house or suckle of proper dimensions must be provided." And that "it is found from practice that a range of building from sixty to seventy feet in length, and fifteen or eighteen in breadth, with three or more coops or divisions of different sizes at each of the ends, for separating the lambs according to their ages, is sufficient for containing and conducting the business of from one hundred and sixty to one hundred and eighty lambs. That the lambs may be enabled to find their mothers with facility, the ewes, when they are separated from them, should be kept apart by deal hurdles in the middle of the house, so that they may be convenient for the lambs in the coops at the ends.

This is a practice which can only be undertaken with advantage in situations at no great distance from large towns, where there is great demand for early lamb; as upon their being ready at an early period, as towards the latter end of December, depends the great profit to be derived from the system.

The principal objects in this sort of management are those of attending to the regular feeding of the ewes, the varying of their food with propriety, and keeping the house perfectly warm, clean, and sweet, so that the process of fattening may proceed in a regular manner without any check being sustained.

Mr. Middleton observes, that a friend of his, who is well acquainted with the subject, says, the farmers of Middlesex do not now rear half so many house-lambs as they did about forty years ago. In Surrey they are likewise falling off. The suckling system is removing to a greater distance from the metropolis, to which place many fat lambs are now sent alive, in light four-wheeled covered carriages.

Grass-Lamb, such lamb as is principally fattened while the ewes are at grass, or other kinds of green food. Mr. Middleton, in his Report of Middlesex, remarks, that the vicinity of Smithfield market makes early grass-lambs an object of considerable importance to the farmers of that county. The Dorset ewes are chiefly selected for this purpose. They are purchased at Weyhill, Kingston, and other fairs, forward enough to drop their lambs in January. The price from 30*s*. to 35*s*. The breeders keep the ewes and lambs principally on turnips and second-crop hay. They sell the lambs in the months of April and May, fat, at from 25*s*. to upwards of 35*s*. each. The ewes, being dried early, are fattened and brought to market about Michaelmas, and sold at the same prices. The wool is about three pounds, which, at 10*d*. amounts to 2*s*. 6*d*. The whole of the stock is cleared within the year, and the profit or loss thereby ascertained. The account in general is, he says, as follows:

	£.	s.	d.
The lamb sells for	1	10	0
The ewe for	1	10	0
The wool at 2*s*. 6*d*. or	0	2	0
Together	£3	2	0
Deduct prime cost	1	12	0
Remains, the increase of an ewe in 1 year	£1	10	0

House-Lamb, that sort of lamb that is fed and fattened in houses constructed for the purpose. The principal art in this business, as has been seen above, is to have the lambs such as will turn out of a fair delicate colour on being killed, and having them ready at an early period. See *Lamb-suckling*.

LAMENESS, in *farriery*, an affection in the feet or limbs in horses or other animals by which motion is rendered less perfect. It is observed by Clark, that "various causes may occasion this, and frequently a combination of causes may take place at one and the same time in different parts of the same limb;

for instance, a prick with a nail in the foot, and a strain in the tendons of the legs, the ligaments of the joints, or in the shoulders, happen frequently together; for, as the pain arising from the nail in the quick causes the horse to trip and stumble in riding, an exertion to save the pained foot may, and indeed frequently does, occasion the straining of the ligaments of the joints, or the tendons, &c. of the legs; and thus a complication of the causes of lameness is produced. The same effects are likewise produced from bony excrescences on the legs, which occasion pain; or even an exertion of the horse, to save the pained limb, in such case, may occasion his straining some of the muscles in the shoulders, &c." And after observing that very erroneous notions have been entertained of what is called a shoulder-slip, a phrase which is supposed to imply a separation of the shoulder-blade from the ribs, a circumstance which never can happen to this bone, from the nature of its junction with the ribs; for the scapula is not fixed to the body by any joint, but by apposition, that is, laid along the outside of the ribs, and there fastened by the muscles, &c. which lie both on the inside and outside of the shoulder-blade; hence though the muscles and tendons of the shoulder may be overstretched or strained, the bone never can slip out of its place without a force sufficient to destroy the texture of the part which connects the latter with the ribs. It is true that the ligament which surrounds the articulation where the humerus joins with the scapula, at the point of the shoulder, is exposed to considerable injury from strains, &c. as is the case with other joints, but that he never knew or heard of a single instance of its being dislocated in a horse, although it is allowed that the thing is possible. Hence, therefore, he thinks the term "shoulder slip" improper, tending to mislead the young and inexperienced, and should be expunged. He proceeds to remark, that it frequently proceeds from tumors growing upon the bones of the legs, or on those immediately connected with them: these are commonly termed in horses, splints, spavins, osslets, ringbones, &c. and are distinguished or named from the particular part on which they grow. But, as these bony excrescences are not limited to particular parts of the legs, but are liable to grow on every other bone, they sometimes are concealed in such situations that it is impossible they can be discovered, although their effects in causing lameness, when connected with the parts that are conducive to motion, are very apparent, these likewise take place on the small bones of the joints, especially in those of the hind-legs, the osseous matter forming a number of small tumors between the joints, and cementing two or more of these bones together, which impedes the action of the joint, and consequently occasions lameness."

He adds, that "many persons flatter themselves they can cure these bony excrescences by blistering, &c. even after they have acquired their utmost solidity; but those who are acquainted with the anatomical structure of the parts, the solidity and broad basis of these bony tumors, together with the firm connection they have with the bone on which they grow, will at once see the insufficiency of this method. It is true, in some cases where these tumors have a narrow base, they may be taken off with a chissel; but this operation must in many cases be attended with consequences much more detrimental to the horse than the excrescence would be in its fullest growth: indeed a *caries* in the leg-bone may follow, and the cicatrix that remains will disfigure the horse more than the excrescence would have done in its full extent. Splints of an uncommon size are daily seen on horses' legs that do not go lame in the least. Hence, therefore it is obvious that it is not the size of a splint that causes lameness, after it has grown to its full extent, but rather its interference with some of the soft parts that are subservient to the motion of the legs. It likewise frequently happens, that these excrescences grow up between the two small bones on the back-part of the fore-legs, and immediately under the tendons; the grooves or hollows that are there formed on the surface of the excrescence, whilst it is in its soft state, by the friction of the tendons, evidently shew that they have been impeded in their motion. In this situation it becomes impossible to remove the excrescence, especially as it frequently happens that the leg-bone in such cases is considerably enlarged, a case for which there is no cure, as will be evident on inspecting the bare leg bones that may be found almost in every field in which there are any dead horses. "That the same effect," he observes, "is produced by these excrescences growing on the leg-bones of horses, called *splints*, is very evident from their first beginning to rise on the outside of the bone: they distend or overstretch the periosteum which covers the bone; this creates pain, which is followed with lameness in horses: but, when this membrane is either divided, ruptured, or becomes benumbed by the distension it has undergone, the pain arising from it ceases, and unless the excrescence communicates with some other bone, or presses on some of the parts that are conducive to motion, as the tendons, &c. the lameness goes off, although the tumor on the bone remains in its full extent. "Lameness likewise proceeds from *rheumatic pains* in different parts of the body, which frequently change from one place to another, and from *cramps*, *spasms*, *sciatica*, &c. all of which produce lameness; the true seat of which, in some cases, cannot be ascertained with any degree of certainty. Other causes of lameness are more easily discovered from their external appearance or the symptoms which attend them, as a swelling of the parts affected, attended with pain to the animal upon touching them: of this kind are sprains, either of the ligaments of the joints, or of the muscles and tendons of the legs and shoulders." It also arises "from blows, as these occasion contusion; or from wounds and punctures, from watery sores about the legs or heels, under every denomination whatever; as, in these cases, the parts are more or less swelled and inflamed, and, of course, unfit for action. From violent and long continued exercise, which occasions too great a waste of the synovia of the joints; hence they become stiff, and, on the horse's moving, make a crackling noise. The same effect is also produced

from a variety of other causes which are confined to the feet, as pricks from nails in shoeing, wounds in the hoofs from nails picked up in the streets, glass, sharp-pointed bones, &c. which penetrate into the quick; from injudicious shoeing and paring the hoofs to excess, or suffering them to grow too large and long at the toes, by which the feet are benumbed, a partial contraction taking place at the coronet and heels, or a contraction of the whole hoof, which is commonly known by the name of hoof-bound. This last disease is a consequence of keeping the legs and hoofs too hot and too dry, by a great quantity of litter and perhaps hot dung at all times under them. It likewise proceeds from corns, running thrushes, from gravel insinuating itself between the shoe and the sole of the foot, especially in weak hoofs, or, by forming a lodgment there, it at last penetrates into the quick which is called gravelling. There is likewise another kind of lameness peculiar to the hind quarters, which occasions a sudden jerking of the legs upwards on moving; by some it is called string-halt, and by others click-spavin. This complaint seems to be a particular affection of the nerves of the leg, which causes this kind of involuntary motion, for which no one has yet proposed any certain method of cure. From all these and a variety of other causes, lameness is, he asserts, produced, the true seat of which, in many cases, cannot be discovered by any external appearances; hence, practitioners ought to be very cautious in speaking of the causes of lameness, before they positively have discovered the particular seat of the disease, or the circumstance which produces it. From a want of this precaution, together with a too superficial inspection of the parts, and too hasty a determination as to the seat or cause of lameness, applications have been made to the sound parts, whilst the real cause has soon afterwards shewn itself to be elsewhere, perhaps in the hoof, to the shame and confusion of the practitioner. Therefore unless the cause of a horse's lameness is perfectly evident, it will be prudent to examine, at all times, the foot of the lame limb first, with care and attention; and, if it should still appear doubtful, to inspect it on the next day, and even a third time, rather than give too hasty a determination with respect to the seat of a horse's lameness. Indeed, the foot is always to be suspected; and especially after a horse has been newly shod, or has had his shoes fastened, or when the shoe lies too flat, so as to press upon the sole, or when the shoe is made too narrow for the hoof, or if there be a corn in the foot. A horse may be lame from a nail, although it be not driven immediately into the quick, by its thickness pressing on the soft parts, or from its being bent inwards upon the quick: or, when driven too near, it will raise a small portion of the hoof, its own breadth, and force it upon the quick; and this last is the reason why horses remain a longer time lame after such accidents, than when a nail has been driven immediately into the quick. A wound by a nail in the fleshy part of the foot, if discovered soon and properly treated, suppurates, and soon heals up; but a thin splinter, when raised from the hoof by a nail, and forced on the quick, has more lasting effects, and the horse will be longer lame.

This able writer therefore insists, that no certain rules can be laid down for discovering the true seat of lameness in a horse from the motion of his body, although much has been said upon the subject. "For when any of the parts which are necessary to the motion of the body are injured, the adjacent parts will be affected more or less; and thus, by a kind of sympathy, the whole limb will be affected: thus, a prick with a nail in the foot will cause an inflammation of the whole leg; the shooting pains, in these cases, may affect the muscles of the shoulders, so as to obstruct their motion, and, upon touching or pinching those parts, the horse will flinch, and shew a sense of pain in them, and a stiffness in moving forward or sidewise, that will be very apt to mislead the unwary, and make them conclude that the cause of lameness is centered entirely in the shoulder, when, in fact, these are only symptoms which proceed from the shooting pains occasioned by the nail in the foot." And that "the caution above mentioned will appear still more necessary, when it is considered that bony excrescences excite the most acute pains whilst they are growing, by their effect in extending the membrane which covers the bone, and which is always attended, more or less, with some degree of inflammation of the part, although, in some cases, the situation of these tumors cannot be perceived. Whilst growing, they may be compared to the pain of teething in children, which continues till the periosteum which covers the jaw-bone is penetrated by the new tooth." There is another cause of lameness noticed, which is the injury done to the backs of horses by ill-made saddles, or those that are not properly fitted. "This is a consideration of importance both to the ease of the horse and to the rider's safety. It frequently happens, however, that both suffer from inattention to it; for, if the saddle-tree be too wide, and the saddle without a crupper, it moves too far forward upon the shoulder-blades, by which means the weight of the rider, together with the points of the saddle-tree, confining the motion of the shoulder-bones, impedes their action, which causes the horse to stumble, and frequently to come down, whilst, at the same time, the cartilaginous ends of the shoulder-bones, muscles, &c. are bruised. Hence large swellings are produced on the shoulders or withers, which terminate in fistulous ulcers, and which, from the situation of the parts, are very difficult to cure. On the other hand, too narrow saddle-trees bruise the skin, and occasion those hard lumps called *sitfasts* or *warbles*, and render the horse's back tender for a long time." "A saddle that is well sitted should press equally on every part of the back, the middle or ridge of the spine excepted, without touching, pressing, or even coming near the shoulder-blades, which ought by no means to be interrupted in their motion; the saddle pannel, opposite to the hollows that are on each side of the spine, should be bolstered and well-fitted upon each side, which will prevent it from moving too far forward on the shoulder-blades, even although no crupper be used."

As a general means of preventing lameness in the feet of horses, the *artificial frog* with shoes *properly adapted to the state of the hoof*, and an attention to the keeping the feet cool, and in that state of moisture which is most natural, as suggested by Mr. Coleman, may prevent many troublesome diseases. See *Foot* and *Frog*.

The particular affections or diseases which occasion lameness in horses, are treated of under their several heads. And in plate II. are given representations of the chief diseases or affections of the feet and legs that cause lameness in these animals in which

a, *fig.* 1, shews the inside of the hock, with the varix or blood spavin, as the distended veins appear in that affection; and at *b*, *fig.* 2, is shewn the bone spavin, on the inside of the lower part of the hock, and upper end of the instep-bone. At *fig.* 3, is seen the fore leg of a horse in a straight position. *a a a*, the ring-bone or circular hard swelling round the pastern joint; and *fig.* 4, shews the hind leg of a horse in a bent position; *a*, the heel of the hock; *b*, the curb, a hard swelling, as it appears when in its state of full growth.

At *fig.* 5, is seen the hinder or back part of the fore leg, so as to shew a thorough splint; *a a*, the splint situated between the shank-bone and the back-sinew, appearing on both sides. At *fig.* 6, is seen the fore leg sideways, to shew the more usual and ordinary kind of splints; *a*, a splint under the knee, near the joint; *b*, a splint on the middle and fore part of the shank-bone, disfiguring the leg; *c*, a more formidable splint on the back part of the shank-bone, near the insertion of the back sinew or tendon.

At *fig.* 7, is shewn windgalls or flatulent tumors that appear on the fore part of the leg; *a b*, two windgalls that sometimes arise under each side of the knee; *c*, a windgall on the shin, between two muscular tendons a little above the joint of the fetlock.

And at *fig.* 8, is shewn windgalls on the hind part of the fore leg, with an extraordinary one above the knee; *a*, a large windgall between the tendons of the muscles above the knee; *b*, a windgall under the knee behind; *c c*, the common and usual windgalls on each side the back sinew or tendon.

At *a*, *fig.* 9, is a large wen as it appears on the heel of the hock. And at *a b c*, *fig.* 10, windgalls or flatulent tumors arising in the hollow parts of the hock.

At *fig.* 11, is shewn a quittor; *a*, the orifice whence the matter generally flows; *b*, the matter running down the quarter; *c*, the swelling round the coronet; *d*, the sinking and depressure of the hoof, caused by the errosion of the diseased part.

And at *fig.* 12, is seen the false quarter; *a*, the seam on the quarter from the coronet to the bottom of the foot. These particular diseases are noticed in their proper places. See *Strain*.

LAMPAS, in *farriery*, an excrescence in the roof of a horse's mouth, which is sometimes so luxuriant, that it grows above the teeth, and hinders his feeding. The cure consists in lightly cauterising the flesh with a hot iron, taking care that it does not penetrate too deep, so as to scale off the thin bone that lies under the upper bars: the part may then be touched with burnt allum and honey, or this may sometimes be sufficient without the use of the cautery.

LAND, the earth or soil in which plants grow, or which produces crops.

It is remarked by Mr. Marshall, in his able work on the Landed Property of England, that "land, viewed in the light of agriculture, is the foundation on which it rests, the materials on which it operates, and the visible source of its productions. And it may, he thinks, generally be considered as being composed of three distinct parts:- the *soil*, the *subsoil*, and the *base*, or *substructure*, on which they rest." It is added that "the soil, or plant-feeding stratum, is not more various in quality than it is in depth. The soils of cultivated lands, however, have their limits as to depth. These limits may, he conceives, be fixed at three and fifteen inches. For although, in many instances, the component parts of land are pretty uniform, to a greater depth than fifteen inches, a uniformity of colour and vegetative quality seldom reaches to that depth. The influence of the atmosphere, the fibres of vegetables (living and decayed), the operations of animalculæ, and larger animals, that inhabit soils, and above all, the powerful effects of manures, tend to furnish the surface mould with qualities which the substrata have not the means of acquiring. The medium depth of cultivated soils, in England, may, he imagines, be set down with sufficient accuracy for this purpose, at nine inches. For although a majority of the cultivated soils of the kingdom may not reach that depth, he is of opinion that the major part of them might, under proper management, be sunk to nine inches deep, with advantage in many respects." See *Soil*.

It is likewise further stated by the same writer, that "the subsoil, or intervening stratum of land, is still less definite, with regard to depth. In some instances, as where the cultivated soil rests upon rock, it may be said to be wanting; though, in most cases of this kind, a stratum of a gravelly nature, composed of broken rock and earth, is found between them. And, in many cases, a regular bed of gravel, sand, or other earth, intervenes between the soil and the substructure. While in others, an uniform mass of earthy materials reaches to a great depth. If therefore a definite thickness, or depth, may be assigned to the subsoil, it must be, in a degree, arbitrary," or without any great degree of exactness.

It is conceived that "the soil affords nourishment and stability to agricultural plants, and that the subsoil assigns them temperature, with respect to moisture and internal warmth. If the subsoil is of such a nature, or is so situated, as to receive and *retain* more moisture than is requisite for the natural growth of plants, their health is injured. If it not only holds water in its own pores, but freely communicates it to those of the soil, the more valuable plants in agriculture give place to ranker herbage, let the sur-

face soil be what it may. On the contrary, if an open stratum of sufficient depth intervenes, between the cultivated soil and the base, to permit the superfluous moisture, which filters through the soil, or which is communicated subterraneously, to pass off, the plants in cultivation will be relieved from collected moisture, in the immediate region of their feeding fibrils; though the substructure may be charged to the fill with water. Hence, where nature has not furnished land with this valuable interstratum, it is the business of art to remedy the defect," in some way or other, and which in general " is to be done by draining off the superfluous moisture to a sufficient depth to prevent its evil effects on the soil, and thereby supplying the required stratum." It is however, well observed, that " in doing this, the artist must be led by the given properties of the base, and can seldom lower it to any determinate or arbitrary depth. Nevertheless it will be right, before he proceeds further, to endeavour to form an adequate idea of the medium depth required;" in doing which much, he says, depends on the specific quality of the subsoil. Sand will hold up water that is lodged at its base to a much greater height than gravel. A stratum of gravel of one foot in depth forms a drier subsoil, than a bed of sand of twice or three times that thickness. But *clean* sand or gravel is rarely found in land: sand and gravelly loams being the more ordinary materials of absorbent subsoils: and these are capable of raising and holding up water to a considerable height. " Let us therefore," says the author, " admit that effective subsoils may vary from one to two feet, and fix the medium depth at eighteen inches." And " by thus fixing the mean depth of soils at nine inches, and that of subsoils at eighteen inches, place the base or substructure of the land at twenty-seven inches beneath its surface; which is a depth of land that is, (he says,) equally conformable with theory and with practice. To this depth drains may be sunk, at a moderate expence: and covered stone drains of this depth may be rendered effectual, yet free from injury by the operations of tillage. In the practice of skilful workmen, the depth of ordinary *subsoil-drains* varies, (he says,) from eighteen inches to three feet, according to the circumstances of the given case, and the method of draining employed" or which is made use of for effecting the purpose.

After this general view of the component parts of land, and of their due arrangement, the common varieties of it, as they are given by soil, subsoil, and base, may, he says, be enumerated and considered. In the execution of which it may be proper to divide lands into classes, and mark the varieties of each.

1st Class. This comprehends, according to the above author, such lands as are liable to surface water, only with their absorbent strata (if any) *open*, —so as freely to discharge the superfluous water they receive upon them: the varieties of which are, he says, first, where " the soil, the subsoil, and the base are repellent, or in a state of moistness, impenetrable by water, as clay and strong deep clayey loam." The second where " the soil is repellent, the subsoil absorbent, the base repellent." The third where " the soil is repellent, the subsoil and base absorbent, or in a state of moistness, conducting water; as sand, gravel, open rock, and the lighter more open loams." The fourth where " the soil, the subsoil, and the base are absorbent." The fifth where " the soil and the subsoil are absorbent, but the base repellent." And the sixth where " the soil is absorbent, the subsoil repellent, and the base absorbent or repellent."

2d Class. This includes such lands as are liable to surface water only, with their absorbent strata *closed*, or permitting an imperfect discharge, either for want of sufficient descent, or by reason of impervious strata or beds of impenetrable materials. The varieties of which are, first, where " the soil is repellent, the subsoil absorbent, and the base repellent or absorbent." The second, where " the soil and the subsoil are absorbent, but the base repellent, or absorbent." The third, where " the absorbent and repellent strata or masses are thrown together irregularly; or not disposed in regular strata, which correspond with the surface" or upper part.

3d Class. This comprises such lands as are liable, not only to surface waters, but to those which are subterrene, and which either *descend* from higher grounds in their respective neighbourhoods, or *rise* beneath them, from subjacent reservoirs: the absorbent strata of this class being *closed*, and thereby rendered retentive, as in the second class or kind of land. The varieties of which are, first, where " the soil is absorbent or repellent, the substrata absorbent and *closed*, and uniformly charged with *descending* waters, by an even stratum of gravel, free sand," or some other similar material. The second, where " the same soil and substrata are partially charged with descending waters, through veins of sand, or gravel, or fissures of rock, &c. The third, where " the soil is repellent or absorbent, the subsoil absorbent and *closed*, and uniformly charged with descending waters; the base repellent with a sub-base freely absorbent and *open*." The fourth where " the soil is absorbent or repellent, the substrata uniformly absorbent and closed, and charged with *rising* waters. And the fifth where " the soil is repellent or absorbent, the substrata complex and *closed*, and charged with *rising* and *descending* waters."

The nature of these different kinds or classes of lands and their varieties, with that of their different constructions, the effects to which they are each particularly exposed from a superabundance of water, the methods of removing such wetness, both with the view of ameliorating the lands for the purposes of cultivation and that of providing supplies of water for economical uses, as the working of light machinery, the consumption of pasturing stock, and in particular cases where a sufficient quantity can be procured for the watering of land, will be fully considered in their proper places; and many useful observations may be found in the work here alluded to, especially in what relates to draining. The two objects of applying water to the use of live stock, and that of irrigation

should constantly be kept in the mind of the improver. See *Soil. Watering of Land* and *Draining of Land.*

It is evident from various circumstances in the management of lands, that some sorts are much better calculated for the production of grain crops than those of the grass kind; while, on the contrary, others are much more suitable and better adapted to the raising of grass than those of the corn kind, and that there are still others that may be cultivated under a convertible system of corn and grass, with more success than in either of the other methods separately.

All those lands which possess a sufficient degree of dryness, whether they have much depth of mould or not, and which in their natural state have but little tendency to produce good herbage, such as those covered with different sorts of coarse plants and vegetable productions, whether in an open or inclosed state, are proper for tillage. It has been well observed by Mr. Davis, that grounds of this nature are of considerably more value when in a state of tillage than in pasture; as they are particularly adapted to the improved methods of cultivation, and in addition to the quantity of grain to be produced from them, will afford a greater quantity of vegetable food for animal stock when in a tillage state, than they did when kept entirely in that of pasture or sward. The same writer likewise observes that there are various other descriptions of light lands that may be kept in a state of tillage with more advantage than in that of grass, as they are peculiarly suited to those improved modes of cultivation that are necessary for raising large supplies of green food for the support of live stock of different kinds. That the poorer sorts of sand lands, where marl, clay, chalk, or other similar substances can be readily procured, are much more proper for the purposes of tillage than those of grass, is sufficiently shewn by the improvements that have been made in many of the more southern districts of the kingdom. And that lands of the chalky kind, whether of the more superficial or deep descriptions, are in most cases better suited for tillage than grass, is proved from their wetness in the winter season, and their openness and friability in the summer, rendering it almost impossible to establish good herbage upon them. Beside these, there is another sort of land that is better for the purposes of tillage than those of grass, which is that which in the state of grass is constantly so disposed to the production of moss, as to afford but a very scanty share of good herbage in any circumstance.

The author of Practical Agriculture states that "most of the clayey and more heavy descriptions of land, especially when situated in valleys or other low confined exposures, though they may be capable of affording good crops of particular kinds when under the plough, as those of the wheat and bean kind, are, on account of their retention of moisture, the increased expences of labour and the uncertainty of season for tilling them, as well as their inaptitude for most other sorts of crops, and their fitness for the production of good herbage, much more beneficial in the state of grass than in that of tillage. Where there is an opportunity of procuring sea sand, and of applying it at an easy expence, they may, however, it is observed, be converted to the purposes of tillage in a profitable manner. Most of those strong cold grass lands which in a state of tillage would be improper for the growth of turnips, and other applications of improved cultivation, should also constantly remain in the state of grass. And likewise those lands that are situated near large towns, where manure is plentiful, and of course capable of being procured at a reasonable rate; and where the produce of such lands is always in great demand, and therefore capable of being disposed of to great advantage. Such lands as are situated on the banks of large rivers or brooks, which are capable of being improved by means of watering, are likewise more beneficial when kept constantly under the grass system than any other mode of cultivation that can be practised. The lands of a calcareous nature which are distributed in the valleys of the more mountainous districts, where old grass land is scarce and of much importance, and most part of that in the state of tillage incapable of being converted to the condition of good grass, may also, it is believed, be the most advantageous when continued in a permanent state of herbage."

It is plain that "the sorts of land that are the most adapted to the practice of convertible husbandry are those of the loamy kinds, which are not too strong for the growth of turnips. These in all their different varieties are capable of being changed from the state of tillage to that of grass, and the contrary, not only without sustaining any injury, but frequently with the most evident advantage, as the practice of some of the western and midland districts has fully proved." And "the richer kinds of sandy lands are in most cases also well suited to this sort of husbandry; especially where marl is at hand, to be applied at the time of laying them down to grass. Grounds of the peaty sort may likewise in many cases be the most beneficially employed in this mode of culture, as, from their producing little else than plants of the aquatic kind, it is obvious that they must be completely destroyed, and those of the proper grass kind be introduced, before any useful herbage can be produced. And this is capable of being accomplished in by much the most perfect manner under the state of tillage. But as they are in most instances much too tender and moist for the purpose of remaining long in the state of tillage, as soon as the above intention has been fully effected, they should be restored to the state of permanent grass" or sward. See *Ground* and *Soil.*

LAND *Carriage*, that sort of conveyance which is performed on land, which, in many cases is highly inconvenient and always greatly expensive and troublesome to the farmer. It should therefore be lessened as much as possible in situations that will admit of it, by the substituting of water conveyance by the forming of small *narrow* canals, which may, in many instances, be done at a trifling expence, and thus,

much lessen the extent or distance of land carriage. See *Canal* and *Inland Navigation*.

LAND-*Guard*, a sort of fence or embankment constructed of stones, wood, or other materials on the borders of rivers and brooks, in order to prevent their carrying away the land. The cases in which they become more particularly necessary, are where they are confined in the parts where they are required to bend, by rocks or other means, to an unaltered channel; it often occurs in hilly situations, and where deep pools occur in such parts at low water, so as to render it difficult or impossible to provide a good foundation for a pier. The mode of applying and forming these sorts of guards, will be explained in considering the nature and manner of guarding river-banks. See *Embankment*, and *River-banks, guarding of*.

LAND *Mark*, any thing placed as the division of land. These marks were formerly chiefly used for shewing the different lots or divisions in common field lands.

LAND-*Reeve*, a person whose business it is to overlook certain parts of a farm or estate; to attend, not only to the woods and hedge timber, but also to the state of the fences, gates, buildings, private roads, drift-ways, and water-courses: and likewise to the stocking of commons (where there are any), and encroachments of every kind;—as well as to prevent, or detect waste and spoil in general,—whether by the tenants of the estate, or others: and to report the same to the manager or land steward.

Mr. Marshall observes that, "the utility accruing from these inferior officers of an estate occurred to him in the highlands of Scotland; where they have been commonly appointed on every estate, he believes from time immemorial, under the name of *ground officers*." And he has "since experienced their utility so fully in England, as to induce him to recommend their appointment, on every large estate: not merely as helpmates to the acting manager; but as authentic evidences in matters of dispute; and as intelligent informants to a proprietor, in going over, or inquiring after, the affairs of his estate. Active intelligent tenants of known integrity, are generally the most suitable persons for having the management of this sort of trust."

LAND *Springs*, such as rise or are produced in land, from the water being obstructed in its descent by some sort of impenetrable material, such as clay, &c. and thus forced up to the surface, where it breaks or oozes out, having different appearances according to the nature of the soil and situation. See *Spring* and *Draining of Land*.

LAND *Steward*, a person who overlooks or has the management of a farm or estate.

The number, description, and qualities of land stewards must be regulated according to the nature and extent of the property and the particular circumstances of the proprietor. In order to be fully qualified according to the author of the Modern Land Steward, for the proper management of large estates, the stewards should have attained that thorough and correct knowledge of the business of life, that full tried experience in men and things, which ought not to be expected earlier than at the middle age. No material part of their time or attention should be engrossed by their own private concerns, as in such cases they must evidently neglect their own, or the business of their employers; and it would be paying human nature too great a compliment to suppose the former. To an ample share of agricultural knowledge they ought to have a thorough insight into the nature of every sort of improvement, of which estates may be capable, whether upon or beneath the surface; or from its local situation, whether inland or upon the sea-coast. Their attention should be also directed to the useful sciences of political economy, and political arithmetic, as there is, he says, a strict and happy coincidence between public and private wealth. They should be well versed in and qualified to superintend the culture of waste lands; the disposal of timber; the eradication, or planting of woods; irrigation and warping, drainage, embankment, and the recovery of land from the sea, the cutting of canals, the laying out and repairing of roads, the construction of bridges, mills, and engines, and be possessed of a considerable skill in rural architecture of every kind. Nor is it less necessary that they thoroughly comprehend the nature of all the various methods in which money business is transacted, together with the advantage of bargaining in the purchase or sales of estates. Their intelligence ought also to extend to the valuable inventions and improvements of other countries, as well as those of their own; which, whether in the mechanic or agricultural relation, they should use their best means to introduce and fairly experiment upon the estates under their care, with the honourable and patriotic views both of private and national benefit. In short with sufficient honesty, a mind amply replenished, a cool, deliberate, and calculating head, a quick discernment, they should, he says, lay hold of every occasion, as it springs, to enhance the worth, the reputation, and the embellishment of the property committed to their charge.

For these qualifications and endowments they should have full and adequate allowances in the way of salaries or wages according to the service to be performed. Their practical skill in agriculture should particularly extend to the management of cattle, and the common outlines, at least, of rural architecture, as far as regards repairs, or ordinary new erections; and they should be thoroughly masters of common accounts, and able to describe or correspond by letter intelligibly and with propriety. When thus qualified they may make very capable and respectable stewards: but they would not be the less eligible for a sufficient portion of mathematical and mechanical knowledge, and the practical habits of mensuration, both of timber and land; though a defect of these branches of science ought not to operate to the rejection of those otherwise well qualified; since they are acquired, he says, by a very moderate application and practice, and since there are always at hand, professional men in these sciences, whose services are, perhaps, after all, the most eligible and proper.

Land-stewards should have the care and manage-

ment of every thing that relates to the farm or estate over which they have the care. The author of the above work also further advises that "every estate should be accurately surveyed, and correctly described in a map, of which the tenant also should have one. It is, he thinks, particularly necessary, both to steward and tenant, to keep an exact terrier of all common field lands, and where the bounds and abutments of any single parcel of land are dubious, to have them defined and ascertained with durable land-marks, by a jury purposely impanelled at the manor-court: and in order to preserve the bounds and precincts of a parish, with the particular property of the lord entire, and free from encroachment, and to preclude the necessity of quarrels and suits at law, it is good to keep the ancient custom of annual perambulation." And he considers it, as "the duty of stewards to ride over, and make actual personal surveys of th eestates in their trust, sufficiently often to offer timely advice, to obviate any dangers, and nip any irregularities or encroachments in the bud: to have in their possession duplicates of all leases, covenants, deeds, &c." And that "where the case of default or danger does not admit of immediate remedy through their own means," to exonerate themselves by instant application to their employers.

It is likewise their business, he says, "to inspect all repairs, that they be duly and substantially performed, fencing regularly kept up according to covenant, ditches cast and scoured, water-courses free, and common rights fairly enjoyed, according to the custom of the manor, the larger tenants not overstocking, to the prejudice of the inferior; in which case, the stewards are bound to interfere. To observe that the cutting of underwood be at the regular, customary, or covenanted periods; that the lopping of pollards be fair, and no damage done, in any wise, to the proprietor's timber or woods. To mark the spots where new plantations may be necessary or advisable. Woodwards to be admonished of their duty, that they report all persons who trespass, either with their cattle, under colour of cutting up hand-sticks, faggot-bands, or similar pretences." And "to discourage poaching and destruction of the game, rather by rational and moderate indulgences, than either by the threat, or exertion of the excessive rigour of the law, which according to the complexion of the present times, can have no other possible effect, than to detract from the popular character of the proprietor, and from the safety of that which such measures are intended to insure." Further, "to caution the tenants that they do not suffer the land to be over-run and rooted up by moles, or the commons and woodlands by unrung swine.

And in addition, that "the strictest caution be observed, that all materials produced by the farm or estate, in any respect fit for manure, or other useful purpose, such as marl, limestone, coal or kelp-ashes, weeds, shells, sand, clay, virgin-earth, &c. be disposed of and used among the tenants of the estate only, and by no means alienated from it; since such practice would be to rob the soil of a natural and most valuable mean of improvement."

It is concluded by observing, that "there is great convenience in land stewards being surveyors of the highways for the parishes in which they reside, in which case it lies in their own power to preserve them in a condition creditable to the county and the proprietors for whom they act. Nor ought they ever to be inattentive to the conduct of the surveyors of those other parishes in which they are concerned; never permitting the least neglect, nuisance, decayed bridge, or dangerous way; but occasionally, and according to the necessity of the case, making a few examples in a genteel and temperate, but firm tone, always pleading for their punctiliousness, the strict and peremptory orders of their employers, which they dare not disobey." And "the like strictness is, he thinks, necessary with respect to trespasses from neighbouring cattle, for some farmers are so excessively dilatory in this respect, that they will take no kind of pains, either for the security of their own or their neighbour's crops."

Mr. Marshall remarks, that on a large estate, a resident manager is generally found,—"a land steward,—a man who has some knowledge of what is termed country business, and who acts under the controul of his employer, or of a confidential friend who is more conversant in rural concerns, or perhaps of a law agent, who knows less of them." And that such residing steward, especially of a detached estate which li es at some distance from the residence of its proprietor, acts without controul. In this case, if he is a man of judgment and integrity, he becomes, at least in the eyes of the tenantry, a superior being; frequently, in their minds, a more exalted character than their landlord,—than the proprietor himself;—who, perhaps, never deigned to glance his eye upon them or their lands." But that "on the contrary, if such possessory manager wants those requisite qualifications, the consequence becomes mischievous to the lands, their occupiers, their proprietor, and the community. If this unprincipled agent has an interest in the derangement of the estate, and the ruin which will follow,—and is *suffered* to make use of it,—the crime of neglect, on the part of its proprietor, might well be cognizable as a crime against the public." And further, that "similar evils are liable to befal an estate which lies round the residence of its proprietor if he is equally inattentive" to its proper management and regulation.

He considers agriculture as the only firm foundation on which the other required attainments can be securely reposed. It is not more essentially valuable in the superintendence, than in the improvement, of an estate. "It is," he says, "difficult to become an accurate judge of the value of lands, without a practical knowledge of their uses: nor can any man, without it, properly appreciate the management of occupiers; much less assist them in correcting their errors,—and improving their practice." And that "*land surveying* is another requisite qualification; not so much, however, for the purpose of mapping and measuring an estate, at large, as for checking and correcting the works of

professional men: as well as to assist in laying out its lands to the most advantage" and with the greatest propriety. Further, that "some knowledge of *mechanics*, and the other sciences, that are requisite to the business of an engineer, may be highly useful in prosecuting the improvements incident to landed property in various ways. As well as a competent knowledge of *rural* architecture, and the superintendence of artificers, as they may be said to be of daily use. The nature of planting and the management of woodlands, are acquirements that cannot, he thinks, be dispensed with. Nor should his knowledge and attentions be confined to the surface of the estate entrusted to his care;—he ought to have some acquaintance with *natural* history, to enable him to search with due effect for the subterrene productions which it may contain." And lastly, that a thorough knowledge of accounts is essentially requisite, as hinted above, in this sort of management.

But that, besides these qualifications of business, there is another important quality, which a resident manager or land steward ought to possess; which is, as before suggested, that he should be a man of good character,—of upright principles and conciliatory manners:—to set an example of good conduct to the tenants, and to become their common counsellor and peace-maker, in those trifling disputes, which never fail to arise among the occupiers of adjoining lands: and which too often bring on serious quarrels and law-suits, that end in the ruin not only of themselves, but of the tenements they occupy. A proprietor has, therefore, he conceives, an interest in checking such disputes in the bud." And no man can do this with so much effect, as a steward or manager in whom they have a proper confidence; and who possesses a due share of popularity on the estate or farm over which he presides.

On large estates, especially where they lie in detached and scattered parts, he considers it necessary to have other assistants, as a woodward, land-reeve, or ground officer, a clerk or under-steward, a law assistant or solicitor, and a surveyor. As the under steward, a tenant's son who has been properly educated, and is fully acquainted with farming business, is, he says, the most suitable and proper. See *Bailiff*.

LAND-*Surveyor*, one whose business is the planning and surveying of lands or estates.

It is remarked by Mr. Marshall, that land-surveyors are not only useful, merely to measure and map the whole or parts of estates, but to assist in matters of arbitration and the amicable adjustment or settlement of disputes; as well as to act as *valuers* or referees, which are highly useful in the management of landed property. See *Surveying of Land*.

LARCH-TREE, a kind of pine or fir tree, the leaves of which are long and narrow, are produced out of little knots or tubercles, in the form of a painter's pencil: the cones are produced at remote distances from the male flowers on the same tree: the male flowers are very like small cones at their first appearance, but afterwards stretched out in length. These trees are propagated by seeds, which should be sown in the beginning of March, upon a bed of light soil, exposed to the morning sun only; or they may be sown in pots or boxes of light earth, and placed near a hedge, where they may be exposed to it. The seed should be covered about half an inch thick with fine light earth, and in very dry weather should be gently refreshed with water. In about six weeks, if the seeds be good, the plants will come up, at which time they should be carefully guarded against rapacious birds, which would otherwise pull off the heads of the plants, as they thrust themselves out of the ground with their covers on them: and refresh them with water in dry weather, especially if they are sown in pots or boxes; also keep them clear from weeds, which, if suffered to grow among the young plants, will soon destroy them. In October, if they are in boxes or pots, remove them into a situation where they may be defended from sharp winds, which are sometimes hurtful to them, while young; but afterwards they will endure the severest weather of our climate. These trees are very proper for the sides of barren hills, where few other sorts will thrive so well: nor are they very delicate in regard to soil, but will grow much better on poor, strong, stony land, than in rich ground: during the summer, they appear very beautiful; but in autumn they cast their leaves, and are not evergreen like the fir.

Mr. Young, in the fifth volume of Annals of Agriculture, observes, that "larix wood is possessed of so many valuable qualities that to enumerate the whole would appear an extravagant hyperbole. It is known to resist water, without rotting, almost for ever. The piles of larix timber on which the houses of Venice were built many hundred years ago, when examined are still found as fresh as when first put in. And he has been told, stakes of it have been tried in the decoys of Lincolnshire, which between wind and water, have already out-worn two or three sets of oak stakes, and do not yet discover any symptoms of decay. It is also known to possess the valuable quality of neither shrinking nor warping, when put into work; nor is it liable to be pierced by worms in our climate, as many of the paintings of Raphael Urban, which are done on this wood, and are still perfectly entire, sufficiently prove. Experiments have not yet ascertained whether it will resist the sea-worm in tropical climates, like Bermuda cedar; but there is reason to think it would, as in many of its other properties, it resembles that wood very much. Along with these valuable properties, it is known to be one of the quickest growing trees in this climate, remarkably hardy, and extremely beautiful when growing. It is, besides, much more easily reared than the oak, and could be spread over a great extent of mountains, if sufficiently bare of herbage, at next to no expence, by the natural shedding of its seeds, like birch or fir in soils that favour them, merely by keeping out cattle from those fields in which small clumps of this kind of wood had been planted some years before. In this way very extensive tracts in the condition just described might be entirely filled with this valuable timber. The uses to which it might be applied are innumerable. It would be valuable not only for ship-plank, but even crooked

timbers might be obtained by using a little art when young to bend it, as the Bermudians do their cedar; for flood-gates in navigable canals and wet-docks it would exceed every thing that can be obtained in this climate. For barrel-staves it would be inimitable, and would enable us to furnish that article as cheap as any other nation whatever: and in building it would answer all the purposes to which fir is now applied, being much stronger and more durable than that wood. And when it is also adverted to, that it is next to incombustible, the reader will not think it strange that he in this manner so strongly recommends it to the attention of his countrymen, particularly those in the most rugged and barren districts: for, in such situations, it would be easy to shew, that, at a very trifling charge, they might, in a short period of years, bring their estates to a hundred times the value they bear at present, or even can be made to bear by any other kind of improvement. This would be a much more eligible plan of bettering their fortunes than that of trying to squeeze with difficulty, from a poor people, a raised rent for a subject that does not admit of proportionable improvement. See *Planting*.

LASSITUDE, in *farriery*, a disease in horses, proceeding from exposure to too much heat or cold, and many other causes; the best remedy for which is, generally rest, and strengthening medicines. See *Fever*.

LATH, a long, thin, and narrow slip of wood, used in buildings for the purpose of being nailed to the joists, in order to sustain and keep up the plaster-covering so as to form cielings.

Laths are distinguished into three kinds, according to the difference of wood of which they are made: viz. heart of oak, sap and deal laths, of which the two last are used for cielings and partitions, and the first for tiling only. They are also distinguished according to their length, into five-feet, four-feet, and three-feet laths; though the statute allows but of two lengths, those of five and those of three feet, each of which ought to be an inch and an half in breadth, and an eighth or half an inch in thickness; but they are commonly less.

LATH-BRICKS, are bricks made much longer than the ordinary sort, and used instead of laths for drying malt upon; for which purpose they are extremely convenient, as not being liable to catch fire, and retaining the heat much longer than those made of wood, so that a very small fire is sufficient after they are once heated.

LATHE, an useful machine or engine for turning wood and some other materials. It may be employed with advantage by the farmer for forming many different sorts of tools.

LATHE, a provincial term used in some counties to signify a barn.

LAVENDER, a small shrubby plant sometimes cultivated in fields near large towns for the spikes of flowers, which are distilled for lavender water.

The common spike lavender is mostly employed in this intention. According to some the method of cultivating it is by planting the slips or cuttings of the young shoots, after being struck in rich shady borders the preceding spring, about September or October, in rows two or three feet distant from each other and about two feet apart in the rows, the ground being kept clean by digging or hoeing in the spring or autumn, and the plants retained in order by proper pruning. The spikes of flowers are ready for gathering in June or July. It will flourish in most sorts of soil, even those of the more clayey kinds.

But this plant, when cultivated in the field, should according to others have the ground well prepared by digging or repeated ploughing and harrowing, after which, in the spring season, as about March or beginning of April, a proper quantity of slips or cuttings of the young shoots or branches should be provided and planted at once by means of a dibble, in rows two and an half or three feet apart, and one and an half or two feet distant in the rows, closing the mould well about them. They afterwards require to be kept clean by means of the hoe, and to have the mould brought up to them occasionally, particularly in the autumn, and the dead stems or leaves cleared away.

They will mostly afford spikes of flowers in plenty in the second summer, after being thus planted out.

Lavender succeeds best where the soil is rather of a dry quality, and not too stiff. In some parts of the southern districts near London, it is grown in the fields with much profit as suggested for the use of the flower spikes in distillation and other purposes.

LAX, in *farriery*, a frequent disease among cattle, horses, &c. See *Looseness*.

LAY, a term applied to such land as is in the state of grass or sward. This sort of ground is frequently distinguished into such as has been long in the state of sward and such as is newly laid down to grass or into old and new lays. The proper method of managing the latter is of great importance to the farmer, and which Mr. Young thinks, should be by keeping them perfectly free from all sorts of stock for the following autumn and winter after their being laid down, when, in the spring they will afford a flow of young grass highly valuable for sheep, with which they should only be well stocked, and kept down then, and during the whole following summer; "nothing, in his opinion, being more pernicious than mowing a new lay, as directed by certain authors. They may, he thinks, have succeeded *in spite* of such bad management, but never *by* it." The most suitable method of managing these new lays under different circumstances, are described in speaking of laying lands down to the state of sward. See *Laying Land down to Grass*.

The treatment necessary for old lays, must vary much, according to their nature and the particular circumstances under which they are placed, as will be shewn under the management of meadow and pasture lands, as well as in considering the nature of grass. See *Meadow*, *Pasture*, and *Grass*.

It has been observed by Mr. Young, that, on many farms there are often "tracts of barren lays, from moss, poverty, neglect, and bad herbage, upon which a very great improvement may be made by a single

ploughing in August. For this purpose, a strong four-horse plough must be used with a skim-coulter; then going over it twice in different directions with the scarifier, so as not to disturb the flag; harrowing it once, and immediately sowing a quarter of a peck of coleseed, two bushels of cock's foot, and one bushel of Yorkshire white per acre, adding some of whatever seeds may be procured at the moment cheaply." He advises it to be left "unfed and untouched till the March following, in which month, and through April, it should be loaded well with sheep; the use will then be very great; keeping sheep feeding it heavily through the year; the cole will be killed, and you will have a pasture worth treble what it was before. The expence is, he says, small, and the improvement rapid." Various modes of improving land in the states here described, will be explained under the heads mentioned above, as well as that of laying land down to grass.

The same writer also thinks, that, by December, old days will be wet enough to begin to break them up, "a work that should not be done while the land is dry: for it will not then turn up in clean well-cut furrows. Ploughing grass lands is, he says, a very good piece of husbandry, when they are worn out and over-run with moss and other rubbish, or hide-bound. To keep land under such unprofitable turf is bad management: it should, by all means, be broken up, and kept in a course of tillage for three or four years, and then laid down again; by which conduct four times the profit will, he thinks, arise, that could be gained from keeping it in lay" or the state of sward.

LAYING *Land down to Grass*, the means of bringing such land as has been under the plough into the state of grass or sward. It is a part of husbandry which is of much importance to the farmer, and which requires much care and attention to accomplish it in a proper manner under different circumstances of soil, climate, situation, and preparation of the land. It is well known by practical farmers that some sorts of soil are much more difficult to be brought into the state of good grass or sward than others, and that, when this point has been accomplished, some are much more profitable and advantageous than others, as affording a much better and more lasting herbage. In some places the business of bringing the land into the state of sward, after it has been in that of arable cultivation, is effected with the greatest ease and facility: the ground, on being left in an unploughed condition, from its natural tendency to the production of herbage, returns to the state of sward, almost without trouble, seed, or expence; while in others all the art of the most careful agricultor is found insufficient for accomplishing the purpose. It has been observed by Mr. Davis, that "after twenty years fruitless expectation and expence, the landholders have frequently been obliged to restore the land again to a state of tillage." But besides this disposition or tendency in soils for taking on the growth and establishment of grass crops, there are other circumstances, according to Dr. Dickson, to be attended to in bringing "them to the state of grass or sward after they have been under the plough; such as those of their possessing neither too much nor too little moisture, and that of their having a sufficient staple or depth of mould for the full and secure establishment of the grass plants. As where the soils are too wet, or too retentive of moisture, they will sustain much injury if not be wholly destroyed during the winter season, when there is much rain and frost, as well as be quickly superseded by plants of the coarse aquatic kind, such as the rush, &c. And where they are too dry, the grasses will be liable to be destroyed by heat during the summer months, by the little moisture which they contain being thus carried away, and of course leave their places to be supplied by other sorts of coarse plants, such as those of the moss, fern, and heath kinds, according to the nature of the ground. A good depth of mould or soil is likewise requisite, in order that the roots of the grass plants may penetrate or run down to such a depth below the surface, as to be in a great measure out of danger from the effects of heat and evaporation in the summer season. On this as well as other accounts it is therefore better, he thinks, that the lands intended for grass, especially where they are to be kept in a permanent state of sward, should incline in some measure to a state of moisture, or be in such a degree retentive of it, as to preserve that state of humidity which is necessary for the healthy and vigorous growth of the plants, without endangering the destruction of their roots by putrefaction, from its stagnating in too large a proportion about them. It is chiefly on this principle, he observes, that the more light, thin, dry, descriptions of soil are better suited for the production of grain, or the occasional practice of convertible husbandry, than for that of permanent grass."

It is farther stated by the same writer, that "there are still other circumstances connected with the nature of the soils, which are necessary to be particularly attended to in the laying of lands down to the state of grass, as those of properly adapting the grass plants to their qualities, some sorts of grasses being much more impatient of wet than others, consequently more proper for the drier sorts of lands; some more capable of resisting the effects of heat and drought, and of course more suitable for the thinner and more porous kinds of soil; while others delight in a moist or wet soil, and are incapable of being grown with any success on such as are of a dry quality. They likewise differ much in respect to their hardiness: some resisting the effects of cold much more effectually than others, of course are more adapted to high exposed situations. Besides these, they vary in other respects, some succeeding to the most advantage in soils of the clayey kind, others in those of a loamy quality, while others delight in those of a sandy nature, a few in those of the calcareous kind, and some in those which partake much of the nature of peat."

In addition to these different natural propensities, he also observes that "there are some grasses that have the property of rising to a great height in the stem, and of course of affording a large coarse produce, while others are more limited in this respect, but

spread and extend themselves more in a lateral direction, affording a less proportion of produce, but which is of a finer quality. The former, with certain restrictions, would seem better adapted to the purpose of hay, though the latter may be applied to the same use, where the fineness of quality is preferred to quantity of produce. There are likewise some sorts of grasses that contain much larger proportions of saccharine matter in their compositions than others, as well as more leaves and fewer flower-stems; and which, from the avidity with which they are fed upon by different sorts of live stock, and the success that attends their being thus consumed in the improvement of such stock, would appear to possess the largest proportion of nourishment; and of course to be the most proper for being introduced where the lands are intended for the purpose of grazing, or fattening animals by means of vegetable food in its grassy state." And further, that "there is another property of grasses in which they differ considerably; and which is of much consequence to have regard to in the laying lands to the state of sward. This is that of early growth, which is a circumstance of vast importance in a grazing point of view, as there is in general a great deficiency of grass for the support of stock in the early part of the spring." It is the opinion of Mr. Curtis, that in the forming of good meadows, or other grass-lands, there should be a combination of these different circumstances, as it is chiefly by the first, or the quantity of produce, that the cultivator is enabled to support his live stock, and pay his rent; of course no expence in labour or manure is spared to obtain it by the prudent farmer. It does not, however, follow, he thinks, that this should be solely regarded, or that to attain it the coarsest sorts of plants should be cultivated; nor will the grasses that are recommended merely for their being relished by cattle, or for the sweetness of their foliage, if they are found to be deficient in the quantity of produce, fully answer the views of the farmer or grazier, as, to constitute a good meadow or pasture, an abundant produce is, he says, necessary. And that, though animals prefer some sorts of food to others, it is not possible to indulge the live stock that is to be supported constantly with the finest and most delicate hay or herbage. Beside, it is not, he thinks, improbable but that the productive grasses may in some cases be highly nutritious, or that cattle may eat as eagerly the herbage or hay made from the coarse as the fine grasses. And cattle are frequently known to thrive on food to which they are habituated by necessity, though at first they could scarcely be prevailed on to eat it. It is added, that in making experiments, persons are apt, he believes, to conclude too hastily from the appearance which a plant assumes on its being first planted or sown; as the most insignificant plant or vegetable will often make a great shew, when its fibres have fresh earth to shoot into: "but the trial, he well observes, comes when the object of the experiment has been in a meadow or pasture several years, when its fibres, from long growth, are matted together, and it meets with powerful neighbours, to dispute every inch of ground with it:" if, says he, "it then continue to be productive, it must have merit." It is well known, he says, that "lucern, when left to itself, is soon overpowered; and if broad-leaved clover, which is undoubtedly a perennial, the first year be sown, a great crop is produced; but let the field be left to itself, and the clover, like the lucern, will yearly diminish,—not, he asserts, because it is a biennial, as has been often supposed, but because plants hardier, or more congenial to the soil, usurp its place:" this shews, he says, "that at the same time that a good plant is introduced, it should be a powerful one, and such as is able to keep possession, and continue to be productive." And that "in respect to the property of cattle's thriving on the food they eat, it is unquestionably of great consequence; and it is to be regretted, he says, that our knowledge of the most nutritient kinds of herbage is so confined; but of those plants which have been in cultivation, we are enabled to speak with some certainty: it is well known, he says, that "clover, lucern, saintfoin, tares, and several other similar plants, have a great tendency to fatten cattle; but what natural grasses, or other plants, which have not been subjected to separate culture, have this particular tendency, and in what degrees, remains to be ascertained by the test of experiment." But, he thinks, "that as leguminous plants are in general found to agree with cattle, it may be reasonably concluded, he thinks, that a certain quantity of them may be proper and beneficial in pastures. It is well known that certain pastures are more disposed to fatten animals than others; but how far this depends on situation, and their particular produce, remains, he says, to be ascertained." Further, with respect to the property of early growth, he remarks that the "want of early herbage in the spring is the general complaint of farmers and graziers in all the best grass districts of the kingdom: those plants, therefore, which are found to shoot at an early period, and to put forth early foliage, especially when it is such as is grateful to cattle, must be deserving of great attention. As far as grasses have to do in this business, these mentioned hereafter may, he supposes, effect all that can be expected in this way: much must, however, depend on seasons; if the winter should be severe, or north-easterly winds prevail in the spring months, grassy herbage will be backward, in spite of all that can be done; but in order to counteract the bad effects of such seasons as much as possible, pastures and grass lands should, in his opinion, be warmly situated, and not drenched too much with moisture, being sheltered by thick hedges, and divided into small inclosures." But where early pasturage is the great object of the farmer, there are other plants that may deserve a place among them, such as those mentioned below. And that "though early herbage is highly valuable for pasturage, it is not less so for the purposes of hay; as by the middle of May at the latest, a meadow of this sort would be fit for cutting; and the second hay-making might begin by the time that hay-making usually takes place in other cases; and by this means the double advantage be obtained, of a larger produce, and less risk in securing or making it."

The author of Practical Agriculture thinks, that

" on the principles that have been already explained, there can be little doubt but that by a judicious and due attention to the different circumstances and uses for which grass-lands are intended, as well as to the selecting and mixing of the best and most proper grass-seeds, and adapting them to the particular nature and circumstances of the soils, after they have been brought into a suitable condition for receiving them, those grounds which have been in a state of tillage may be laid down to the state of sward, in a much better and more beneficial manner than has been the case under the indiscriminate use of such as were in, or which have sown themselves on the lands from the contiguous pastures." It has, he says, "been long since remarked as extraordinary, by Mr. Stillingfleet, that cultivators should have neglected to make a proper advantage of plants of such importance, and which, in most situations, constitute the principal food of live stock, from the want of properly distinguishing and selecting such as are the most advantageous and useful under different circumstances of the land." Some have likewise, he observes, contended that " the best grass-seeds cannot be collected at too high a rate, as it is possible by such means to render lands, which are suited for the production of grass, much more valuable than can be done by the common modes of laying them down."

It is, however confessed, that much difficulty has " been thrown in the way of introducing the most proper sorts of grasses, in laying lands down to sward, from their near resemblances to each other, in many instances, requiring the nicest discernment to distinguish them, and from the want of other means of procuring them."

Mr. Curtis has observed, that " if grass-lands, such as downs, pastures, and meadows, be carefully examined, they will all, except such as have been recently laid down with rye-grass or clover, be found much in a state of nature, replete with an indiscriminate mixture of plants, some of which produce cattle-food of a good kind; others such as is of a very indifferent description; some affording good crops, while others scarcely yield any thing at all." It is therefore sufficiently obvious, Dr. Dickson thinks, " that by a careful attention to the procuring of the best and most suitable sorts of grass-seeds, and applying them according to the principles which have been given above, much superiority may be attained in the forming of pasture or other sorts of grass-lands." See *Grass*.

Preparation of the Land. The proper preparation of land for grass-seeds, is a part of management, the same writer remarks, " that is of vast importance to the success of forming good grass-lands, but which has been much neglected in the practice of laying them down. From the smallness of the seeds, and the fibrous nature of the roots of the grass-plants in most cases, it is evident, he thinks, that lands which are intended for being laid down to the state of sward, whatever their quality may be in respect to soil, should constantly be brought into as fine a state of pulverization and mellowness as possible before the seeds are put in. As where the contrary is the case, from the lumpiness of the surface mould, the seeds can neither be sown with so much regularity, vegetate in so equal a manner, or extend their roots, and establish themselves at first so perfectly in the land, they are of course more liable to be destroyed by hot seasons coming on afterwards. It is probable that in this way much new laid down grass-land is greatly injured the first summer, especially when it turns out to be hot and dry. The necessary fineness of mould may, he says, be obtained in different modes, according to the nature of the lands. In the more stiff and heavy ones, by ploughing before winter, and leaving them to be exposed to the action of frosts and other causes during that season; having recourse to severe harrowing and occasional rolling in the early spring months; and by the frequent interposition of such sorts of crops, in the courses that precede those of grass, as have a tendency, from the peculiar nature of their roots, to loosen and render the soils fine; such as those of the bean, cabbage, rape and clover kinds. The lighter sorts of land may be brought into a proper condition for the reception of grass-seeds, by repeated ploughing and harrowing, or scuffling, and the frequent introduction in the previous crops of such sorts of green fallow crops, as have a power, by the great degree of shade and stagnation which they afford, as well as by the culture which they require while growing, of bringing the soil into a fine friable state. These are, he says, turnips, potatoes, tares, saintfoin, and others of a similar description." It has been contended, he says, by Mr. Close, " that where the grass-seeds are to be put into the ground with grain crops in the spring, the tillage should be performed with more than ordinary attention; which, in the case of turnips, will depend greatly upon their being consumed at such an early period as will admit of the ground being thoroughly broken down and reduced; for if there be much delay, and the season prove unfavourable, a bed of mould, sufficiently loose and mellow, will not be procured for the reception of the seeds: and when grown with spring corn, the lands should be ploughed over three times: and where the first of these earths can be given early enough to be influenced by the vernal frosts, it will be found to be much more beneficial." The use of the harrow and the roller will, he says, be occasionally necessary after the different ploughings, according to the nature and state of the land. " But where the sowing is executed in August, the same degree of attention is not believed by the Rev. Mr. Young, to be so necessary, as the time and season afford so full an opportunity of bringing the ground into suitable order, that the most inattentive cultivator can scarcely experience any other difficulty than what originates from an unusual wetness of season."

It is further added in the System of Practical Agriculture, mentioned above, that " besides this fineness of preparation in the soils, it is necessary that the method of cropping and application of manure in the preceding courses be such as to leave them in a state of high fertility and richness; as no good grass-land can be supposed to be produced where the lands have been worn out and exhausted by the previous crops,

—a practice which has, however, been too general in the returning of arable lands to the condition of grass. Mr. Marshall has, he says, indeed very justly observed, that the want of proper condition in the lands at the time of their being laid down to sward, added to those of improper sorts of grasses and bad seeds, is the chief cause of their not succeeding." According to some, cultivators "manure ought to be applied with every other crop, and always with that which immediately precedes the grass. This is, he says, a practice that should be adopted as much as possible." And "in order to have grass-lands of the best kind, it is likewise of great utility to have them so managed in the preparation, as to be rendered perfectly clear and free from all sorts of weeds, as by their rising with greater rapidity than the sown grass plants, they are often liable to shade, and destroy them, or greatly injure their growth."

It has according to the first of these authors, been advised by Mr. Billingsby, in restoring old worn-out lands to the state of good pasture, to clear the land from injurious weeds by means of a full winter and summer fallowing, or instead of the latter, by a crop of potatoes well manured for, and kept in a perfectly clean state by attentive culture while growing succeeded by winter vetches fed off in the early spring." And "in all the more light sorts of soil, it is unquestionably, he thinks, the most beneficial practice to bring the ground into that sort of fine tilth, which is proper for the reception of grass-seeds by a judicious mixture of green crops of different sorts with those of the corn kind, according to the nature of the soil." The most appropriate methods of combining and intermixing these with each other are explained under the modes of cropping land. See *Rotation of crops*.

It is added, that "when the lands have been by these methods brought into a good state of fertility, and reduced into a sufficiently mellow and friable condition of mould, the surface should be made as fine, loose, and even as possible." And that "where the grounds are much inclined to moisture, the ridges may be preserved, which should be of considerable breadth, with very slight furrows; but in the more light and porous descriptions of land, the whole should be laid as even as possible without any ridges or furrows. In the former cases, in some districts they prefer making the ridges six, eight, or more yards in breadth, which when the land is to be under the scythe is in a much better state for being mown, and if for pasture there will be less danger of the animals being injured by being cast in the furrows. And in the latter the surface will not only be more agreeable in its appearance, but be more advantageous for all the purposes of grass management" after it has been thus laid down.

Proper Natural Grasses. In respect to the kinds of natural grasses, the circumstances that have been observed above, render it sufficiently plain that the proper choice and application of grasses must be a matter of great consequence in the laying down lands to the state of sward or herbage.

It is, however, Dr. Dickson remarks, "a business attended with uncommon difficulty, from the number of trials that have been yet made, being very inadequate for affording the means of fully deciding upon their properties, advantages, and uses, in many cases, as well as from their habits, and the soils to which they are the best suited, being often very imperfectly known; and also from the great trouble and inconvenience of obtaining their seeds genuine, and in a proper state for the purposes of healthy vegetation."

It is suggested that the plants of the natural grass kind which have been found by experienced cultivators most useful in the different intentions mentioned above, are, "the Sweet-scented Vernal Grass; Meadow Foxtail Grass; Smooth-stalked Meadow Grass; Rough-stalked Meadow Grass; Meadow Fescue Grass; Sheep Fescue Grass; Hard Fescue Grass; Tall Fescue Grass; Crested Dog's Tail Grass; Ray or Rye Grass; Yorkshire White; Cock's-foot Grass; Tall Oat Grass; Timothy Grass; Yarrow; Burnet; White Clover Trefoil; Cow Grass; Rib Grass; and a few others;" most of which will be found useful in laying lands to grass under different circumstances of soil, situation, and moisture, or dryness, as is shewn under the different heads to which they belong and in the article grass. See *Grass*.

It is recommended by the Rev. Mr. Young, in the third volume of Communications to the Board of Agriculture, to vary grass seeds according to the nature of the soil in the following manner.

Clay.
"Cow-grass.
Cock's-foot.
Dog's-tail.
Fescue.
Fox-tail.
Oat-grass.
Trefoil.
York-white.
Timothy.

Loam.
White clover.
Ray.
York white.
Fescue.
Fox-tail.
Dog's-tail.
Poa.
Timothy.
Yarrow.
Lucerne.

Sand.
White clover.
Ray.
York-white.
Yarrow.
Burnet.
Trefoil.
Rib.

Chalk.
Yarrow.
Burnet.
Trefoil.
White clover.
Sainfoin.

Peat.
White clover.
Dog's-tail.
Cock's-foot.
Rib.
York-white.
Ray.
Fox-tail.
Fescue.
Timothy."

And in regard to the proportions or quantities per acre, according to the means of getting them. "In situations where women and children are fully employed, it may," he says, "be difficult to procure large quantities gathered by hand: in such places a man must be content with what can be bought. Crested dog's-tail is so very generally to be thus procured, that he cannot but suppose it in a good measure at command. However, without adverting to this point, he may remark, that from the lands which he has laid down to grass to a considerable extent, and in which he has used every one of these plants largely except the poa, and that on a smaller scale, he is inclined to think that the quantities stated below may be safely employed."

CLAY.

Seeds.		*Substitutes.*
"Cow-grass, -	5 lb.	
Trefoil, -	5 lb.	
Dog's-tail, -	10 lb.	Yorkshire white, 2 bush.
Fescue, -	1 bush.	Timothy 4 lb.
Fox-tail, -	1 do.	Do. 4 lb; or, York white, 1 bush.

LOAM.

White clover, -	5 lb.	
Dog's-tail, -	10 lb.	Ray 1 Peck; Rib-grass, 4lb.
Ray, -	1 peck.	
Fescue, -	3 pecks.	Yorkshire white,
Fox-tail, -	3 do.	Timothy, 4lb.
Yarrow, -	2 do.	Cow-grass, 5lb.

SAND.

White clover,	7 lb	
Trefoil, -	5 lb.	
Burnet, -	6 lb.	
Ray, -	1 peck.	
Yarrow, -	1 bush.	Ray, 1 peck; Rib, 4lb.

CHALK.

Burnet, -	10 lb.	
Trefoil, -	5 lb.	
White clover,	5 lb.	
Yarrow, -	1 bush.	Ray, 1 bush.

PEAT.

White clover,	10 lb.	
Dog's-tail -	10 lb.	York white, 6 pecks.
Ray, -	1 peck.	
Fox-tail, -	2 do.	Rib, 5lb.
Fescue, -	2 do.	Cow-grass, 4lb.
Timothy, -	1 do."	

Sowing grass seeds. In regard to the time and manner of sowing grass seeds, they are different in practice according to the mode of preparation and the particular circumstances of the land. The most usual period of putting in grass seeds has been the spring, at the time that the grain crops are sown: but where the land has been brought to a suitable state of preparation by means of green and other fallow crops, the latter end of the summer, as about August, has been the more general time. In the former case they are most commonly put in with the grain crops; but in the latter without any other sort of crop. The author of the System of Agriculture mentioned above remarks that "there has been much diversity of opinion among agricultural writers with regard to the superior utility of these different seasons of introducing the seeds, as well as with regard to their being sown with or without other sorts of crops. The advantages of the autumnal over those of the vernal sowings are, he says, contended to be: those of the grass plants being less exposed to danger from the shade, closeness, and choking that must necessarily occur at the latter season; there being less risk of stocking the ground with noxious weeds in case of the seeds of haychambers being indiscriminately sown; their being put in upon a better preparation and more mellow and fertile state of the land; their growth being more strong and vigorous from their not being robbed of their proper nourishment by other exhausting crops, and the great superiority of the hay produce: while, on the contrary, it is maintained in support of the vernal sowings, that besides their being less precarious, shade is necessary in the early growth of the grass plants to protect them from the effects of heat; the moisture is better preserved in the soil for their support; small annual weeds more effectually prevent it from rising to injure them; and the loss the farmer must sustain from the want of the grain crop guarded against."

With respect to the objection on the ground of weeds being produced, Mr. Close has remarked, that "sowing rubbish in August is not of so great importance as in the spring. In the former season all the annual seeds vegetate, and if the beginning of the winter be mild, they will blossom; but they cannot perfect their seed, and the first frost destroys them. If sown in the spring they vegetate, blossom, perfect and shed their seeds, and thus stock the land with noxious weeds."

On this, Dr. Dickson observes, that "though some of the arguments urged on both sides of this controverted point may be objected to, the autumnal sowings not preventing the perennial weeds from rising and shedding their seeds in the following summer, nor the great closeness of grain crops being without injury to the growth of the young grass plants; there are facts which render it probable that each method may have advantages under particular circumstances. In the more southern districts, where the severity of the winter season is later in its approach, the autumnal season may frequently be made use of with advantage, after fallow crops, for sowing grass seeds, especially in cases where the lands are in too rich a condition for the successful growth of corn. But in the more northen parts of the kingdom, and exposed situations, where the frost sets in at an early period, it may be in general the most advisable practice to put the seeds in, in the vernal months, with suitable crops of the grain kind." An intelligent writer of much experience, the Rev. Mr. Young, has, he says, observed, that "grass seeds answer almost equally well in either method: he prefers, however, the August sowing without corn, though the success of his trials in the different seasons has not justified any decisive conclusion." It is even admitted that "in moory and mountainous situations, where the snows come early, autumnal sowings are not advisable, or to be performed later than the very early part of August; the vernal season with oats, for being cut young for soiling, or hay, is constantly to be preferred." Mr. Dalton, in Yorkshire, after trying other methods, also recommends the autumn without corn as the most advisable. And the Rev. Mr. Close states, that "a friend of his, wishing to procure a good meadow or pasture around his house, fallowed the land for barley; but the spring proving wet, and the soil being a strong loam, he could only put half of it in order for that crop, which was sown and laid with clover and rye grass. The other part was fallowed and sown in

August with the sweepings of hay chambers. The barley was a good crop, and the clover and rye grass were probably equal to the first year's cut of hay. The second year the artificial grasses began to fail; worse the third, fourth, and fifth: the sixth year, after having received two dressings, the spontaneous product of the soil began to give a fleece over the surface of the land. About ten years after these lands were sown, Mr. Close saw this field, when the part sown in August was worth at least fifteen shillings per acre more than the part which had been sown with artificial grasses in the barley. Thus from actual experiments, numbers of which he could adduce, he concludes that sowing the sweepings of hay chambers in August is preferable to sowing artificial grasses in the spring with any crop of corn. Suppose, says he, the corn worth five pounds per acre, the difference in the produce of hay or seed in the second, third, fourth, and fifth years, would more than counterbalance this; and the proprietor would find a permanent improvement in his land of from fifteen shillings to twenty shillings per acre." Mr. Young thinks the best season in the whole year for this purpose is August, and the only one admissible for it on strong, wet, and heavy soils, in forty years experience having never failed at that period. It is stated in the System of Agriculture just noticed, that "on comparative experiments being made with corn in the spring months, and without it in August, the latter was found by much the best mode by different cultivators." But that in the experiment of an accurate agricultor, mentioned by the Rev. Mr. Young, in his paper in the communication to the board, "in comparing different methods of vernal sowings, in which four acres were sown with seeds alone, on pease and buck-wheat ploughed in the preceding autumn; five acres with barley, and five more with the seeds put in alone without corn or manure: the portions sown alone were overrun with weeds, and only preserved from being smothered and destroyed by being eaten down by a dairy of cows." And others, as Dr. Dickson states, after repeatedly trying the experiment of sowing in the spring with corn, and the autumn without, and from long and extensive practice, conclude, "that, even if we were to have no regard to any other circumstance except the grass crop alone, it would be always best to sow it with some kind of grain; but when we consider likewise the loss that the farmer thus sustains for want of a crop of grain, the practice of sowing alone must be looked upon as highly pernicious to the farmer." And he thinks that it is probably in this last respect that the greatest disadvantage of the practice consists, as without it the farmer can derive no immediate recompense for his great expence of tillage and preparation of the land."

In cases where the vernal sowing with other sorts of crops is had recourse to, barley is that, according to Mr. Cartwright, which is most usually recommended, and "there seems to be no question that barley is in general the fittest grain to be sown with grass-seeds. The same tilth which answers for the one is requisite for the other. Barley has a disposition to loosen the texture of the ground in which it grows; a circumstance highly favourable to the vegetation of grass-seeds, which require a free and open soil to extend their roots in; the tender and delicate fibres of which have much difficulty in contending with the resistance of a stubborn soil. And this points out the reason why grass-seeds so frequently fail on strong land not in a proper state of cultivation. In the choice of barley, that sort should, he thinks, be preferred which runs least to straw and which is the soonest ripe." But Dr. Dickson observes, that as from the grassy nature of the stem, and the large size of the ear in this sort of grain, a considerable degree of closeness and shade must constantly be kept up, it should never be sown so thickly as in other cases where there are no grass-seeds. Some object to sowing grass seeds with barley on other principles—as those of its drawing its nourishment from the surface, which is also the case with the grass-plants, and that in consequence they must be greatly retarded in their growth from the want of due support. Where the land is in a proper state of preparation and tillage, if sown with oats, they will be apt to become so luxuriant as to greatly injure, if not wholly destroy, the young grass-plants by the closeness of their shade. In some cases they, however, succeed tolerably with this sort of crop. On the stronger kinds of land the sowing of grass-seeds has been found to answer well with thin crops of beans. In an experiment of this kind, it is stated that Mr. Dalton found that the beans did not "rob, but sheltered and nourished the grass plants, the plan answering beyond his expectations."

In order to effect the purposes of distribution and perfect vegetation in the most complete manner, the seedsman should, it is stated, "be accustomed to the business, and the seeds, as being of different weights, be as little mixed with each other as possible. It is much better to have more casts than to blend the seeds together for the sake of dispatch. For all the smaller sorts of seeds, it has been suggested by the Rev. Mr. Young, as preferable to deliver them by means of the Norfolk turnip trough, which has lately been adapted to clover and ray grass. And this operation should always be performed as soon after the land has been ploughed as possible, as under such circumstances the seeds vegetate in a much more quick and vigorous manner. But it should never be attempted in such a wet state of the land as produces any great degree of tenacity or adhesiveness in the mould, as in such circumstances the seeds would be apt to come up in a tufty unequal manner. Nor for the same reason should the lighter sorts of grass-seeds ever be sown in windy weather; as the delivering them in an equal and regular manner is a point of consequence to the forming of good grass-land. In the covering in of the seeds, the author just mentioned observes, that care should be taken that none are left in an exposed state on the surface of the ground, as where that is the case many of them will be destroyed or picked up by birds, and the sward appear patchy. This business is executed in the most complete manner by a pair of light short-tined harrows at one tining. The practice of employing bush harrows is, he thinks, improper, as in

that way the seeds are liable to be drawn into lumps. In all the lighter and more spongy descriptions of land, it may be advantageous to pass a light roller over the surface immediately after the seeds have been well harrowed in." And "in cases where the tenants and not the proprietors of the land are to lay them down to grass, it may be the most advisable practice for the latter to procure the seeds, but at the expence of the former, especially where they have a sufficient interest in such lands,—as, without this precaution, from their general propensity to keep the ground under the plough, and their indifference in respect to the obtaining of the most proper sorts of seeds, there may be danger of the business being improperly performed."

Necessary management after being laid down. The proper conducting of this business is of considerable importance, and is a point upon which much of the success of forming good grass land must in most circumstances depend.

It is advised by some, as soon as the crop with which the seeds have been sown has been removed, to have recourse to rolling the land with a moderately heavy roller, when it is in such a state of dryness as just to admit the impression of the implement; as by this process, from the mould being pressed closely about the roots of the plants, their early growth may be much benefited, and the danger of drought in some measure obviated. The practice is, however, in the opinion of others, the most necessary in the more light and porous descriptions of land. There are still others likewise who recommend the application of manure at this period, in order to promote the growth and support of the young grass-plants; a point which would seem quite unnecessary where the above mode of preparation has been had recourse to.

In the System of Agriculture mentioned above, it is stated, that "as the surface of such grounds as have been newly laid down to the state of sward is, from the previous tillage which they require, extremely tender, and readily broken into holes for some time even in the drier descriptions of land, the turning in of the cattle with the view of feeding them down must in most cases be highly prejudicial by the treading which they cause. The best practice is therefore probably to suffer no sort of stock to be put upon such lands till the spring after their being laid down; or where the farmer finds it absolutely necessary to turn upon the lands, the lightest sort of stock should constantly be selected for the purpose." And "it has been observed by the Rev. Mr. Young that the advantage of feeding such lands during the autumn and winter seasons is scarcely matter of any consequence, as the spring feed for sheep, where it is omitted, is of so much greater utility, a very early pasturage being in this way afforded for ewes and lambs." Mr. A. Young is also decidedly of the same opinion in his useful work, the Farmer's Calendar. There is much diversity and contradiction in the opinions of experienced cultivators as to the future management in different states and circumstances of the lands, some supporting the superiority of keeping the ground closely fed down by sheep or neat cattle, while others consider mowing or seeding as preferable. "There seems little reason to doubt but that feeding by some sort of stock is a much better practice than those of either mowing or seeding; the chief difficulty is in respect to the sort of stock that is the most proper. On the more dry and firm sorts of ground, a mixed stock may be the most advantageous, as neat cattle and sheep, as in that way the new pasture may be fed down in the most regular manner; but on those that are of a more open, porous, and less firm quality, sheep, by their eating so closely, may do much harm, especially in the first years of the new lay, by pulling up the young and imperfectly established grass-plants. Several instances of this kind have been noticed in such soils. In lands that are more inclined to moisture, the consuming of the produce by neat cattle must constantly be liable to do mischief, except in very dry seasons; they must of course be principally fed down by sheep. And in all cases where the new lay is chiefly constituted of the more coarse sort of grasses, sheep would seem to be the most proper kind of stock, as the grasses are thereby constantly becoming more fine and sweet. Many facts of this nature have been noticed by cultivators. The sweetness of the pasturage on many sheep downs has been remarked to depend more on their being kept close fed down than any other circumstance, as on being neglected in this respect it becomes coarse, and is rejected." It has been well observed by the Rev. Mr. Young, in a valuable paper, in the 3d volume of Communications to the Board, that "sheep-feeding not only ameliorates by enriching the soil, and fining the herbage, but also by destroying weeds." And Dr. Dickson has "been assured by a very extensive and experienced cultivator in Somersetshire, that under this sort of management, not only many coarse grasses but other sorts of plants become fine, and eagerly fed upon by animals." It is further stated, that "Dr. Wilkinson, who has been much in the habit of comparing different practices, advises the grazing constantly with sheep, and for the first six years never to permit the scythe to touch the lays," but this is certainly longer than is necessary to preclude the scythe in many sorts of soil. And that the Rev. Mr. Young has remarked in addition, "that it is not merely the first year that feeding with sheep is the best practice on new lays, but it may be so managed the second, and if it extend to the third it is the better: and though there is not any necessity for adhering to it any longer, it has been found to answer well in his practice, four, five, or even six years; and in general, he thinks, it may be concluded, that the more the land is fed with sheep, the greater the improvement will be. But in this management the impoverishing absurd system of removing the animals to be folded in other places, is not to form any part of the practice."

It appears from the Agricultural Report of the North Riding of Yorkshire, that, "it has been long the practice in that district with the most improved cultivators, to have recourse to the method of sheep-feeding for some time after laying the lands down to grass, as two years or more. Where ray grass and

white clover are intended to remain some years, it is found by some, advantageous to eat them the first year by sheep, in closing, thickening, and rendering them more permanent. These facts are all in evidence of the great propriety and utility of the practice of feeding new grass-lands. It must, however, be observed, that in order to render the practice perfectly safe and beneficial, the new lays should not be fed during the autumn, or the stock turned into them at too early a period in the spring. "Nor should they be too heavily stocked, or the stock kept in the pastures too long, especially where it consists principally of sheep, as they may do much harm by paring and eating the plants so closely down as immediately to kill them, or expose their roots too much to the destructive effects of drought. And in cases where the grasses have run up much to stem, if the lands be sufficiently stocked with plants, it may be an useful method to cut them over by means of a strong scythe before their seeds are formed, as by this means they will become more strong and vigorous: but, in the contrary circumstances, they are better left for the purpose of providing a more abundant supply of young grasses, as the benefit obtained in this way will more than counterbalance the injury sustained by the running up of the old plants" to stem.

The author of the Modern System of Practical Agriculture, however, states that, "though the practice of feeding new laid grasses in the first years appears to be the most advantageous and proper mode of management, especially for lands intended for pasture, there are many cases in which they may be mown with great success. This practice is perhaps always the most beneficial and proper, and indeed the only one that can be safely adopted in such soils as possess any great degree of moisture, as under such circumstances the feeding them down with any sort of live stock must in most seasons be injurious to the sward. And, besides, where the object and intention of the farmer is chiefly hay, the grass-plants, by being kept closely eaten down by live stock for a considerable length of time before the scythe is applied, may, from their becoming thereby disposed to a low and lateral spreading growth, be afterwards more unfit for the production of hay crops. Several facts of this nature are, he says, related by writers on husbandry. In one case, where different divisions of land of the same kind were laid down in the same manner, on one of them being kept in the state of pasture and the other alternately mown and pastured, after some years both being shut up for hay, that which had been pastured afforded a much inferior produce to the other. The same thing has happened in other cases of old pastures being converted to hay lands, even when the most favourable season prevailed." He therefore concludes that, "on these principles it may be a more judicious practice to manage lands designed for hay without having them for any great length of time, previously to their being mown, fed down closely with stock, as in this way a larger produce of hay may be afforded."

He thinks that, "where the new lays are mown the first year after being laid down, which is not a method to be recommended, it is an excellent practice to apply a moderate coat of manure over them in the autumn, especially when the state of the land and the season is such, in respect to dryness, as to admit of its being done without injuring the surface sward; as by this means the grass-plants not only become more strong and vigorous, but better established in the soil, and of course bear cutting with much less injury."

As it may be the case sometimes, though seldom, where these modes are fully attended to, that the farmer may fail either in part or wholly of producing a good lay: "in the first case it is the best practice to have recourse to sowing fresh seeds, which should be performed in the early part of the spring, when the weather is in a moist state, the seeds being advised by some to be trodden in by putting sheep upon the land either indiscriminately, or by very open folding, as the use of the roller will not be effectual, and that of harrowing cannot be practised without injury." It is stated that, "Dr. Wilkinson found advantage from putting the seeds in before the manure was applied in the new lays, which are sometimes too hastily ploughed up. By either method the sward of such lays may often be much thickened, as well as benefited in other respects. And that, in cases where the grasses have run up much to stem, if the lands be sufficiently stocked with plants, it may be beneficial to cut them over by means of a sharp scythe before their seeds are formed, as by this means they will be more strong and vigorous, and the lands be less injured; but under the contrary circumstances they are better left for the purpose of providing a more abundant supply of young grasses, as the benefit obtained in this way more than counterbalances the injury sustained by the old plants being left upon the land. But that, where there is a complete failure from particular causes, the most advisable method is, where the seeds have been put in in the spring with grain crops, to take off these crops as soon as they admit of it; and after giving the land one ploughing, to harrow in directly fresh seeds; which should be accomplished as early in the beginning of August as it can be performed; and a roller may be applied over the land when in a suitably dry condition about October. But, that where the latter end of summer has been the time of sowing, it is advised, "that the land should have three ploughings performed upon it in the early spring months, when the weather is sufficiently dry, and the grass-seeds be again put in with a crop of buck wheat in May, which, though it is not a suitable crop for the heavy wet sorts of land, sometimes answers well in dry seasons; and in wet ones, as affording but little seed, may be mown when in blossom as green food for cows." From its not robbing the land much of its fertility, it is probably well adapted for this purpose.

Though the application of manure to new laid down grass lands, is seldom absolutely necessary, where they have been returned to the state of sward under that degree of fertility and preparation which has been here inculcated, it may in many instances be had

recourse to with great advantage and improvement, as it is, perhaps, one of the best methods of preserving a good close state of grass or sward when properly made use of. It has been remarked by Mr. Maxwell, in the 3d volume of Communications to the Board, that "though in general no manure will be wanted till the land has been mown for hay, there can be no doubt but that great additional improvement will be produced where manure of any sort can be applied," and that "the oftener the land is manured, the greater will be the improvement." Where lands have been laid to sward or grass with grain crops, the application of slight dressings of manure in the following autumn may be of much utility in fixing and encouraging the growth of the young grass-plants as has been seen; but in other cases the latter end of the summer following, or very early in the autumn, are supposed by some to be the most beneficial and proper periods for the purpose; "but as at these times, in many instances, much loss of manure may," Dr. Dickson observes, "be sustained both by evaporation, and the washing of heavy rains and snows, it may be a better and more advisable practice to perform the business in the early spring months, especially where the lands are to be conducted under the scythe, as in this way the enriching material will be ready to exert its influence at the moment the young plants begin to send forth their new shoots; and thus not only afford more assistance in thickening and invigorating the new sward, but be less in danger of being uselessly dissipated and wasted."

"Where manure cannot be spared for repeatedly dressing new grass lands, as the grasses are often, especially on lands not suited to their growth, liable to decline and become thin, in some instances it is supposed from the sown grasses disappearing before the spontaneous ones have attained sufficient vigour and strength: but more generally, probably, from the grounds not having been in a proper state of fertility or fineness of surface mould at the time the seeds were put in, or the particular unfavourableness of the season, about the close of the third summer after their being sown, it is believed by the Rev. Mr. Young, to be a better practice to defer the use of manure till that time on such lays as are pastured; and when they are under the scythe, till the hay crop has been taken from the ground. We have no doubt of the success of the application of dung top dressings at these periods though they must evidently be made use of in a less economical manner than at a later season in the Autumn, or an earlier one in the spring. And it is the most common opinion that all the finer and more soluble kinds of top-dressings are applied with the greatest benefits in the very early spring months, as about the latter end of February or the beginning of the following month. The differences in the effects of these sorts of manure have, perhaps, not yet been fully ascertained under different circumstances of application. With the view of encouraging and supporting the growth of the natural grasses when the sown ones decline, as about the third year, an experienced cultivator, Dr. Wilkinson of Enfield, who seems to favour the opinion of manure being the most usefully laid on land early in the autumn, or on hay lands immediately after the crops have been taken off, states that "he has used coal ashes with great success, to the amount of three chaldrons per acre. He has laid of this manure on grass land above 50 chaldrons in a year. About eight years ago he laid down a field of twelve acres with broad clover principally, intending it to stand only for two years. In the summer it was mown twice, next year it was grazed: the clover was but weak. As he had particular reasons for altering his mind, and for wishing to continue it in grass, he resolved to try the effects of grazing it with sheep. On the fourth year it looked so very bad, the clover almost entirely disappearing, that he was tempted to plough it up. He, however, resolved to continue the grazing, and to give it a dressing of three chaldrons per acre of coal ashes. The next year he observed the white clover and natural grasses beginning to form a close turf, and the field is now an excellent piece of sward, without the aid of any hay seeds." And it appears from the further trials of the same agricultor, that the following substances have much effect, not only in promoting the growth and rendering the herbage more fine and sweet, but in renovating the sward—the scrapings of the road or sand-drift, fold-yard liquor and watering; and that the effects of other manures, would seem to be chiefly in promoting the luxuriance of the grasses, and of course to be principally advantageous in increasing the quantity of produce such as "tallow-chandler's graves when used in proportion of a ton an acre, and night soil when laid on to about three horse cart loads the acre. And that in fixing, producing, and rendering the white clover more permanent, marl, on strong cold land, and coal ashes, on wet soils, have been highly beneficial. On the drier clayey lands in Cornwall, "sea sand has been found to mellow the clay and make them hold the grasses." And on what are termed stone brash lands the use of marl is often found of great utility, when applied in the latter part of the summer of the first year of the lay. But it is necessary, to the success of this sort of application, that the ground be well covered with grass before it is applied, as where the surface is much exposed the marl is liable to plaster and cake together, and the young grass-plants to be in consequence exposed to much injury from the heat of the summer. This substance seems to bring up the best sort of natural grasses, but in time it sinks below the reach of vegetation. About thirty cart loads are sufficient for the acre. And chalk on the deep loamy clays was found by Mr. Davis an useful application the first year on new lays, in the proportion of about twenty loads to the acre. On the more sandy sorts of land, clayey marl may be of great advantage in establishing the grass, and on peaty or moory lands, marl and other similar materials will be found of advantage in rendering them more compact, and better suited for preserving the grasses as well as sand and road stuff for fining the herbage and rendering it more palatable.

It is stated that "soot has been much used as a top-dressing, but that Dr. Wilkinson has not found

the effects to last beyond the first year. He has tried it to the amount of sixty bushels per acre, at 8d. per bushel; perhaps it should be used in larger quantity. Lime is nearly as dear, and of that he has used 160 bushels per acre on arable land. If he should use soot again he intends to lay it on to that amount." And he has "used sugar-baker's scum with great success to the amount of two loads an acre, at half a guinea per load, which has been found a strong warm manure, highly serviceable on cold land, its effects being permanent." Lime is also found useful on the more friable red loamy soils, by fixing and rendering them more close, to keep the vegetation more to the surface, as well as to promote the growth of the natural grasses, and prevent their roots from being injured by the heat of the sun. The same writer mentions that "woollen rags, though not generally used as manure on grass land, yet, when chopped small, have been spread with advantage on young clovers before winter to the amount of about 10 cwt. per acre," being useful in protecting and nourishing the young grass plants in their more tender growth, but they are slow in producing their beneficial effects.

Doctor Campbell of Lancaster, "on applying, in order to compensate for an immediate crop of hay, and to thicken the sward, on one part of a field, rotten dung about eight tons to the statute acre, on another part woollen rags chopped at the rate of 100 stones to an acre; and on a third a rich marl in the proportion of about 80 tons to the statute acre:" found, on comparing their effects two years afterwards that "the dung had produced the greater luxuriance. The woollen rags had a superior verdure, a deeper green: but as they had not yet been properly incorporated with the land, by the grass growing over them, their ultimate produce could not be ascertained." An acre of land may, he says, "be manured by this means for about 3l. effectually, should they be found to answer the purpose." The same is, he says, the case with "the marl, which having covered the ground into which it is not yet carried down by the rains, and the grass not having grown through, it has at present rather done harm than good." On this account he supposes that "marl is long in producing its beneficial effects, and the return of which cannot be looked for in less than two or three years."

It is evident from these facts, Dr. Dickson thinks, that different effects may be produced on grass lands by the application of different sorts of substances or materials to them in the manner of top-dressings after they have been laid down to grass; and that "where fine herbage is the principal object in view, coal ashes and composts of the earthy kind formed from sand, mud, scrapings of roads, and other similar materials, intimately blended and incorporated with suitable proportions of well rotted dung, may be the most beneficial applications;" also that "the liquor of fold yards and watering may be useful in the same intention as well as those of restoring the grass-plants or swards, and promoting the luxuriance of the crops." But that "where the increase of produce is chiefly aimed at, good dung in a well reduced state, tallow-chandler's graves, night soil, chopped rags, soot, scum of sugar, and other substances of the more animal kind are the most effectual and proper." While in the intention "of establishing, preserving, rendering durable the different grasses—marl, lime, chalk, the folding of sheep, and other substances and practices of the same sort will be the most proper for producing such effects." And that in "rendering the lands more firm and solid, the three last substances may perhaps be employed with the greatest success and advantage." The effects of substances of these and other kinds, may be more fully seen in speaking of the general applications of manures, as also under the head grass. See *Manure* and *Grass Ground*.

LAYING *out Lands*. See *Farm*.

LAYING *out Homestalls*. See *Homestall* and *Farm Buildings*.

LAYING *out Roads*. See *Roads*.

LAWS *of Estates*. See *Estate and Farm*.

LEAF, the well known fine membranaceous part of a tree or plant, which is put forth and unfolded in the spring, and which in many kinds of trees, falls off in the autumn.

It is observed by Dr. Hooper, in his useful Tract on the Structure and Economy of Plants, that the leaves are produced from the barks of the trunk of the plant, and consist of an epidermis, a vascular network, and a parenchyma full of a greenish juice. They are every where supplied with fibres, which are commonly termed the nerves of the leaf, but which are merely its vessels running in every direction, and branching out into innumerable small threads, interwoven with the parenchyma, like fine gauze or lace. The surface of the epidermis of a leaf, like that of an animal, is full of pores, which serve both for respiration and the absorption of dew, air, &c. These pores or orifices differ both in shape and magnitude in different plants, which, he says, appears to be the cause of the variety of texture peculiar to every plant. The parenchyma consists of very minute fibres, disposed in extremely small cells, which are of various sizes in the same leaf. All leaves, of whatever figure, have a marginal fibre, by which the rest are bounded. The particular shape of this fibre determines the figure of the leaf. The vessels of the leaf have the appearance of inosculating; but, when examined by a microscope, they are found, he says, only to be interwoven or laid along each other.

According to him, the use of the leaves is to nourish the plant with the nutritious juice they reserve in their parenchymatous substance, and to expire and inspire air and water. From various analogies, Dr. Darwin, however, conceives that there can be no doubt but that the leaves of trees or plants are their lungs, giving out a phlogistic material to the atmosphere, and absorbing oxygen or vital air from it.

The distinction of leaves made by those who have written on botany are the following: A simple leaf is that which is not divided to the middle. A compound leaf, is divided into several parts, each resembling a simple leaf, as in liquorice, &c. A digitated leaf is a compound leaf divided into several parts, all

of which meet together at the tail, as in hemp, black hellebore, &c. A trifoliated leaf is a digitated leaf consisting of three fingers, as the trefoil, &c. A quinquefoliated leaf is a digitated leaf, consisting of five fingers, as in the quinquefolium. A pennated leaf is a compound leaf divided into several parts, each of which is called a lobe, placed along the middle rib, either alternately or by pairs. When the middle rib is terminated by an odd lobe, it is said to be unequally pennated, as in the goat's rue, &c. and equally pennated when it is not terminated by an odd lobe, as in the cassia; when the lobes are all nearly of the same form and bigness, it is called an uniform pennated leaf, as in the liquorice; when they are not so, it is said to be difform, as in the agrimony. A winged leaf is, as it were, divided into several pennated leaves, as in the orobus, &c. A ramose leaf is that which is still farther divided than the winged leaf, as in the osmund royal, female fern, &c. An entire leaf or lobe is that which has no division on its edges, as in the apple-tree, &c. A sinuated leaf is that which is cut about the edges into several long segments, as in common mallows. A ferreted leaf is that which is cut about the edges into several acute segments, resembling the teeth of a saw, as in the nettle, &c. A crenated leaf is that which is cut about the edges into several obtuse segments, as in betony, &c. A laciniated or jagged leaf is that which is cut about the edges into several pretty deep portions in an irregular manner, as in the horned poppy, &c.

All the experiments which have been made in order to shew how serviceable the leaves of trees and plants are to their well-being, have proved, that when the plants have been divested of their leaves, or their leaves have been eaten or cut, during their growth, they have been remarkably weakened. If the leaves of plants be the means by which their juices are prepared for their support, as has been just stated, it should teach us not to pull or cut off the leaves of trees or plants, on any account, while they retain their verdure, and are in health, as they may be greatly injured thereby. Hence probably the error of the common practice of feeding down wheat in the winter and spring with sheep, as, by so doing, the stalks may in many cases be rendered weak, and the ears shorter, the grains of corn not being so plump and well nourished as when it is not fed down upon the same ground. It is well known too that in grass which is often mowed, the blades are rendered finer in proportion to the frequency of mowing; so that, though this may be a desirable thing in lawns, &c. where regard is had to the produce, it should certainly be avoided.

Another supposed use of the leaves of plants is that of throwing off by transpiration what is unnecessary to their growth, answering to the discharge made by sweat in animal bodies; for as plants receive and transpire much more, in an equal time, than large animals, so it appears how necessary they are to preserve the plants in perfect health; for it has been found by the most exact calculation, made from repeated experiments, that a plant of the sun-flower receives and perspires, in twenty-four hours, proportionally, seventeen times more than a man.

The leaves of trees or plants, where they can be collected in large quantities, as in parks and woods, may be highly useful in augmenting the manure heaps of the farmer.

It is advised by Mr. Young, in his Calendar, that, in wooded countries, all the leaves that can be had at little expence, should be raked up in October, and carted to the yards, and standing folds, for littering and making them into dung: he does "it, he says, at 3d. per one-horse cart load. They do not rot easily, but that is, he thinks, no objection to them; they are a sponge to be saturated with urine, and if not touched previously to carting on to the land, will convey to the field much of what might otherwise be lost; and they are extremely useful in aiding the main object of bedding the yards" in the autumn and winter season.

LEAF-*eared*, a provincial term applied to horses when their ears are low and badly placed.

LEAF, a measure of capacity signifying half a bushel, sometimes termed *Lip*.

LEASE, a provincial term that implies grassy-ground, meadow-ground, or any unploughed-ground, kept for the use of cattle.

LEASE *of Land*, a kind of contract or agreement for the letting of lands, tenements, &c. either for life, or a certain term of years, under a reserved rent.

It has been remarked by Mr. Marshall, that the different modes of holding land are first that of "the tenant holding *at will* or until the customary notice be given, by either party to the other;—without any legal contract, or written agreement;—the only tie between the owner and the occupier being the custom of the estate,—or of the country in which it lies,—and the common law of the land." This, he conceives, may be considered as "the simple holding which succeeded the feudal or copyhold tenure; but which is now fast going into disuse." The second mode is, he says, that of "holding from *year* to *year*, under a written agreement, with specified covenants." This, which is a more modern usage, is, on the contrary, he thinks, becoming more and more prevalent: even where leases for a term of years were formerly granted." The third, that of a "lease for a *term* of *years*;—as seven, fourteen, twenty-one, or a greater number of years, certain; but without the power of assignment, unless with the consent of the lessor." And the fourth that of a "lease for lives;—as one, two, three, or more,—without the power of assignment, which he believes now are rarely granted in England; but in Wales, they are still prevalent; the rent being, there, settled according to the value of the land at the time of letting; as on granting a lease for a term. And, in the western extreme of England, what are termed life leases are still common. But that they are in fact rather pledges for money taken up,—or deeds of sale for lives,—than leases; as nearly the whole of the estimated sale value of the land, during the life term, is paid down, at the time of purchase, the seller reserving only a quit rent, or annual acknowledgment" of some sort or other.

The same writer conceives that life leases may be

considered in different points of view; as "to a tenant who holds at a moderate rent, a lease for life is gratifying, his farm becoming a sort of life estate; —in which he is fixed for life; but that unless he is a prudent or a fortunate man, it may prove a source of misfortune to his family, who, in the moment of their distress for his loss, may be liable to be turned out, pennyless, from a house and home: a circumstance which can rarely happen, under holdings for certain terms of years." These sorts of leases have a much better effect, he thinks, on agriculture than annual holdings, and that it is more than probable that life tenancy heretofore has assisted in the advancement of the art. "It is, however, a well ascertained fact, he says, that the manifold and great improvements which have taken place, in English agriculture, during the last half century, have not been effected in Devonshire, nor in Wales, but in Norfolk, and in the midland counties, under leases for terms of years." And "that in a political light, life leases have a favourable appearance; as tending to fill up a space between ordinary tenants and yeomanry, or small proprietors; and giving their holders better stakes, than less certain occupiers have, in the established order of things." But that here it is the light in which lifeholds appear to land proprietors that is entitled to the chief attention;" which "on whatever side they have been viewed, by the owners of extensive estates, during the last twenty or thirty years, have doubtlessly appeared in odious colours. For, owing to the rapid depreciation of money, there are, he says, proprietors who have been receiving, year after year, not more, perhaps, than one half, or a less proportion, of the fair rental value of many of their lands. And for such as still hang on good lives, they may not receive more, for many years to come." And further, that, "owing to the perpetual bondage in which their lands are kept, no general work of arrangement can be effected, nor any individual improvement introduced, by a proprietor;—who can scarcely be said to have any authority, either over his estate, or its possessors," proprietors, or owners.

Those sort of holdings which are only for the year, "are, he thinks, to a tenant, most discouraging: —and, to improvements in agriculture, most unfriendly. In a public view, they are of course highly impolitical. While to a proprietor, they are most convenient, as he may be said to be in constant possession of his estate. He can lay out and execute general improvements,—as embankments, and drainage;—extensive works of irrigation,—the alteration of water-courses, roads, and fences,—and complete the arrangement of tenements,—without controul. It would, he thinks, be unwise, therefore, on an estate under this sort of tenancy, to alter it, until the requisite improvements were planned; and put in a train of being performed." It has, however, been further justly remarked, that "whatever discourages agriculture cannot be permanently profitable, either to a proprietor, or the community." And that in regard to present profit they are highly disadvantageous to the proprietor. See *Annual Holding*.

In regard to the third sort of holding of land, as that of leases for terms of years, as "for twenty-one years, though they may be profitable at their commencement, have, the same author thinks, been found much otherwise before their expiration: owing to the great rise in the value of farm produce, during the terms. And while proprietors who were letting their lands, from year to year, were profiting by this circumstance, the incomes of those whose lands were under long leases (whether of lives or years) were stationary: and this while the expences of living were advancing with the value of lands; which circumstances, added to their being controuled in the required arrangements, and perhaps annoyed, during a length of years, by the improper conduct of ignorant, ill-disposed, purse-proud tenants (enriched by these very circumstances) have determined many persons in different parts of the kingdom to discontinue the practice of granting leases; giving written agreements, from year to year only; which is much to be lamented for the interest of agriculture and the community in general." While others have shortened the terms of their leases to fourteen years. But such, he says, "has been the rapid depreciation in the value of money, and the nominal increase of the value of lands, that even this term has been found seriously inconvenient to a landlord: and the term of seven years (without a covenant of remuneration) is, he thinks, of little use to a tenant." These sort of fixed leases are liable, he conceives, to another objection. As "although a man of spirit and worth will not only give an advanced rent, in the first instance, but will, through the improvements he has made, be able and willing to give a still greater advance, at the end of the term; yet, when a lease of this nature has been unfortunately or improvidently granted to a poor, an ignorant, an indolent, a resentful, or a dishonest man, the farm thus let may be left, at the end of the term, in a much worse condition than it was in at the commencement" of the same, which renders it highly necessary for the manager of an estate to be careful in the choice of tenants.

After stating some circumstances of mismanagement, and inconveniency on this account, the writer considers it useful, for owners or proprietors to come to clear understandings with their tenants, three years previously to the terminations of their respective leases. "For, says he, until about that period, a skilful tenant continues to keep his land in cultivation and condition,—for his own interest: which, until then, may be said to go hand in hand with that of his landlord. And if, at that period of a lease, a fresh agreement were entered into, the ruinous consequences of an expiring term might be avoided."

And that on perceiving the objection to giving leases for long terms among owners, "it occurred to him that agreements for holding from three years to three years, instead of from year to year, would be an eligible species of tenancy. Or, which is precisely the same thing, granting leases for six years certain; with a condition that if neither party give notice to quit, before the expiration of the first three years, then the term to be prolonged to nine years; and so on, from three years to three years (or in effect from six years to six years) until three years

after notice has been duly given by either party to the other;" as by these means room is, he thinks, given for a tenant "to turn his hand in," and a loose to his exertions. "He has, in reality, a fresh lease of six years granted him every third year. And this is sufficient to encourage him to keep his lands, continually, in the most husbandlike state. And if he execute any of the higher improvements, it is but reasonable that he should have, whenever he may quit his farm, an equitable remuneration for the remainder of such improvements. Thus, he says, the tenant is placed on sure ground; he may still manure and improve with much the same confidence as if the lands in his occupation were his own property." And that "in return for such advantages, the tenant cannot hesitate, he thinks, to covenant, that, during the last three years of his term, he will manage his farm in a husbandlike manner, and, at the end of the term, leave it in such a state of cultivation and repair, as will induce a good tenant to take it, at a full rent;—or suffer the proprietor to put it in such a state, at his (the out-going tenant's) expence." It is further observed, that, "an estate which is under lease, on these principles, and under attentive management, cannot be let down to an unprofitable state. It must continually remain under a regular course of husbandry, and in a state of cultivation and repair; and the more permanent improvements be kept up. If the acting manager do his duty, even the changing of tenants cannot interrupt its prosperity," while "the incoming tenant (under attentive management) steps into his farm, with the advantages that he would have enjoyed, had it been under his own direction, for the three preceding years." But that, "with a lease on this principle, and with a proper choice of tenants, removals can rarely happen. What proprietor, who knows the difficulty of procuring a good tenant, would wish to discharge him? And no such tenant would readily leave the farm he is settled upon, if he find proper treatment.—Even should notice be given in consequence of any misunderstanding between the parties, three years allow time for reflection; and, before they expire, resentment may die away, and cordiality be restored. If, however, either party be dissatisfied, he has an easy way of dissolving the connexion. Or if a proprietor is desirous to make fresh arrangements on his estate, or to regulate his rent-roll by the existing value of money, he need not wait many years to fulfil his desires; for if the tenant in occupancy will not agree to pay a fair rent, the owner has three years before him to choose one who will,"—which is a consideration of much importance. It is thus evident, he thinks, that "a lease on this principle has a decided preference, by a proprietor, to long leases. And its advantage over annual holdings is not less considerable. The lands of an estate are well worth from five to ten per cent, more, to a tenant, under the former, than under the latter, tenancy. So that, beside the conveniencies mentioned, a proprietor may be immediately adding very considerably to his income, by this principle of management;" as has been proved in many cases, in different parts of the island.

In respect to the necessary covenants,—the reservations, restrictions, obligations, penalties, and remunerations, it is observed by the same author, that the lease (or form of a lease) of any landed estate is (or ought to be) a code of private restraining laws, suited to the circumstances of that particular estate, in order to protect it from injury, and to promote its prosperity: an honest tenant considers the covenants of his lease merely as instructions to direct his steps, but which ought to restrain him no farther, than to protect the farm or the estate from injury. But a worthless tenant, as a thief, is ever ready to break the laws which bind him: and the proprietor of an estate ought to have some means of punishing him for his fault. Penal covenants in leases are of course of the greatest importance to proprietors.

But, it is further remarked, that on account of "the great difficulty withwhich a general law of this nature would be framed,—owing to the great diversity of soils, situations, and modes of culture,—every estate, strictly speaking, requiring its own peculiar code, to govern and defend it (and of course the great difficulty which a court must find to decide with any sort of accuracy in cases of this kind)—one would naturally imagine, it is said, that courts of law would rather be thankful to proprietors of estates for furnishing them with ready and safe means of doing justice, than set their faces against any covenants, which have been formally entered into, and legally confirmed, by the parties before them. If penalties are excessive, or oppressively severe, or have been surreptitiously imposed, it undoubtedly belongs to a court of law to mitigate or remove them. But severe restrictions, and excessive penalties, are highly, he says, impolitic, and altogether improper to be introduced into the lease, or law, of an estate: inasmuch as they tend to depress its character, and may prevent good tenants from settling upon it; or drive away those whom it may already possess:" and of "course militating against one of the first principles of good management." But where by judicious restrictions, and reasonable penalties, designing men are kept aloof, a general good is gained to the estate."

The particular covenants that are necessary must be determined by the existing circumstances of the estate, or the particular farm for which it is intended. As it is obvious, the same author says, that "a grass land farm requires a set of covenants differing from those which are proper for a farm under mixed cultivation. And an arable farm, situated near a great town, should have covenants differing in some respects from those of another, which lies in a recluse district. While every part of an estate, and all estates on which hedge timber can be profitably raised, call for a series of regulations, which an untimbered estate, or one on which grown timber only is to be protected, does not require." And further, that "much depends on the time of changing tenants. A spring, and an autumnal removal require very different stipulations respecting the states in which the lands of a farm are to be left; how the crops in the ground, and the produce on hand are to be disposed of; and by whom the crops of the succeeding year are

to be put in." It is added, that "every district has its customary time or times of removal; and it can seldom be prudent in an individual to alter it (even though very improperly fixed) as he might thereby diminish his choice of tenants. Nevertheless, it is in the power of proprietors conjointly, to effect, in time, the required alteration. Michaelmas and Lady-day may, he says, be considered as the ordinary times of changing tenants in England. The former is not an ineligible time for removing, in autumn; but the latter is extremely improper, as being in the middle of spring seed time, and falling at a time when the winter fodder is partially expended, and the crops of the preceding year are partially thrashed out." It is observed by Mr. Marshall, that "in the north of England (Cleveland, in Yorkshire, being the most southern district in which he has observed it) a far more rational plan of removal is established. There, the arable lands are quitted at Candlemas; the pasture grounds (Cleaveland being much of a dairy district) at Lady-day; and the mowing ground and the homestall at old Mayday." While in Scotland, similar regulations prevail; but with a well judged difference, which naturally arises out of the different climatures of the two situations. There, the premises are finally quitted at what is termed Whitsuntide, namely, the fifteenth of May, old style." And it is the opinion of this able writer, that, for the more southern provinces of England, the first of May, new style, would be a proper time for removals, in the spring" part of the year.

In what regards the forms of leases, those which are good do not, it is stated, "merely require a judicious selection of covenants, but that the several clauses should be properly digested; and be arranged, worded, and lettered in such a manner as to be intelligible to plain countrymen,—to men for whose guidance and good government they are intended." And the plan, which experience entitles the above writer to recommend, is that "of printing leases, on large folio sheets of firm paper, or sheets of parchment folded in the folio manner; each page containing two columns, and each clause composing a distinct paragraph: with a blank page, or half page, to receive a sketch, or rough plan of the farm demised; as well as a particular, or schedule, of the different parcels of land of which it is composed: with the number, name, and measurement of each arranged in the column manner: in order that no doubt may, at any time, arise respecting their identity." Particular forms will be seen below, for particular sorts of farm land.

It is observed by Mr. Kent, in his Hints to Gentlemen of Landed Property, that the ancient feudal tenures had undoubtedly a strong tendency to enslave mankind, by subjecting them to the controul and power of an arbitrary lord; but, like most other things, there were some advantages to be found in the system. Every man who held land had a certainty in it, as the tenant generally held his possession for life. When these tenures were, says he, discountenanced by the more liberal spirit of modern law, some new compact became necessary, and terms of years were substituted in lieu of the former; for, as land properly managed requires great expence, and seldom answers that expence in one year, it was but reasonable that the man who applied his judgment, devoted his labour, and ventured his capital, should have some reasonable time allowed him to reimburse himself, and derive some proportionate reward for what he had done. In the course of time, this term, says he, began to be reduced into a certain number of years; and as most of the land was formerly under the regulation of two crops and a fallow, the time allowed was from three to twenty-one years. And the latter in the end became the most general limitation, and is the most prevalent term for leases at the present period.

That leases are the first, the greatest, and most rational encouragement that can be given to agriculture, admits not, in his opinion, of a doubt: but of late years, he remarks, there are very strong prejudices entertained against them.

Let any impartial man, says he, take a view of two districts, where it is the custom to grant leases, and where it is not: in the former, he will generally find a respectable yeomanry, and a well cultivated country; in the other, an indigent spiritless race, following a contracted system of husbandry, calculated to answer no permanent purpose of advantage to themselves or landlords. Yet, there are many gentlemen, he remarks, who, to have such people at immediate command, prefer the continuance of a slovenly, unproductive style of husbandry, to neatness and fertility. In some parts of England, the prejudice against leases is, he asserts, so strong, that some landlords will be tempted almost as soon to alienate the fee-simple of their estates, as to grant a tenant a reasonable term in them. It is very unfortunate, he thinks, for a county where this abhorrence of leases prevails, as it keeps back an immense scene of improvement, which otherwise would take place, and robs the industrious occupier of a deal of comfort which might be bestowed upon him; and it can produce no other consolation to the owner, than that of his having the country more at command, and forcing a certain degree of respect from it, which is absurd to the last degree; for a landlord may, he conceives, ensure as much real respect from a tenant on lease, as from a tenant at his immediate will and pleasure, and at the same time secure his property better, and stipulate for improvements to the extent of his inclination or desire.

It is farther remarked, that, in the eastern counties, where it is more the custom to grant leases than in the midland parts of England, agriculture is upon the most respectable footing; and that within half a century there are many estates more than doubled in their value; which, without leases, where the means of improvement was heavy, could not have carried a third of the advance that has been put upon them. In short, it seems to him unreasonable to expect a man to employ the whole of his capital, and to devote the best part of his life, upon an estate, which, upon the death or mere caprice of his landlord, he is liable to be turned out of at six months, or perhaps a shorter notice.

He does not, however, mean to imply, that leases ought not in any case to be withheld; there are certainly, he says, some exceptions against the practice he wishes to see established: for instance, if lands are situated very near a gentleman's house, part of which it may perhaps be an object, on some future occasion, to take into hand, or where a minor is very near coming of age, or where there is any immediate view of sale; in such cases, it would, he thinks, be imprudent to grant leases. But where none of these contingencies stand in the way, and where estates are under an entail, or in a family that has no idea of parting with them, leasing is unquestionably the most effectual means of raising the value of an estate, as it enables the owner to stipulate for improvements in what way and proportion he pleases, which he cannot do so well in any other way.

And it is justly contended by the author of the Treatise on Modern Agriculture, that nothing gives such a spring to industry, as the conviction, founded on the experience of ages, that in this country the fruits of the labours of the industrious man are secured to him. Hence, says he, a farmer will be more or less active, in proportion to the security he holds of reaping the fruits of his industry.

He farther observes, that leases are certainly necessary and proper, as a compact between man and man; and though the mode of cropping and general tenor of the lease must vary according to times and circumstances, yet no man who has thought seriously on the subject will deny that they are for the benefit of both parties, as they secure to the landlord the proper management of the land so leased, and to the tenant, the additional profits which may be expected to arise from his superior cultivation of such lands.

As it is, however, necessary to impose some degree of restraint upon tenants, the means of doing it in such a way that they may not be so fettered as to be prevented from making useful improvements, or left so much at liberty as to do mischief, is the point that forms the principal difficulty.

The circumstance to be chiefly guarded against by restrictive penal covenants, are those of preventing the breaking up of old meadows, pastures, or other lands, the removing away hay, straw, or other materials convertable into manure; and the improving or destroying timber trees. To enforce the leaving of green winter food; the keeping up all sorts of fences; the cleaning of water-courses, ponds, pools, &c. and the preserving buildings, gates, pens, and hedge roads in proper repair. To prevent the forming of rabbit-warrens, and the committing of waste of any kind. And finally, to regulate the circumstances of the out-going and in-coming tenants.

Mr. Donaldson farther observes, that although it is not possible to form any particular lease, so as to include clauses that can apply to every kind of soil, mode of cropping, and general management; yet, as he has opportunities of perusing a great variety of leases in different parts of Great Britain; and as he is in possession of two (one adapted to each kingdom), which are the most perfect of their kind he has seen, he thinks they may convey more information on the subject than any explanation that could be otherwise given of them.

In Scotland, he remarks, the practice of granting leases for at least nineteen years has become very general, and may justly be considered as the means by which the spirit which now prevails for agricultural improvements in that kingdom has been so widely diffused.

Form of English Lease.

"THIS INDENTURE, made the day of in the year of the reign of our Sovereign Lord George the Third, by the Grace of God, of the united kingdom of Great Britain and Ireland, King, Defender of the Faith, and so forth, and in the year of our Lord One thousand eight hundred and

Between A. B. on the one part, and C. D. on the other, *witnesseth*, That for and in consideration of the rents and covenants, provisos and agreements, herein after reserved, expressed, and contained, and which on the part and behalf of the said C. D. his executors and administrators, are to be paid, done, and performed, he the said A. B. hath demised, leased, setten and to farm letten; and by these presents, doth demise, lease, set, and to farm let unto the said C. D. his executors and administrators, all those messuages, tenements, or farms, called

situated in the parish of

and county of now or late in the possession of as tenant thereof, to and under the said A. B. *Together* with all and singular houses, out-houses, edifices, buildings, barns,

Form of Scotch Lease.

"IT is contracted, agreed, and ended between A. B. proprietor of the subjects after set, on the one part, and C. D. of the other part, in manner following, that is to say, the said A. B. proprietor, has set, and in consideration of the yearly rents or tack-duty, and other payments and prestations, herein specified, sets, and in tack and assedation, lets to the said C. D. and his heirs, secluding assignees, both legal and voluntary, and subtenants of every denomination, *all* and *whole* the town and lands of

lying within the parish of

and county of and that for the full and complete space of nineteen years and crops, from and after the entry of the said C. D. thereto, which is hereby declared to be and begin, as to the arable lands, meadows, and pastures, at the separation of this present crop from the ground; and as to the houses, at the term of Martinmas, both in the year One thousand seven hundred and

Reserving to the said A. B. his heirs, successors, and assignees, full power and liberty to make search for and work coals, and other minerals, and to quarry lime and free-stone, and dig marl in any part of the lands hereby set, and to apply the same to

byres, stables, yards, garths, stack-garths, gardens, lands, feedings, ways, waters, easements, privileges, appurtenances, whatsoever, to the said demised premises belonging, or in any wise appertaining, *Except*, and always reserved out of this present demise, unto the said A. B. his heirs and assigns, all mines, minerals, and quarries, of what nature or kind soever the same be, as well opened as not opened, lying, being, and remaining within or under the said premises, or which can or may be obtained or gotten forth or out of the same, or any part thereof, with full and free liberty, power, and authority, to and for the said A. B. his heirs or assigns, and his and their agents, servants, and workmen, at all times, to search for all and every such mines, minerals, and quarries, and to sink pits or shafts, and to make trenches, grooves, drifts, water-gates, canals, and water-courses, and to direct or turn any water-course, brook, or river, for the winning and working such mines, minerals, and quarries within the said demised premises: *And also* for the winning and working any other mines, minerals, or quarries whatsoever, with sufficient ground-room and heap-room for laying the ores, metals, minerals, coals, stones, clay, earth, materials, and rubbish, to proceed, or be obtained or gotten forth out of the same or any of them; together with full liberty and power to build and erect engines, machines, houses, hovels, lodges, stables, cabins, and other edifices and erections whatsoever, for the effectual winning and working the same: *And also* full and free liberty of way, leave, and passage in, through, and over the said premises or any part thereof, to and from the said mines, minerals, and quarries, within the said hereby demised premises, or to or from any other mines, minerals, and quarries whatsoever, with carts, wains, waggons, and all other carriages, or contrivances, for leading ores, metals, minerals, coals, stones, cinders, bricks, lime, timber, or any other matter or thing whatsoever, and to make, lay, and place through, over, and upon the said premises any road or roads, waggon-way or waggon-ways, or any way or ways, canal or canals, for the purpose aforesaid, and from time to time to repair such roads ways, or canals, and to do all other acts and things needful or necessary for the winning, working, managing, and carrying on the said mines, minerals, and quarries, and leading and conveying away the produce of the said mines, minerals, and quarries, or any other mines, minerals, or quarries, as he or they shall think proper, with liberty to demise or grant to any persons all such liberties as herein before mentioned: *And also*, except and reserved unto the said A. B. his heirs and assigns, all timber and other trees, woods, underwoods, and plantations, and the ground and soil thereof, now standing, growing, or being, or which shall hereafter at any time during the continuance of this demise, stand, grow, or be upon the said premises, with liberty to make plantations, and inclose the same, whenever and wherever he or they shall think proper, and to fell,

his or their own use, the same being excepted from this lease, with free access to and from the same: the said A. B. and his foresaids being bound and obliged to pay to the said C. D. and his foresaids, all surface damage that may be done to the grounds, by carrying on said operations, as the same may be determined by two men, to be mutually chosen: reserving also power and liberty to the said A. B. and his foresaids, to straighten or alter the marches of the lands hereby set, with those of the adjoining lands: and in case, by such alteration of marches, there shall be lands added to or taken from the farm hereby set, then, and in that case, the rent of the lands so exchanged shall be determined by two men, to be mutually chosen by the said parties, or their foresaids: and further, reserving to the said A. B. and his foresaids, power and liberty, at any time during this lease, to assume the possession of, and to plant with trees any part or parts of the subject, hereby set, as he shall think proper; but such lands so to be assumed and taken possession of by the proprietor, for the purpose aforesaid, shall not exceed in the whole acres: the said C. D. and his foresaids being always entitled to a deduction and allowance out of the rent yearly, during the then remainder of this lease, at and after the rate of per acre of the lands, which shall be so occupied with such planting, it being at the same time expressly understood, that the said A. B. shall fence and inclose such planting in a sufficient manner, and at his own expence.

[*Here follow any further reservations that may be judged necessary*]

Which tack, above written, the said A. B. binds and obliges him, his heirs and successors, under the reservations aforesaid, to warrant to be good and sufficient to the said C. D. and his foresaids, at all hands, and against all deadly, as law will: for which causes, and on the other part, the said C. D. binds and obliges himself, his heirs, executors, and successors whomsoever to content and pay to the said A. B. his heirs, and assigns, or to his or their factors (stewards), for their behoof, the sum of of yearly rent or tack-duty, for the subjects hereby set at Whitsunday and Martinmas, by equal portions, after reaping each year's crop, beginning the first term's payment of the said rent at Whitsunday, One thousand eight hundred and and the next term's payment at Martinmas thereafter, for crop and year, One thousand eight hundred and and so forth, yearly and termly during the currency of this tack, with a fifth part more of each term's rent or penalty, in case of failure, and the legal interest thereof, from and after the respective terms of payment, during the not-payment of the same; and also to deliver yearly to the minister of the parish of the proportion of victual-stipend, payable to him from the subjects hereby set: the said proprietor, and his foresaids, being obliged to make an allowance or discount to the said tenant and his foresaids after the rent or tack

cut down, or lop such timber-trees, or other trees, wood, underwoods, and plantations, and to lead and carry away the same, by any means whatsoever: *And also*, except full and free way, leave and passage, in, through, over, and along the said hereby demised premises, or any part thereof, for any other uses or purposes whatsoever, he the said proprietor, his heirs or assigns, or his or their grantee or lessee, respectively making reasonable satisfaction to the said tenant, his executors or administrators, for the damage or spoil of herbage or ground, to be occasioned by the use or exercise of all and every, or any of the liberties aforesaid, such satisfaction to be from time to time fixed and ascertained by two indifferent persons, one to be named by and on the part of the said A. B. his heirs or assigns, and the other by and on the part of the said C. D. his executors or administrators: *And also*, except and reserved full power and authority for the said A. B. his heirs or assigns, and his and their stewards, agents, servants, and workmen, at all times, during the term hereby demised, to enter upon the said premises, and every or any part hereof, to view the state and condition thereof: *And also*, except and reserved unto the said proprietor, his heirs and assigns, and his and their servants, free liberty to hunt, course, hawk, shoot, and fish, in, upon, through, and over all and every the said hereby demised premises, or any part thereof: to have and to hold the said messuage, tenement, of farm-hold, lands, grounds, and all and singular other the premises hereby demised, or mentioned, or intended so to be, with their and every of their appurtenances (except as before excepted), unto the said C. D. his executors and administrators, from the twelfth day of May, which shall be in the year of our Lord One thousand eight hundred and for and during and unto the full term of Twenty-one years, from thenceforth next ensuing, and fully to be completed and ended: yielding and paying therefore yearly and every year during the said term of Twenty-one years, hereby demised unto the said A. B. his heirs or assigns at in the said county of the clear yearly rent or sum of of lawful money of Great Britain, by equal half-yearly payments, at two days or times in the year, that is to say, the twenty-second day of November, and the twelfth day of May, in every year, by even and equal portions; the first half-yearly payment of the said yearly rent to begin and be made upon the twenty-second day of November next ensuing the commencement of the said term hereby demised: *And also* yielding and paying yearly and every year, unto the said A. B. his heirs or assigns, on the several days and times aforesaid, over and above the said yearly rent of the further rent or sum of pounds an acre for every acre of the said demised premises, that he the said C. D. his executors, or administrators, shall, at any time or times during the continuance of this demise, break up, tear out, or convert into tillage, or have, or use, or

duty before mentioned, according to the fiars* of the county for said crop, for the quantity of grain so delivered, annually, and further, to pay the proportion of schoolmaster's salary, and ground officer's dues, affecting the lands hereby set, and to carry when desired, at his own proper charge and expence, tons of coals yearly from to the mansion house of the said A. B. at or to pay for each deficient ton of coals; declaring that if the carriage of the said coals is not demanded within the year, the tenant shall not be liable for the non-performance of said carriage for that year: and further the said C. D. binds and obliges himself and his aforesaids, to dwell and reside with his and their families, upon the lands hereby set, during the currency of this lease, and to consume the whole fodder that shall be raised on the said farm, and shall not sell or otherwise dispose of any part thereof, hay and wheat-straw for thatch only excepted: and that he shall be bound to apply to the lands hereby set, the whole dung made thereon, and to properly labour and manure the same, and not to cross-crop the same during the first seven years of this lease, by sowing wheat after wheat, oats after oats, wheat after oats, or oats after wheat, and in no way to waste, run out, or deteriorate said lands; but on the contrary, shall use all proper means for meliorating and improving the same: and the said C. D. binds and obliges himself and his aforesaids, particularly to observe the following rules and regulations in the management and cultivation of the subjects hereby set, viz. The whole farm shall be divided into seven parts, as nearly equal as the situation of the grounds will permit, and the following rotation of cropping adopted; one-seventh part thereof shall be sown the first year with turnips and potatoes, which shall be sown the second year with barley, and eight pounds of red clover, eight pounds white clover, four pounds rib-grass, and a bushel and a half of rye-grass seeds; † the third, fourth, and fifth years in grass, ‡ the sixth year in oats, and the seventh year in barley; The said C. D. and his foresaids being left to their own discretion to bring the remaining parts of the farm to this mode of cropping, under the restrictions herein contained, so that from and after the

* Fiars *are the prices of all kinds of grain which are ascertained annually in each county in Scotland by a jury, in presence of the sheriff, and which regulate in various cases, where the prices are not or cannot be ascertained by covenant.*

The tenant is generally bound to pay the proportion of stipend grain to the clergyman, over and above the stipulated money rent.

† *The kinds and quantities of grass-seeds sown vary on almost every estate; but these above mentioned are most commonly used.*

‡ *The tenant should be permitted to make the first year's crop of grass into hay; but the two succeeding crops ought to be used as pasture.*

employ in any course of husbandry, contrary to the covenants hereafter contained, without the license and consent of the said proprietor, his heirs or assigns, in writing for that purpose first had and obtained, and so in proportion for a greater or less quantity than an acre; the first payment of the said additional rent to be made on the first of the aforesaid half-yearly days of payment, which shall happen next after the ploughing, breaking up, tearing out, or converting into tillage, or having or using, or employing in any course of husbandry, contrary to the covenants herein after contained, any part of the said hereby demised premises, which said two several and respective rents are to be paid as above expressed and reserved, free and clear of all taxes, assessments, charges, and impositions whatsoever, as well parliamentary as parochial or otherwise, which the said demised premises now are, or may hereafter be liable to answer or pay: *Provided* always, and upon condition, and it is the true intent and meaning of these presents, that if it shall happen that the said yearly and other rents, herein and above reserved, or any of them, or any part thereof, be behind or unpaid, by the space of forty days next over or after either or any of the said days or times whereon the same ought to be paid as aforesaid, or in case the said C. D. his executors or administrators, shall neglect or refuse to do and perform all and every, or any of the covenants or agreements herein mentioned and contained, on his and their parts and behalves, to be paid, done, and performed; or in case the said tenant, his executors or administrators, shall, or do, at any time or times during the term hereby demised, alien, let, or assign over the said premises, or any part thereof, unto any person or persons, without the license and consent of the said A. B. his heirs or assigns, in writing, for that purpose, first had and obtained, that then, and in any of the said cases, it shall and may be lawful to and for the said A. B. his heirs or assigns, or such person or persons as shall be by him or them appointed for that purpose, without any previous demand or notice whatsoever to be made or given to the said C. D. his executors, administrators, or assigns, into and upon the said demised premises, or into any part thereof, in the name of the whole, to re-enter, and the same to have again, re-possess, and re-enjoy, as in his and their first and former estate, and from and immediately after such re-entry made, the said term hereby demised shall cease, determine, and become utterly void and of none effect, any thing in these presents contained to the contrary thereof in any wise notwithstanding: *And* the said A. B. for himself, his heirs and assigns, doth hereby covenant, promise, and agree to and with the said C. D. his executors and administrators, that it shall and may be lawful to and for the said C. D. his executors or administrators, (he and they paying the rents and performing the covenants and agreements herein reserved and contained, on his and their parts and behalves, to be paid, done, and performed, according to the true intent and meaning of these pre-

expiry of the first seven years of this lease, one-seventh of the farm shall be regularly under turnips and potatoes; two-sevenths under barley; one-seventh under oats; and three-sevenths in grass: and the said C. D. binds and obliges himself and his foresaids, to adhere to the rotation of cropping above prescribed, during the then remaining years of this lease, and to leave the farm in that order of cropping at the expiry thereof: and in regard the rent before mentioned is stipulated for these methods of culture; therefore in case the said C. D. or his foresaids shall crop the lands, or any part thereof, in a manner different from the methods hereby prescribed, the said C. D. binds and obliges himself and his foresaids to pay to the said A. B. or his foresaids, at the term of Whitsunday, after every such crop, the sum of of additional rent for each acre that shall be cropped differently from the rotation of cropping hereby prescribed; and which additional rent shall be subject to no modification: and further the said C. D. binds and obliges himself and his foresaids, to allow the incoming tenant to sow grass seeds in that seventh part of the farm which shall be under barley after turnips the last year of this lease, and that without any payment or deduction of rent: and in regard the whole houses on the farm, which are hereby declared to be in sufficient order, have been valued and appraised by persons mutually chosen by the said A. B. and C. D. and the same ascertained to amount in value to Therefore the said houses are to be wholly upheld and kept in habitable condition by C. D. and his foresaids, at their own expence, during this lease; and at the expiry thereof, the same shall in like manner be again appraised and fully valued by persons mutually chosen: and in case the valuation at the expiry, shall fall short of the aforesaid valuation, the said C. D. binds and obliges himself and his foresaids to pay the shortcoming or deficiency to the said A. B. or his foresaids: but in case the valuation at the expiry shall exceed the above-mentioned sum of the said C. D. or his foresaids shall have no claim for the said excess or meliorations:* and further, the said C. D. binds and obliges himself, and his foresaids, upon their own proper charges and expences, to insure from fire in some proper office, so to be approved of by the said A. B. the whole houses built or to be built on the said farm, at such sum as shall be fully equal to the value thereof; declaring, that if any deterioration shall happen to the said houses by fire during the continuance of the present lease, the said C. D. and his foresaids shall be liable to make good the damages to the said A. B. and his foresaids: And as the lands hereby set are at pre-

* *When new houses are necessary, the proprietors in the southern parts of Scotland generally agree to advance such a sum as is necessary to defray the expence of materials and workmanship; and the tenants are bound to be at the expence of the carriage of all materials.*

sents,) peaceably and quietly to have, hold, use, occupy, possess, and enjoy, all and singular the said premises, with their appurtenances, hereby demised (except as before excepted), for and during the said term of twenty-one years, without the lawful let, suit, trouble, denial, hindrance, molestation, eviction, or interruption of him the said A. B. his heirs or assigns, or any other person or persons, claiming by, from, or under him, them, or any of them: *And also*, That it shall and may be lawful to and for the said C. D. his executors or administrators (he and they paying the rents, and performing the covenants and agreements, as aforesaid), in the harvest season next after the expiration of the said term hereby demised, peaceably and quietly to have, cut down, reap, and lead the crop of corn or grain by him, them, or any of them, sown and then growing upon two-third parts of the lands then in ploughing or tillage (according to the covenants herein-after contained, and the true intent and meaning of these presents), commonly called the way-going crop; and the same corn or grain to set in the stack-yards, and thrash the same in the barn or barns of and belonging to the said demised premises: *And* that he the said C. D. his executors or administrators, shall, for the purposes aforesaid, have the use of all the stack-yards, barns, and granaries, of and belonging to the said demised premises, with barn-men's houses, until the twelfth day of May next after the determination of this demise; and the same corn and grain so thrashed (after payment of rents and arrears of rent then unpaid), shall and may carry away, sell, and dispose of, to and for his or their proper use and benefit, leaving and delivering all the straw of the said way-going crop, as soon as the same is thrashed (as herein after mentioned), in and upon the said premises, unto and for the use and benefit of the said A. B. his heirs or assigns, or his or their next succeeding tenant or tenants: *And* the said A. B. his heirs or assigns, or his or their next succeeding tenant or tenants, shall and will lead the said way-going crop from the lands where it grew to the barns or stack-yards, and fork the same from the loaded carts to the stacks: *And also* shall and will bear and pay one-half the expence of making and erecting new quick fences upon the said premises, and of cleaning, rearing, and preserving the same for seven years, after being first planted: *And also*, &c. [*Here follow any other covenants on the part of the lessor for new buildings*, &c. &c.]

And the said tenant, for himself, his heirs, executors, administrators, and assigns, doth covenant, promise, and agree to and with the said A. B. his heirs and assigns, by these presents, in manner following, that is to say, that the said C. D. his executors or administrators, shall and will well and truly pay, or cause to be paid, unto the said A. B. his heirs or assigns, the said yearly rent or sum of and also the other casual or eventual rents herein above reserved, and payable on the days and times, and in manner above mentioned for payment there-

sent completely inclosed, subdivided, and fenced, which inclosures and fences amount, by valuation to the sum of the said C. D. binds and obliges himself, and his foresaids, to preserve the same in a proper manner during the currency of this lease, by regularly repairing any breaches that may happen in the same; and also from time to time, as occasion may require, to cut and make proper ditches and drains through the subjects hereby set; Declaring, That in case the said C. D. or his foresaids, shall fail or neglect regularly to repair the breaches that may happen in the fences, or to cut and make proper drains within one month after he or they shall be required so to do by the said A. B. or his foresaids, then, and in that case, the said A. B. or his foresaids, shall be at liberty to employ proper persons to execute the same: And the said C. D. binds and obliges himself and his foresaids to pay to the said A. B. or his foresaids the full amount of the expences so incurred, on the production of the workmen's accounts and receipts, without further proof: Declaring, that the said inclosures and fences shall be valued at the expiry of this lease, and the deterioration, if any, paid by the said C. D. and his foresaids, in the same way as has been hereby prescribed with regard to the houses: *And the said C. D. for himself and his foresaids, becomes bound to protect and take care of all trees planted, or to be planted, on the subject hereby set, during the whole currency hereof: And in case any of the trees or plantations shall be damaged or destroyed, whether by himself or others, then, and in that case, the said C. D. and his foresaids shall pay such damage as may be ascertained, and that in terms of the acts of parliament made anent the preservation of planting: Further, the said C. D. binds and obliges himself and his foresaids to give over to the incoming tenant the whole dung that may be remaining unused, together with the crop of turnips that shall be on the farm at the expiry of this lease, the value of which shall be ascertained by two persons, to be by them mutually chosen: And farther, the said C. D. binds and obliges himself and his foresaids, to remove him and themselves, their servants, dependants, and others, forth and from the possession of the subjects hereby set, at the expiration of this lease, and that without any previous warning or process of removing instituted for that purpose.

[N. B. *Here follow any additional obligations on the tenant that particular circumstances may render necessary.*]

And both parties bind and oblige themselves, and

* *It happens, in many parts of the country, that improvements are carried on by an allowance being made by the proprietor to the tenant, at the end of the lease, for houses, dykes, and fences, according to the value of them. But it is much better for the proprietor to advance the money, as the tenant in the other way seldom has the means of carrying on the improvements with spirit or effect.*

of, according to the true intent and meaning of these presents: *And also* shall and will, from time to time, and at all times during the term hereby demised, well and truly pay and discharge all and all manner of taxes, assessments, rates, charges, dues, tithes, and impositions, parliamentary or parochial, whatsoever, which now are, or at any time hereafter during the term hereby demised shall be, taxed, assessed, rated, charged, or imposed upon the said premises, or any part thereof: *And also* shall and will, from time to time, and at all times during the said term hereby demised, at his and their own charge and expence, repair, uphold, maintain, and keep, with all manner of needful and necessary reparations, all and singular the houses, buildings, barns, byres, stables, offices, gates, stiles, rails, fences, hedges, ditches, drains, and water-courses, of and belonging to the premises hereby demised, or which may at any time hereafter, during the said term, be built, erected, or made upon the said premises, or any part thereof: *And* at the end, expiration, or other sooner determination of the said term, shall and will deliver up all and singular the said houses, buildings, barns, byres, stables, offices, gates, stiles, rails, fences, hedges, ditches, drains, and water-courses, and the glass-windows, locks, keys, bolts, snecks, latches, and hinges, of the said houses, buildings, and erections, unto the said A. B. his heirs or assigns, in such good and sufficient repair and condition, together with the peaceable and quiet possession thereof: *And also* shall not and will not, at any time or times during the continuance of this demise, sell, dispose of, send or carry away, or permit to be sold or disposed of, sent or carried away from off the said premises hereby demised, any of the hay, straw, clover, turnips, cabbages, or other fodder, that shall grow or be produced from, or made thereon, but shall and will eat and consume the same (for the increase of manure) upon the said premises: *And also* shall and will, from time to time, during the continuance of this demise, at the proper seasons in every year, duly lay and spread upon the fallow grounds of the said premises (where most requisite and proper for the improvement thereof), in an even, regular, and uniform manner, all the manure, dung, and compost that shall be bred and made on the premises: *Except* the manure, dung, and compost to be bred and made thereon in the year next before the determination of the said term: and which manure, dung, and compost, shall be left in the fold-yards, dung-hills, or midden-steads of the said premises for the use and benefit of the said A. B. his heirs or assigns, or his or their next succeeding tenant or tenants: *And also* shall not and will not plant or sow any hemp, flax, or mustard, or any rape for seed * upon the said premises, or any part thereof: *And also* shall not and will not at any time or times in the year next before the determination of this demise, depasture or graze, or suffer to be depastured or graz-

* *Rape for green food is allowed.*

their foresaids, in case any dispute shall arise between them or their foresaids, respecting the true meaning, intent, or fulfilment of all or any of the clauses and obligations herein contained, to refer the same to the determination of two neutral persons to be mutually chosen, whose judgment or award shall be final and binding upon both parties, and their foresaids: and in case either party shall fail or delay to name an arbiter, for settling such disputes, for the space of one month after a formal submission is presented, and he or his foresaids are required so to do by a writing under the hand of the other party, it shall and may be lawful for the arbiter named by the other party to proceed to determine the said disputes, as sole arbiter, and the determination of the arbiter or arbiters so named shall be final and binding upon the parties and their foresaids: Declaring, That in every case where a reference is made to arbiters or valuators, in virtue of these presents, it shall be in the power of such arbiters or valuators, in case of a difference of opinion between themselves, to name an oversman to decide between them, whose decision shall be as binding on the said parties as if chosen by themselves. And, *lastly*, Both parties bind and oblige themselves and their foresaids, to implement their respective parts of the premises, *hinc inde*, under the penalty of sterling, to be paid by the party failing to the party performing, or willing to perform, over and above performance: and they consent to the registration hereof in the books of Council and Session, or others competent, that letters of horning, on six days charge, and all other execution necessary, may pass thereon in due form: for which purpose they constitute their procurators.

In witness whereof they have subscribed these presents, written on this and the preceding pages of stamped paper, by with another duplicate of the same, at the day of 1796, before these witnesses, and

English Lease continued.

ed upon the said premises, or any part thereof, any larger stock of cattle or greater number of stints than were usually depastured or grazed thereon in the two years next preceding the said last year of the said term, or other sooner determination thereof: *And also* shall and will, yearly and every year, during the said term hereby demised, catch and destroy the moles, and scale, mould, dress, and clean the grass-grounds of and belonging to the said demised premises: *And also* shall and will thrash the way-going crop, at the determination of the said term, in an uniform manner, so as to deliver a constant, regular, daily supply of straw to and for the use of the said A. B. his heirs or assigns, or his or their tenant or tenants: *And also* shall and will, from and after the first day of October preceding the termination of the said term, hain, free, and keep uneaten, all those fields or parcels of ground sown with grass-seeds in the last fifteen months of the said term; save and except that it shall and may be lawful for the said C. D. his executors and administrators, from and after the first day of April next before the end of the said term, to depasture, with not more than sheep an acre, one-half of the said hained clover or new grass, which half shall be chosen and set out by the agent of the said A. B. his heirs or assigns, in the month of March preceding: *And also* shall and will permit the said A. B. his heirs or assigns, or his or their tenant or tenants, to sow with grass-seeds all or any part of the lands sown with corn or grain, for the way-going crop, and to roll in the same with a roller, drawn by horses, according to the custom of the country: *And also* shall and will permit and suffer the said proprietor, his heirs or assigns, or his or their servants, draughts, and workmen, from time to time, and at all times, from and after the first day of December preceding the determination of this demise, to enter into and upon all the then fallow grounds of the said premises, or the grounds which, according to the true intent and meaning of these presents, ought to be in fallow, and the same to plough, sow, harrow, dress, manure, lime, and prepare for such course of agriculture as he or they shall think proper to convert the same into, without the let or hindrance of him the said C. D. his executors or administrators: *And also* shall not, and will not, have, use, or employ, in ploughing or tillage, a greater quantity of land than acres of the said premises at any one time, or in any one year, during the term hereby demised: *And also* shall and will, yearly, and every year, during the term hereby demised, summer-fallow * at least one-third part of the tillage, and plough the same at least several times, at proper seasons in each year, and keep the same free and clear from quickins, wild oats, thistles, coltsfoot, runch, dead nettles, and every other pernicious plant or weed, and lay and spread upon every acre of such fallow, in an even and regular manner, at least
fother of well-turned clod-lime, or in lieu thereof twenty fother of good well rotted dung, and so, in proportion, for a less quantity than an acre: *And also* shall not and will not have, keep, or continue in ploughing or tillage, any part of the said demised premises, more than three years at one time, that is, from being ploughed out from grass, to being laid down to grass again: *And also* shall and will, yearly, and every year, sow with grass-seeds, and lay down to grass, at least one-third part of the ploughing or tillage-lands, after a clean summer-fallowing, and a crop of wheat, or a crop of turnips and white corn, and sow upon every acre thereof at least eight pounds of red clover seed, three pounds of white clover, three pounds of rib-wort plantain, and two pecks of rye grass † of the best quality to be had in the country at the time; the quantity to be ascertained by proper vouchers from the persons of whom the said seeds were bought, and by whom the said seeds were sown: *And also* shall and will, whenever any part of the ploughing or tillage lands are laid to grass, keep and continue the same in grass at least three ‡ years before the same, or any part thereof, be again ploughed out, or converted into tillage: *And also* shall and will, in the last three years of the said term, lay down to grass as aforesaid, or have in grass, and at the end thereof leave in grass, all those fields or parcels of land, called *And also* shall and will, during the whole of the said term, keep in grass, and, at the expiration thereof, leave in grass, all those fields or parcels of land called § *And also* all such lands as shall be converted into watered meadows: *And also* shall and will, during the term hereby demised, bear and pay one-half the expence of making and erecting new quick-fences upon the said premises, and of cleaning, rearing, and preserving the same for seven years after being first planted.

[*Here follow any other particular covenants that circumstances may require.*]

In addition to these general forms of leases, others with particular covenants become necessary for particular sorts of farms. For timbered farms under different sorts of management, and where the times

* *On the fallow turnips should be sown, if a proper soil, or cabbages or drilled beans, at thirty inches distance.*

† *To these upon light soils are generally added three or four pounds of yellow hop-clover.*

‡ *This blank is sometimes filled up with two or one, according to soil, situation, and circumstances, and weak soils, improper for corn, generally continue in grass five, six, or seven years, until it is thought they want refreshing by tillage, which is only used in such situations, as being subservient to rearing stock.*

§ *This covenant is used only in such situations where there are any rich old grazing lands.*

ENGLISH LEASE FOR TIMBERED FARMS.

of removal are the autumn and spring, heads or outlines have been given by Mr. Marshall in his useful work on the Landed Property of England, somewhat in the following manner for the first period of removal.

THIS INDENTURE, made the day of in the year of the reign of our Sovereign Lord George the Third, by the grace of God of the United kingdom of Great Britain and Ireland, King, Defender of the Faith, and so forth, and in the year of our Lord God , between Andrew A—— of of the one part, and Richard B—— of of the other part, *witnesseth*, that, in consideration of the yearly rent, covenants, conditions, and agreements herein after contained, and on the part of the said Richard B——, his executors, administrators, and assigns, to be paid, done, kept, and performed, the said Andrew A—— hath demised, leased, set, and to farm let, and by these presents, doth demise, lease, set, and to farm let unto the said Richard B—— his executors, administrators, and assigns, all farm with the appurtenances, commonly known or called by the name of situate, lying, and being within the parish of in the said county of now in the tenure of together with all &c. &c. to the said farm or any part thereof belonging or in any wise appertaining (except and always reserved out of this present demise unto the said Andrew A—— his heirs and assigns, all mines and quarries, with proper power to work them; also timber and other trees, with power to take them down; with all seedling and sapling plants, fit to be trained for timber; as well as the power of planting, removing, or altering hedges, and of planting trees in hedge-rows; likewise of inclosing a specified quantity of land, for planting timber trees or coppice woods; due allowance being made for it; common rights, and the power of inclosing; with the power of exchanging intermixed lands; and also of altering roads; allowing for damage together with free ingress, &c. &c. And the right of free warren, &c. &c. TO HAVE AND TO HOLD the same, with the appurtenances thereunto belonging (excepting as before reserved) unto the said Richard B—— his heirs and assigns, for the term of (six years,) from Michaelmas, (namely the 29th of September or the 11th of October, according to the custom of the county in which the farm may be situated). And if neither of the parties herein before declared, their heirs, or assigns, give legal notice to the other, before the expiration of the first three years of the said term, to quit the said farm, and terminate this lease, at the end of the said six years, the term shall become extended, and continue for (nine years) from Michaelmas, and if, before the expiration of the said six years, no such notice should be given, by either of the said parties to the other, in that case the said term and the operation of the said lease, shall be further extended to (twelve years,) from Michaelmas ; and shall continue in like manner, from three years to three years, so long as the said Andrew A—— his heirs and assigns, and the said Richard B—— and his representatives, shall refrain or avoid giving such legal notice: and the said parties hereby severally and mutually agree to observe and abide by the conditions, covenants, and agreements, herein after contained, during the continuance of the said lease: that is to say, First, "it is mutually understood and reciprocally agreed, by and between the said parties, that the said Richard B—— his heirs or assigns, shall pay unto the said Andrew A——, his heirs or assigns, the yearly rent, or sum of by equal half yearly payments, at Lady-day and Michaelmas, in every year of the said term, free from all charges and deductions whatsoever, of taxes, tithes, or other outgoings; and that the last of the said half yearly payment of rent, with all former arrears of rent (if any) shall be fully discharged, forty days before the expiration of the said term; and, further, that in case any rent shall be in arrear at any time during the said term, forty days after the same shall have been legally demanded, the said Andrew A——, his heirs and assigns, shall, by virtue hereof, have a right to re-enter the said premises, and avoid every other condition of the said lease." That "the said Richard B—— shall make the said premises his home, and only place of residence or abode; and shall not underlet or assign over the whole or any part thereof, without license, in writing, from the said Andrew A——, his heirs or assigns; who, in case of desertion, underletting, or assignment, shall have the right of re-entry, as aforesaid." And that "the said Richard B——, agrees to keep the foundations, walls, timbers, and coverings of the said buildings, as well as the gates, fences, ditches, water-courses, private roads, driftways, and foot-paths, now belonging, or which may hereafter during the said term belong, to the said premises, in good and sufficient repair and condition, or to suffer the said lessor, his heirs or assigns, his or their workmen, (after three months notice being given) to repair the same, at his the said Richard B——'s expence: provided that no more than one part, (according to the course of husbandry) of the whole of the said fences, ditches, water-courses, and ways, severally considered, be so repaired, in any one year; the last three years of the said term excepted: he the said Andrew A —— hereby agreeing previously to put the said buildings, gates, fences, water-courses, private roads, driftways, and foot-paths into a state of tenantable repair, or to see that the outgoing occupier do leave them in such state; also to furnish rough timber, sufficient to keep them in such repair, during the term hereby granted" or demised. And that, "in consideration of the hedges, trees, and plantations, which the said Andrew A—— herein before reserves the liberty of planting and forming, being chiefly intended for the protection and shelter of the said farm, the said Richard B—— agrees to do his utmost endeavours to defend and train up the

hedges and trees which may be planted in consequence of such reservation; and after they have been once well and sufficiently planted and guarded by the said Andrew A——, to repair and keep up the fences and guards (the said Andrew A—— furnishing or allowing rough materials for the same); and to renew and replace, at his own proper cost, and in a workman-like manner, such hedges and trees or any part or parts thereof, so often as they shall be destroyed or materially injured, through the neglect of the said Richard B——, his heirs or assigns, his or their servants or workmen, with healthy plants of the same size and species or kind as those destroyed or injured, or pay one shilling a year, during the remainder of the said term, or so long as the said hedges and plantations shall remain insufficient, or in any part unprofitable, through his or their neglect, for every three feet in length of live hedge, and for every tree so destroyed," injured, or in any way hurt. And also "the said Richard B—— agrees not to cut down hedge-row woods partially, or without scouring the ditches, (where it is requisite) and repairing the banks, in a workmanlike manner; nor without sufficiently guarding newly cut hedges, so as to defend them from the browzings of cattle, sheep, and other animals, as well as to prevent the mounds or hedge-banks from being thrown down by the same: nor to fell any hedge-row, being a fence to arable lands, unless when such lands are broken up for a course of tillage; nor then, until six months notice has been given to the said Andrew A——, or his acting steward, or woodward for the time being, of such intention:" And further, the said Richard B—— "agrees to suffer such steward or woodman to set out and mark whatever sapling or seedling plants he may deem fit to be trained for timber trees, the said tenant being allowed three pence for every plant thus set out and marked) under the penalty of twenty shillings for every statute pole or perch of live hedge-row wood which shall be cut down, contrary to the true intent and meaning of this covenant. Also to prune, trim, or pare the sides of such recently cut hedges, during the month of June, in the first, third, and fifth years after the same shall be cut down; clearing them at the same time, from weeds and noxious plants; or suffer the said Andrew A——'s workmen to prune and weed them, at his the said Richard B——'s expence, (to thicken and strengthen the hedge, and prevent the undergrowth of the sides of the banks from being destroyed by the drip and shade of overhanging boughs) under the like penalty." And "furthermore, the said Richard B—— agrees not to cut out or otherwise destroy the young shoots of oak, ash, elm, or other timber tree, that are rising in hedge-rows, in pits, or steep surfaces, or in other unculturable places; under the penalty of five shillings for every sapling or seedling shoot so taken out or destroyed: nor to cut off, maim, or materially injure, through wilfulness or neglect, any young seedling or sapling plant, set out and marked as aforesaid; nor any young timberling that has been planted and reared agreeable to the above stated reservation and covenant, under the penalty of ten shillings for every such plant so cut off, maimed, or injured: nor lop or top any timber or other trees (such pollards as have usually been topped excepted); under the penalty of five pounds: nor destroy, fell, or take down any timber tree or other tree, or pollard, of more than six inches timber girt, or twenty-four inches in circumference, at five feet high, under the like penalty of ten pounds, over and above the value of the timber and bark so taken down or destroyed." Also that "the said Richard B—— agrees to preserve all orchard and garden trees, growing within the said premises, from spoil and damage; or to forfeit five pounds for every grown tree taken down or destroyed through wilful or negligent management: and to plant, or suffer the said Andrew A——'s workmen to plant, at his (the said tenant's) expence, young trees in the vacancies of orchards or garden grounds;—such trees being furnished by the said Andrew A——: and to guard and protect the trees so planted, from injury and waste; or to supply their places with others of equal value, so often as they shall be destroyed or stinted in their growth, through the want of due protection; or pay twenty shillings a year, during the remainder of the said term (or until the vacancies be again filled up) for every young tree which he shall suffer to go to decay, or to remain in an injured or damaged state" or condition. And further, that "the said Richard B—— agrees not to break up or destroy the herbage of any meadow or pasture ground, of more than years laying, under the penalty of five pounds an acre, a year, during the remainder of the said term; nor if this be done within the last three years of the said term, under the penalty of twenty pounds for each acre broken up by the plough, spade, or other implement, or destroyed by stagnant water, unnecessary treading of live stock, or any other negligent or improper treatment," of the said Richard B——. That the said Richard B—— "agrees not to open or form any mine, quarry, or pit, within the said demised premises, or in the waste or commonable lands thereunto belonging, without leave in writing, as aforesaid, under the penalty of five pounds for each offence: nor cut or cast peats or turves, for fuel or other purpose, on any of the said lands (whether appropriated or common) without leave as aforesaid, under the penalty of shillings for every hundred; nor pare off the sod, sward, or turf from the soil of any of the said lands with the intent of burning the whole or any part thereof, for manure, without leave as aforesaid: nor, then, without ameliorating the soil with ten cubical yards of dung, or other digested vegetable substance, an acre, within three years from the time such paring and burning shall have taken place; under the penalty of five pounds an acre." Also that the said Richard B—— "agrees not to cultivate any hemp, flax, rape-seed, or weld, without leave in writing, under the penalty of ten pounds an acre: nor to

take more than two crops of corn, or white grain, in succession, without leave in writing as aforesaid, under the penalty of five pounds an acre: nor to carry off, or suffer to be carried off, the farm, without leave in writing as aforesaid, any hay, straw, chaff, green herbage, or roots, (potatoes for human food, or for planting, only excepted) under the penalty of five pounds a ton, nor any dung, compost, limestone, marl, or soil, unless as aforesaid; under the penalty of shillings for every ton weight carried off, contrary to the tenor of this covenant." And further, that the said Richard B——, "in the last three years of the term hereby granted (that is to say, after due notice has been given, by either party to the other according to the purport of this lease) agrees to manage the dung or yard manure arising on the said farm, in a husbandlike manner; by preserving it in hollow receptacles, and preventing it, as much as may be from being washed away by the currents of heavy rains, or other running water; and, moreover, to prepare the floor or area of each receptacle, or dung dish, or stead, on which such yard manure is intended to be laid, with a covering of mould or earthy materials, such as the scrapings of roads, the waste soil of lanes, yards, or other vacant places, or the soil of a fallow, or a stubble field (taking it, promiscuously, or from the rising parts, so that no pit or hollow be thereby formed in the face of the field whence it is taken); such covering, layer, or stratum of earth being formed, not less than one foot, in depth or thickness; in order to absorb and retain the more liquid and valuable parts of the dung; and furthermore, to apply the said dung, and the mould thus saturated with its liquid parts to the use of the said farm, and in a husbandlike manner; under the penalty of pounds a year," for neglecting to pursue and enforce this practice or method of management. That the said Richard B—— "also agrees to lay down, yearly, and every year, during the last three years of the said term, not less than one part (according to the course of management which is proper to be pursued, on the given land) of the arable lands of the said demised premises, to grass, or ley herbage, in the following manner, (that is to say) immediately after a whole year's fallow of five or more sufficient ploughings, (with a share not less than inches wide) or a fallow crop (as beans or pease, in rows, at from eighteen to twenty four inches asunder, or vetches, or rape, eaten off, or cut for green food, or cabbages, turnips, or potatoes, cultivated in a husbandlike manner) with four such ploughings, or with three ploughings and two sufficient hoeings, such ploughings and hoeings to be timed and executed according to good husbandry; and not to sow the lands thus fallowed or tilled with more than three statute bushels of barley, or five such bushels of oats, on each statute acre; and over each acre thus seeded with corn, to sow, in due season, two gallons of clean winnowed raygrass seeds, seven pounds of white clover seeds, five pounds of yellow clover, or trefoil seeds, or such other mixture of seeds, as the said Andrew A——, or his steward or acting manager shall direct; such seeds being furnished, sown, and covered (if required) by the said Andrew A——, at the said Richard B——'s expence; under the penalty of five pounds an acre, for the neglect or refusal to comply with the course of management which is herein set forth" and laid down. Also, that the said Richard B—— "agrees to complete, during the last three years of the said demised term, the repairs of the fences, water-courses, and ways belonging to the said demised premises, or permit the said Andrew A——, his servants and workmen, to put them in sufficient repair, at the said Richard B——'s expence; provided not more than one third of the whole quantity that shall require to be so repaired, be done in any one year; under the penalty of five shillings, for each statute rod or perch that shall be left unrepaired, through the said Richard B——'s neglect or refusal." And, further, that the said Richard B—— "agrees to do his utmost endeavours to free the buildings, the yards, and the said premises in general, from vermin; and, in particular, to destroy, by every means and device publicly known in his neighbourhood, rats, mice, and sparrows, inhabiting the same, in the last three years of the said term, or suffer the said Andrew A—— or his servants to destroy them, at his said lessee's expence; or pay pounds, for neglect or refusal. Also, to free the lands of the said farm, in a husbandlike manner, from weeds; preventing, especially, thistles and docks from seeding thereon: or, during the last three years of the said demised term, to suffer the said Andrew A—— or his orderee, to mow off, hand weed, or hoe the same, at his the said Richard B——'s expence, or pay the like penalty." And, further, "the said lessee agrees not to depasture any agistment stock upon the said farm, in the last three years of the said term; under the penalty of forty shillings for every head of cattle, or other live stock, not being his own property, that shall be depastured thereon: nor suffer any swine, of more than three months old, to range over the grass grounds of the said farm during that period, without being properly rung, or otherwise prevented from breaking up the sward of such meadow or pasture grounds; under the like penalty, for each offence." And, that the said Richard B—— "agrees to suffer the said Andrew A——, or his incoming tenant, in the *last year* of the said term, to sow grass seeds over any of the arable crops of the said farm, and to harrow in or cover the same: also to suffer either of them to break up, in the month of May, or any succeeding month of the said last year, not less than one part of the arable lands of the said farm, (namely, such as have usually been subjected to a course of tillage, and such as have lain in a state of ley ground or herbage, years or upward,) as a preparation for wheat; and to cultivate and manure the lands so to be broken up, without molestation or hindrance, from the said

English Lease for timbered Farms.

Richard B——, or his representatives; under the penalty of pounds, for refusing to comply with the condition: also, to pile up, in a husbandlike manner, such dung and soil of the yards and homestall of the said farm, as may not be used for the crops of the said last year, or suffer the said Andrew A——, or his incoming tenant, to pile up such manure, (and thereby preserve it from spoil and waste,) at his the said Richard B——'s expence. Also, not to mow more than the accustomed quantity of clover, meadow, or other grass or ley ground, for hay, in the said last year, under the forfeiture of the produce of the overplus quantity mown for that purpose." And that the said Richard B—— further "agrees to leave, at the end of the said term, not less than one part of the arable lands of the said farm, (namely, such lands as have then been usually subjected to tillage,) in young ley or seedling herbage, which has been cultivated in the manner stipulated above, and which has not been depastured or trodden by any species of domestic animals: nor less than one in herbage of the first year's laying, and which has been produced by the same course of management: nor less than one in herbage of the second year, which has been produced in the same manner, and from neither of which more than one crop of hay has been taken: nor less than one in clean fallow of three sufficient ploughings, or in fallow crop cultivated in the manner herein before directed; or forfeit five pounds for every acre delivered up in a contrary state." Further, the said Richard B—— "agrees to yield up the buildings, yards, fences, and gates of the said demised premises, at the expiration of the said term, in good and sufficient repair; or pay the full amount of the dilapidations and deficiencies which may arise from his own or his representatives' neglect, (the same to be ascertained by referees, chosen in the manner hereinafter declared) before any part of his or their property be removed therefrom." And "it is, moreover, mutually agreed between the said parties, that the several penalties, forfeitures, and payments, which may be incurred in consequence of the foregoing covenants shall be considered as an augmentation of rent, and shall be paid, as such, at the said Andrew A——'s audit or rent day, next succeeding the accruing thereof: and, in default of payment, shall be recoverable by law, as rent." That, "it is also further mutually agreed, that the said Richard B——, or his representatives, on legally quitting the said farm, shall, by virtue of the lease, be entitled to the following allowances; namely, for the corn and pulse produced in the last year of the said term, the same to be paid for by suitable instalments; or the use of the barns and stack yard of the said premises, until Mayday next ensuing the termination hereof; such corn and pulse being to be thrashed out, cleaned, and carried to market, (provided the distance do not exceed miles) at the incoming occupier's expence: also, for the hay mown in the last year, conformably to the above covenant: as well as for that of any preceding year, provided the quantity do not exceed one of the usual produce of the farm, on a par of years: also, for the aftergrass of such grounds as shall have been mown, in the said last year, conformably with the above covenant, and which may be left thereon, at the expiration of the term: also, for the turnips or other green herbage or roots, which may be left on the ground, at the end of the term; or for the labour judiciously expended to produce the crop; at the option of the said Richard B—— or his representatives: also, for the labour expended, in a husbandlike manner, on such uncropped fallows as may be made in conformity to one of the above covenants hereof, together with the rent and taxes of the lands so fallowed and uncropped, provided they be left in a husbandlike state: also, for the pasturage of the ley grounds broken up for wheat, agreeably to one of the above covenants hereof: also, for the market price or value of the grass seeds, which may have been sown in the said last year of the term, at the said Richard B——'s expence; as well as for every other just charge and expence that may have been borne by the said Richard B—— as outgoing tenant, for the sole benefit of the incoming occupier: and, furthermore, it is mutually agreed, that in case the said Richard B—— or his representatives shall have executed, on the lands hereby granted, any permanent or lasting improvement (whether by erecting buildings or fences, which have been set out by the said Andrew A—— or his known agent or steward for the time being, or by clearing, draining, watering, marling, or other operation, not enjoined in the lease) and that he quit the said premises, legally (and not for a breach of covenant) before the effect of such improvement shall have been exhausted, he or they shall be allowed whatever the remainder of such permanent or lasting improvement shall be worth, to the succeeding occupier, at the time of quitting." And, "it is finally understood and agreed, between the said parties, that the several allowances, herein before stipulated, as well as every matter of difficulty or dispute, which may arise in consequence of the said demised lease, shall be settled by referees; one of whom shall be chosen by each party, and the two so appointed shall choose a third person, before they enter upon the arbitration; and that in the case of their disagreement, the award of such third person shall be final" or conclusive.

In witness whereof the said parties have hereunto set, &c. &c.

There are various practical observations on this interesting subject that deserve the attention of the proprietor as well as the farmer, in the work mentioned above, to which we refer them.

Besides these different descriptions of leases, there are others that are made use of locally for different purposes. But before we give one which is used in

ENGLISH DAIRY LEASE.

the western dairy districts, it may be proper to introduce the following observations. It is stated, that "not only lands * and houses may be let for years, but also goods and chattels.—Bacon's Abridg. Tit. Leases, (A.)"

"But the interest of the tenant in the latter differs from the interest which he hath in lands or the like; for if one let or lease for years a stock of live cattle, such letting or lease is good, and the tenant shall have the use and profits of them during the term; but yet the owner, or, technically speaking, the lessor, hath not any reversion in them, in like manner as in respect of land, to grant the same over to another, either during the term or after; till the tenant hath re-delivered them to him;† for the lessor or owner hath only a possibility of property in case they all outlive the term; for if any of them die during the term, the lessor or owner cannot have restitution, and during the term he hath nothing to do with them; and consequently of such as die, the property rests absolutely in the tenant. *Ibid.*"

Further, "so whether they live or die, yet all the young ones coming of them, as lambs, calves, or the like, belong absolutely to the tenant, as profits arising and severed from the principal, since otherwise the lessee would pay his rent for nothing."

And therefore "this differs from a lease of other dead goods and chattels; for there if any thing be added for the repairing, mending, or improving thereof, the owner or lessor shall have the improvements and additions, together with the principal, after the term is ended, because they cannot be severed without destroying or spoiling the principal. *Ibid.*"

However "the tenant cannot, in such case, kill, destroy, sell, or give away the individual cattle demised during the term, without being liable to an action. *Ibid.*"

A Lease or Form of Contract employed in Dorsetshire and other western Districts, for letting a Dairy of Cows.

ARTICLES OF AGREEMENT made and entered into the 10th day of in the year of the reign of our Sovereign Lord George the Third, by the Grace, &c. and in the year of our Lord *Between* A. B. of in the county of yeoman, of the one part, and B. C. of the said place, dairyman, of the other part, as follows; (that is to say),

First, the said A. B. doth hereby agree with the said B. C. that he the said B. C. ‡ shall and may, from the day of next ensuing the day of the date hereof, to the day of which will be in the year of our Lord possess and enjoy the messuage or dwelling-house, called the near the in the parish of aforesaid, and now in the possession of him the said B. C. together with the garden thereunto belonging, and the garden ground in the orchard hereinafter mentioned, called *Also* that he the said A. B. shall and will, from the said day of next to the said day of which will be in the year of our Lord find, provide, maintain, keep, and fodder for and for the use and benefit of the said B. C. forty good cows, fit and proper for a dairy, and permit and suffer the said B. C. during the term last aforesaid, to have and take the milk, produce, and increase of the said cows, to and for his own use and benefit. And that in case any of the said cows shall die, or by any accident lose their milk, or become dry and wholly unprofitable during the term last aforesaid, then and in either of the said cases, the said A. B. shall either provide other cows in full milk, in the place of those dying or losing their milk, or make such abatement or allowance out of the rent hereinafter agreed to be paid as shall be reasonable, and is usual in like cases not exceeding [*allowance should be here especially stated*]; which said cows are to have the sole and entire pasturage of all those two closes called containing, by estimation, twenty-six acres; the close called containing, by estimation, nine acres and a half; the close called containing, by estimation, six acres; the close called containing, by estimation, nineteen acres and a half; an orchard called containing, by estimation, six acres. A close called containing, by estimation, two acres; and a close called containing, by estimation, three acres. All which lands are situate, lying, and being in the parish of aforesaid, and are to be hained up for such dairy on the 5th day of April next, and to be stocked therewith on the 13th day of May next, or sooner if the said B. C. shall be so minded. Also it is agreed, that the said cows shall have the after-grass of the following closes of land (that is to say), all that close called containing, by estimation, twenty-two acres and a half; the close called containing, by estimation, thirteen acres and a half; the close called and containing, by estimation,

* "*Land is a general and most comprehensive term in itself, as it includes, not only the surface of the earth, but every thing under or over it.*"

† *It is necessary,* "*therefore, in every such contract that there should be a covenant to deliver.*"

‡ *It has been remarked, that a* "*transmissible interest may be given to the dairy-man by adding the usual words,* "*executors, administrators, or assigns.*"

FORM OF INDORSEMENT OF LEASE.

twelve acres; and the close called containing, by estimation, four acres and a half; a close called containing, by estimation, five acres; and a close called containing, by estimation, ten acres. Which said last mentioned lands are also situate in the said parish of *Also* it is agreed that the said cows shall have a fortnight's pasturage in a certain field, called lying in the said parish, such fortnight to commence at the time of the said last mentioned field being first stocked.

Also the said A. B. doth hereby agree that he the said A. B. shall and will permit and suffer the said B. C. to keep and depasture a horse, mare, or gelding, on any part of the said premises, where the said cows shall be feeding at any time during the said term ending as aforesaid on the day of *And* if the said B. C. shall keep a mare on the said premises, and she shall have a foal, then the said A. B. shall and will permit and suffer the said B. C. to keep and depasture such foal with such mare until the 23d day of November next. *Also* the said A. B. doth hereby agree, that he the said A. B. shall and will permit and suffer the said B. C. to keep pigs in the barton of the farm now in the occupation of the said A. B. or elsewhere on the said farm, such pigs being properly rung and doing no damage to the land, hedges, or apples, of the said A. B. *Also* the said A. B. doth hereby agree to allow to the said B. C. such fuel for the use of the said dairy as he can conveniently spare from the said farm, and to carry at his the said A. B.'s own expence, such coals as the said B. C. may want for the use of the said dairy, from the he the said B. C. paying for such coals, and also paying the tolls of the turnpike-gates through which such coals shall be brought. *Also* the said A. B. doth hereby agree to allow the said B. C. sufficient litter for his pigs, cows, and calves, and also hay for the sucking calves, and also one hogshead of cider for every twenty hogsheads that he the said A. B. shall make from the said day of next, during the said term on the said farm. *Also* the said A. B. doth hereby agree to carry at his own expence the butter and cheese of the said B. C. the produce of the said dairy, either to in the county of or to in the county of or to any other place not more distant from aforesaid than or aforesaid, at any time or times, at the request of the said B. C. *And* the said A. B. doth hereby also agree, that in case all of the said cows shall not have calved by the sixth day of next, he the said A. B. shall and will allow out of the rent hereinafter agreed to be paid, at and after the rate of five shillings per cow per week, for each cow that shall not have so calved, until the time that such cow shall drop her calf. *And* the said B. C. in consideration of the premises aforesaid, doth on his part and behalf agree with the said A. B. that he the said B. C. shall and will well and truly pay or cause to be paid unto the said A. B. his executors, administrators, or assigns, the sum of of lawful money of Great Britain, as and for the rent, use, and produce of the said forty cows, at the four quarterly payments herein after mentioned, that is to say, the first quarterly payment to be made on the day of next, for which the said B. C. is to be allowed the usual interest; the second quarterly payment on the day of next, the third quarterly payment on the day of next, and the fourth quarterly payment on the day of next. *And* also that he the said A. B. shall and may, at his will and pleasure, stock with sheep the said lands, (of which the said B. C. is to have the aftergrass) from the day of next to the end of the said term. *Also* that he the said B. C. shall not nor will keep the said horse, mare, or gelding in the stable. *Witness* the hands of the said parties, the day and year first written.

It has been observed, that in this case "*the following covenant seems necessary*," from what has been "laid down in *Bacon's* Abridgments, title Leases (a), respecting contracts for letting of live stock." See above.

"And further, that he the said B. C. *his executors, administrators, or assigns*, [when the tenant's interest is intended to be transmissible] shall and will, at the end, expiration, or other sooner determination of the said term, peaceably and quietly leave, surrender, and yield up unto the said A. B. his executors, administrators, and assigns, all that the said messuage or dwelling-house hereinbefore mentioned, with the garden and garden-ground, land and premises herein before also described; and also all such cows or milch-kine as shall or may be then living and depasturing, or kept and fed in or upon the several closes or parcels of land herein before mentioned and described, or any or either of them, for the then use and benefit of the said B. C. by virtue of these presents. In witness."

As it may frequently not only be necessary, but convenient, especially where the farm is small, to save part of the now great expence of new leases; the following is the "*form of a lease for a further term of years, before the expiration of the existing term by an* INDORSEMENT *on the original demise or lease*," that has been granted. This INDORSEMENT was considered by the great Lord Camden as just, as effectual, if properly stamped, as a new lease.

THIS INDENTURE, &c. "BETWEEN the within named A. B. of the one part, and the within named B. C. of the other part, WITNESSETH, That for and in consideration of the rent hereby reserved,

FORM OF ASSIGNMENT OF LEASE.

and of the covenants, conditions, and agreements respectively hereinafter contained, which on the part and behalf of him the said B. C. his executors, administrators, and assigns, are to be paid, done, and performed: he the said A. B. DOTH demise, lease, and to farm let, unto the said B. C. his executors, administrators, and assigns, ALL that piece or parcel of ground, and all and singular other the hereditaments and premises respectively comprised in the within written indenture of lease, and thereby demised in manner therein mentioned, (except as therein is excepted). TO HAVE AND TO HOLD the said piece or parcel of ground, and all and singular other the hereditaments and premises hereby leased, set, and to farm let, or mentioned or intended so to be, (except as aforesaid) unto the said B. C. his executors, administrators, and assigns, from the feast day of which will be in the year of our Lord and when the term granted and demised in and by the said within written indenture of lease will expire, for, and during, and unto the full end and term of 14 years longer from thenceforth next ensuing, and fully to be complete and ended, SUBJECT to and under the like rent, and payable in the like manner as is within mentioned for and in respect of the rent reserved in and by the said within written indenture of lease, and subject to the like power of entry, as well as non-payment of rent as on the happening of any of the other incidents mentioned in the within written proviso or condition of re-entry. AND IT IS HEREBY DECLARED AND AGREED, by and between the parties to these presents, that they, and their respective heirs, executors, administrators, and assigns, shall and will by these presents, during the continuance of the additional term of 14 years hereby granted, stand and be bound for and in respect of the said hereby demised hereditaments and premises, with the appurtenances, in such and the like covenants, conditions, and agreements respectively, as they the said parties and their respective heirs, executors, administrators, and assigns, do now stand bound in and by the said within written indenture of lease, for and during the now residue to come and unexpired of the within mentioned term of years hereby granted, it being the intent and meaning hereof, that this present indorsed indenture of lease, and the additional term hereby granted and demised, shall be upon such and the like footing, and all the covenants, clauses, conditions, and agreements respectively therein contained, be equally available, take place, and have the like force and effect, to all intents and purposes, as if every article, clause, matter, and thing, contained within the said within written indenture of lease, were word for word repeated, and again inserted in these presents. *In witness* whereof," the parties, &c.

The following is the "*form of an assignment of a lease by indorsement*," which is a method that ought to be adopted where practicable, in order to avoid the heavy increasing expence of new leases

"TO ALL whom these presents shall come, Elizabeth A——, of the widow of the within named S. A. and sole executrix named in his last will and testament, sendeth greeting. WHEREAS, the said S. A. since the execution of the within indenture of lease, departed this life, having first duly made and published his last will and testament in writing, and thereof appointed the said Elizabeth A—— sole executrix and universal legatee: AND WHEREAS, the within demised premises and indenture of lease were lately put up to sale by public auction; and Richard Roads of the parish of having attended at such sale, and offered the sum of one hundred pounds for the purchase thereof, he was declared to be the highest bidder for the same, and the said premises and indenture of lease were accordingly sold to him, at and for the same sum: NOW, KNOW YE, that for and in consideration of the sum of one hundred pounds of lawful money of Great Britain, to the said Elizabeth A—— in hand paid by the said Richard Roads, at and before the sealing and delivery of these presents, the receipt whereof is hereby acknowledged; she the said Elizabeth A—— hath bargained, sold, assigned, transferred, and set over, and by these presents doth bargain, sell, assign, transfer, and set over unto the said Richard Roads, his executors, administrators, and assigns, all that piece or parcel of ground, and all and singular other the premises in and by the within written indenture of lease demised or mentioned, or intended so to be, with their and every of their appurtenances; and all the estate, right, title, interest, term of years to come and unexpired, property, claim, and demand whatsoever, either of the within named S. A. or of her the said Elizabeth A——, as executrix or otherwise, of, in, to, or out of the same premises, every or any part or parcel thereof, together with the said indenture of lease. To have and to hold the said piece or parcel of ground, and all and singular other the premises hereby, or mentioned to be hereby assigned, with their and every of their appurtenances, unto the said Richard Roads, his executors, administrators, and assigns, from the feast-day of the birth of our Lord Christ, next ensuing the date hereof, for and during all the rest, residue, and remainder, which shall be then to come and unexpired, of the term of sixty-one years, in and by the within-written indenture of lease granted thereof; *Subject* nevertheless to the payment of the rent and performance of the covenants in the same indenture of lease, respectively reserved and contained on the tenant or lessee's part, from thenceforth to be paid, done, and performed: *And* the said Elizabeth A—— doth hereby, for herself, her heirs, executors, and administrators, covenant, promise, and agree, to and with the said Richard Roads, his executors, administrators, and assigns, in manner following, (that is to say), that he the said Richard Roads, his executors, administrators, or assigns,

paying the rent, and observing and performing the covenants and agreements reserved and contained in and by the said within-written indenture of lease, on the tenant or lessee's part, to be paid and performed, from and after the said feast of the birth of our Lord Christ next ensuing the date hereof, shall and may from time to time, and at all times thereafter, for and during all the residue and remainder which shall be then to come and unexpired of the said term of sixty-one years by the within-written indenture of lease granted, lawfully, peaceably, and quietly have, hold, occupy, possess, and enjoy the said piece or parcel of ground and premises hereby assigned, or intended so to be, with their and every of their appurtenances; and receive and take the rents, issues, and profits thereof, and of every part thereof, to and for his and their own use and benefit, without any lawful let, suit, trouble, denial, eviction, or interruption, of or by the said Elizabeth A——, her executors, administrators, and assigns, or any other person or persons whomsoever, lawfully claiming or to claim, by, from, or under her, them, or any of them, or by or through her or their act, means, neglect, default, or procurement; *and* that free and clear and freely and clearly acquitted and discharged, or otherwise, by the said Elizabeth A——, her executors, or administrators, well and sufficiently saved, kept harmless, and indemnified of, from, and against all and all manner of former and other deeds, gifts, grants, bargains, sales, assignments, mortgages, surrenders, reentries, judgments, executions, extents, statutes, recognizances, and all other incumbrances whatsoever, *and* of and from all arrears of rent, taxes and assessments, until the said feast-day of the birth of our Lord Christ now next ensuing. *And further*, that she the said Elizabeth A——, her executors or administrators, or all and every other person and persons, having or lawfully claiming, or to claim, any estate, right, title, or interest, of, in, to, or out of the said hereby assigned premises, or any part thereof, from, by, under, or in trust, either for the within-named S. A. or for her the said Elizabeth A——, her or any of her executors or administrators, shall and will, from time to time, and at all times during the continuance of the said term hereby assigned, upon every reasonable request, and at the costs and charges in the law of him the said Richard Roads, his executors, administrators, and assigns, make, do, and execute, or cause and procure to be made, done, and executed, all and every such further and other lawful and reasonable acts, conveyances, and assurances in the law whatsoever, for the further, better, and more perfect assigning and assuring the said premises unto the said Richard Roads, his executors, administrators, and assigns, for the then residue of the term within demised, as by the said Richard Roads, his executors, administrators, or assigns or his or their counsel learned in the law, shall be reasonably devised, or advised and required." *In witness* whereof the said parties have hereunto set, &c.

As it not unfrequently happens that leases become sources of litigation and dispute, it may be of utility to give a concise view of the relative rights of landlord and tenant, and the legal doctrines respecting leases.

It is obvious that "the relation between landlord and tenant, or, in the language of the law, the *lessor* and *lessee*, arises upon a contract for the possession and profits of lands or other hereditaments on the one side, and a recompense by rent or some other consideration on the other.—*Sheppard's Touchstone*, 267: 2 *Blackstone's Commentaries*, 317; 1 *Term Reports*, 598-9. But there is no occasion for the rent to be, as it usually is, a sum of money; for *spurs*, *capons*, *horses*, *corn*, and other matters, may be rendered, and frequently are rendered, by way of rent. *Coke Littleton*, 142; 2 *Blakstone's Commentaries*, 142." But "if in a renewed hospital or other lease, the reservation be *so many quarters of corn*, this shall be understood to mean legal quarters, reckoning the bushel at eight gallons, although the old leases before the statute 22 and 23 *Car. II. c.* 12, contained the same reservation; and although in fact the tenants, or lessees, never paid in kind, but by composition, reckoning the bushel at a customary measure of nine gallons or more, for the parties having made use of the term quarters, the court must construe the lease according to the law existing when the lease was made; and by the positive restrictions in the above act of parliament, the bushel is now to contain eight gallons, and no more. 6 *Term Reports*, 333."

And "this contract may be entered into either by parol, that is, by verbal, agreement, or by deed, or other instrument in writing." But it must be observed "that a distinction has been established between these two modes of contracting, by an act of parliament, mostly known by the title of the statute of frauds and perjuries: by which (29 *Car. II. c.* 3,) it is enacted that "all leases, estates of freehold, or terms for years, of any uncertain interests, of, in, to, or out of any messuages, lands, tenements, &c. *not put into writing, shall have the force and effect of estates at will only, and shall not, either at law or in equity, be taken to have any greater effect:* except only leases not exceeding three years from the making, whereupon the rent reserved shall be at least two-thirds of the improved value."

A parol "or verbal agreement to lease lands for a term exceeding three years, creates only a tenancy at will, for the statute of frauds is express that such an agreement shall only have the effect of creating a tenancy at will.—4 *Term Reports*, 680." "All leases for uncertain terms are *prima facie* leases at will: but if there be a reservation of an annual rent, that turns them into leases from year to year. 2 *W. Blackstone*, 117. Thus a parol demise for more than three years, at an annual rent, now operates as a tenancy from year to year, the meaning of the statute of frauds being, that such an agreement shall not operate as a term: and what was considered at the passing of that statute as a tenancy at will, has since been properly construed to endure as a tenancy from year to year. 8 *Term Reports*, 3. So a general parol or verbal de-

mise, at an annual rent, where the bulk of the farm is inclosed, and a small part in the open common field state, is only a lease from year to year, and not for so long as the usual round of husbandry extends: in this case it was contended, that as part of the farm was open field land, and the term uncertain, it ought, for the benefit of agriculture, to be considered, according to the usual round of the husbandry of the place, to be a holding from three years to three years. But the court observed, that although a special agreement of this kind might be very prudent and reasonable, and would be good in law, all the cases from king *Henry VIII.* (when inclosures were little known) to the present time, determine such takings, or holdings over, to be only leases for one year: that where the course of husbandry is not finished under four years, as in Berkshire and other rich counties, a general parol taking cannot be construed to be a lease for four years consistent with the statute of frauds." It was said, however, "that it might be possible, that circumstances may make it a lease for a longer term, as where the crop (such as liquorice, madder, or the like) does not come to perfection in less than two years. 2 *W. Blackstone*, 117." But "a tenancy at will, now considered as a tenancy from year to year, by the reservation of an annual rent, as above mentioned, may be created either by express words, as where one lets land to another, as long as both parties shall agree, or if a man enters and enjoys land by consent of the owner, he shall be tenant at will to him, though there be not any express lease at will, for he enters and has the land by consent. *Littleton*, *sec.* 70; 1 *Rolle's Abridgment*, *l.* 21; *Raymond*, 147; 8 *Term Reports*, 3." See *Tenant at Will.*

And, "in the case of a tenancy from year to year, as long as both parties please, if the tenant die intestate, his administrator has the same interest in the land which his intestate had, and may bring an ejectment against the landlord. 3 *Term Reports*, 13." But, "a tenancy from year to year cannot be put an end to, or determined, without reasonable notice from the one party to the other. 3 *Burrowes*, 1609." Of course, "if the landlord bring an ejectment for lands so let at will, he must prove that *half a year's previous notice or warning was given to the tenant, or to his executor, in case of his death*, or the plaintiff will be nonsuited on the trial. 3 *Wilson*, 25." Which "notice or warning to quit cannot be given on any quarter-day; but only on that which is six months previous to the day on which the tenant first entered. 1 *Term Reports*, 159." Nor, "can a tenant from year to year quit at any other quarter than that in which the year expires; and he must give six months' previous notice in like manner, as in the above case to the landlord." Besides, "the notice from the landlord must be positive, and not leave an option in the tenant to quit or to hold over on certain terms; such as, 'I desire you to quit at Lady-day next, unless you agree to pay double rent:' but if the words be, 'or I *shall* insist on double rent,' it is otherwise, and the notice is good, because the latter words are added as a threat, which may be waived, and the former leave an option to the tenant. *Douglas*, 167. But a notice to quit is not necessary where the tenant has attorned, that is, has acknowledged himself to be tenant to a third person, in contravention of his landlord's title, or where he denies to hold as mere tenant to the landlord. *Buller's Nisi Prius*, 96." Where "the landlord receives rent which becomes due *after the expiration* of the notice to quit, it is not of itself a waiver of the notice; and if an ejectment be brought to recover the lands for not quitting in pursuance of the notice, it will at the trial be left to the jury to consider with what intention the rent was received, as it may be *a waiver only of the double rent*, to which the landlord may be entitled, or he may have taken it under the terms, that it should not be considered as a waiver of the notice." But, "by the stat. 11. *Geo. II. c.* 34, *sec.* 18: In case any tenant shall give notice of his intention to quit the premises, and shall not accordingly deliver up the possession at the time in such notice contained, the said tenant, his executors, or administrators, shall pay to the landlord double the rent which he would otherwise have paid; and it has been determined, that the notice by the tenant to quit under the above statute need not be in writing, but that a parol or verbal notice to quit is fully sufficient. 3 *Burrowes*, 1603."

It has been already remarked, that, "leases exceeding the term of three years must be in writing, but no precise form of words is essential to constitute a good lease; for whatever words are sufficient to explain the intent of the parties, that the one shall divest himself of the possession, and the other come into it, for such a determinate time, such words, whether they run in the form of a license, covenant, or agreement, are of themselves sufficient, and will amount to a lease for years, as effectually as if the most proper and pertinent words had been made use of. *Bacon's Abridgm. tit. Leases* (K); *Croke Eliz.* 484; *Rolle's Abridgm.* 847; *Moor*, 459; *Noy*, 57; 2 *W. Blackstone*, 973." According to the most approved precedents, the usual words to make a lease are, demise, lease, set, and to farm let. And, "a lessee or tenant for years may assign or grant over his whole interest, or he may grant it for any fewer or less number of years than he himself holds it; and such derivative or under lessee is compellable to pay rent, perform covenants, &c. according to the terms agreed on in such grant or agreement. *Bacon's Abr. tit. Leases* (I) 3."

It may be further necessary to shew by whom leases may be given or granted: First, "a tenant *in fee-simple* may make leases without limitation or restraint, having an absolute and unlimitted interest. *Comyn's Dig. tit. Estates* (G) 2." And, second, "a tenant *in tail* may make a lease for his own life, and by the stat. 32 *Hen. VIII. c.* 28, make leases for three lives, or twenty-one years, to commence from the making, or a short time after, provided the lands leased have been usually letten to farm for twenty-one years past, and the accustomed yearly rent paid within that period be reserved, the intent of the

statute being that the tenant in possession shall not diminish the value of the estate to the person entitled in reversion." Thirdly, "all husbands seised of lands in right of their wives are enabled by the same stat. 32 *Hen. VIII. c.* 28, to make leases for twenty-one years, or three lives in being, to commence from the time of making the lease, the directions therein contained being the same as in respect to tenants in tail; which leases bind the wives and their heirs, so that they cannot now, after the husbands' death, avoid such leases, as they might have done before the above statute at common law. *Bacon's Abridgm. tit. Leases* (C)." And, where "the directions in the statute are not observed, then the common law takes place, and the wives and their heirs are at liberty to avoid such leases, in the same manner as they might have done before. *Ibid.*" But, "in all such leases the wife ought to be made a party." And, fourthly, "although either a tenant *in dower*, or by the *curtesy* of England, may make a lease for years, reserving rent; yet if such tenant die before the expiration of the term granted, the lease is absolutely determined, and no acceptance of rent by the heir or those in reversion can make it good. *Croke Car.* 398; *Jones*, 254; *Vaughan*, 81." Where "a man takes a wife seised in fee, or in tail, by whom he has issue born alive, though such issue may die immediately, he shall hold, by the curtesy of England, the lands after the death of his wife for life. *Littleton, sec.* 35; *Coke Littleton*, 296; 8 *Coke's Reports*, 356." Fifthly, "tenants *for life* may also grant leases of their lands for their own lives, or the life of the person on whose death the estate may determine, but no longer, unless there be a power reserved in the deed or instrument under which they are entitled, granting them liberty to demise for a longer term: and even in that case it must be observed, that if the lease varies from the conditions limited in the power of leasing in any respect whatsoever, either as to the interest demised, the rent reserved, or the mode of executing the power, such leases, upon the death of the tenant for life, are void, and cannot be supported against the heir, or those next in remainder." But where "the tenant for life has no power to grant leases by the deed or other instrument under which he is entitled, it is usual to make the lease for a definite and certain number of years, if he (the tenant for life) shall happen so long to live." Sixthly, "likewise *joint* tenants and tenants in *common* may grant leases for life or years, or at will, either of the whole estate or of their several shares or moieties therein; and such leases, will at the death of the one, bind the other who may survive, because it is a present disposition of an immediate interest, and binds the land from the time of the lease made. *Coke Lit.* 163; *Rolle's Abridgm.* 848; *Coke Lit.* 186." The reason of this, namely, that the lease for years of one joint tenant of his moiety, is good and binding against the survivor, is, that these joint tenants, having a reciprocal interest in each other's life, when one of them makes a lease for years of his moiety, this does not depend for its continuance on his life only, but on his life and the life of the other joint-tenant, which ever of them shall live longest, according to the nature and continuance of the estate whereout it was derived and then so long as that continues, so long the lease holds good; and by consequence such lessee shall hold out the surviving joint-tenant, and the reversioner, till the estate whereout his lease was derived be fully determined and ended. *Bacon's Abridgm. tit. Leases* (I) 5." But, "if a rent were reserved on such lease, it is said, this is determined and gone by the death of the lessor, for the survivor cannot have it, because he comes in by title paramount to the lease; and the heirs of the lessor have no title to it, because they have no reversion and interest in the land. *Coke*, 96; *Coke Lit.* 185, *a*; *Moor*, 139." At present, however, it rather appears "that the executors or administrators might maintain an action of debt or covenant, either upon the covenant in law, or express covenant, for payment of the rent, and so become answerable over to the surviving joint-tenant; or perhaps a court of equity would interfere under such circumstances." But in order to "obviate any such difficulty, it is advisable that the lease granted by a joint-tenant, of his part or moiety, *should be made to continue for a certain term of years*, 'if the estate and interest of the said joint-tenant of or in the demised premises shall so long continue" or remain. Likewise where "one joint-tenant or tenant in common makes a lease for years of his part to his companion, this is good; as it only gives him a right of taking the whole profits, when before he had but a right to the moiety thereof; and he may contract with his companion for that purpose as well as with any stranger. *Coke Lit.* 186, *a*; *Croke Jac.* 83, 611; *Moor*, pl. 194; *Rolle's Abridgm.* 851, 1 *Rolle's Abridgm.* 877."

Seventhly, "*ecclesiastical* persons and *eleemosynary* corporations may, by the stat. 32 *Hen. VIII. c.* 8, amended by 1 *Eliz. c.*19; 13 *Eliz. c.* 10; 14 *Eliz. c.* 11; and 39 and 40 *Geo. III. c.* 41, make leases under a condition that this power is not to extend to leases of lands in farm by virtue of any old lease, unless such old lease be expired, surrendered, or ended within one year after making of a new lease;—or to a grant of any reversion of lands;—or to a lease of lands not most commonly letten by the space of twenty years before;—nor to a lease without impeachment of waste;—nor to a lease above twenty-one years, or three lives, from the day of making —and that on such lease there be reserved the most accustomably paid rent for the same within the preceding twenty years." Eighthly, likewise "*executors* and *administrators*, as they may dispose absolutely of terms for years vested in them in right of their testators or intestates, so they may also lease the same for any fewer number of years; and the rent reserved on such leases shall be assets in their hands, and go in a course of administration. 6 *Coke*, 63, 67, *b*; *Bacon's Abridgm. tit. Leases* (I) 7." Ninthly, "but mortgagors cannot in strictness grant leases of the lands which they have previously mortgaged,

unless the mortgagee be made a party. Therefore a mortgagee may recover in ejectment, without giving notice to quit, against a tenant who claims under a lease from the mortgagor, granted after the mortgage, without the privity of the mortgagee. 1 *Douglas*, 21." And besides, "a mortgagee, after giving notice of the mortgage to the tenant in possession under a lease *prior* to the mortgage, is entitled to the rent in arrear at the time of the notice, as well as what accrues afterwards; and he may distrain for it after such notice. 1 *Douglas*, 278." Lastly, "a copyholder cannot without license from the lord make a lease for a longer period than one year, unless warranted by the custom. *Moor*, 184. *Salk.* 186. The only method of safely effecting this, is, by making a lease with the following form of words in the habendum: TO HAVE AND TO HOLD all and singular "the said demised premises, and every part and "parcel thereof, with their and every of their appur- "tenances, unto the said his executors, "administrators, and assigns, from unto the "full end and term of one whole year, and so from "year to year *until the expiration* of the term of " years, from the said day of " , if the of the manor or ma- "nors whereof the same demised premises are holden "shall consent thereunto, and if, according to the "custom or customs of the said manor or manors, "the same may be so demised without prejudice or "forfeiture, but not otherwise, yielding and paying," &c. being careful always to let the covenants run in these words, namely, "During the continuance of the said term from year to year."

In all cases of leasing of lands, the great objects of consideration, are those of permitting the lessee or tenant to have a sufficient interest in them, to warrant his carrying on such improvements as may be necessary, as well as that of conducting them under the best systems of management according to their particular kinds, while at the same time the full value of them in the way of rent is secured to the landlord, and their deterioration effectually guarded against.

LEASE, *Valuation of*, the mode of ascertaining, or finding out its value.

The circumstances that are to be more particularly attended to in this sort of valuation, are those of the peculiar nature or circumstances of the lease, and the difference between the lease rent, and the full or actual rental value; as all sorts of leases where the rent payable is not equal to the just or true rental value at the period of their being sold, lessen the value of the land, and are obviously an incumbrance in different points of view. The mode of managing this business with propriety, according to Mr. Marshall, is after that of ascertaining the difference between the lease rent and the full rental value (incumbered with the same outgoings and repairs, as the lease rent,) to multiply it by the number of years that are unexpired, deducting the product *in full* from the value of the land, free from such incumbrance; and from the product thus found, to further deduct half the interest thereof during the said number of years, together with that of one half year over, where the rent is payable half yearly, and one year, where it is payable annually; as all that a purchaser of this sort of property has a right to expect, is that of receiving the full rent for his land during the continuance of such *lease*. See *Valuation of Landed Property*.

LEASEHOLD *Tenure of Land*, that sort of tenancy which is held under lease or special agreement for any definite term, whether of lives or years; which also admits of several distinctions, as, where the term is for a *great* length of time, as a thousand years, and where it is for life, of which there are different kinds, as where the fine is certain, or under certain limitations on renewal,—with an uncertain fine; payable to a proprietor or other superior, who has merely reserved a conventional rent, the tenant having given a sum of money to obtain the lease and the right of alienation: this is a practice common in the western counties:—with an uncertain fine payable to a proprietor, who receives the full rent of the land at the time of granting the lease, the landlord having a power of alienation: this is a practice common in Wales, and some parts of this country. And where it is for an *ordinary* term, (as for less than 100 years) with the power of alienation. They are all tenures, which give a sort of temporary property or interest in the lands, by which they are rendered liable to bargain or sale as other sorts of property. See *Tenant*.

LEASH, a term applied to game &c. by sportsmen and which signifies three, as three hares, partridges &c. It also signifies a line to hold a dog by.

LEES, the dregs or more gross and ponderous parts of liquors, which, after being separated by fermentation, fall to the bottom of the vessels. All the various kinds of lees, such as those of wine, beer, ale, oil, &c. may be made use of as manures when they can be had in sufficient quantities.

LEET, a little court held within a manor, and called the king's court, on account that its authority to punish offences originally belonged to the crown, and from thence descended to inferior persons.

LEGS, the extremities that form the support of animals. In horses they should have a due proportion to that of the body. The fore-legs are subject to many infirmities, as being the parts that suffer most, and are commonly the weakest. It is a mark of bad legs when they appear altogether straight, or as if they were of one piece.

A horse is said to be straight upon his legs when, from the knee to the fore-part of the coronet, the knees, shank, and coronet descend in a straight or plumb-line, and the pastern joint appears more, or at least as much advanced as the rest of the leg; such legs are like those of a goat, making a horse apt to stumble and fall; so that in time the pastern is thrust quite forward out of its place, and the horse becomes lame and liable to stumble.

Horses which are straight upon their legs are quite contrary to those that are long jointed, that is, whose pasterns are so long and flexible, that,

in walking, they almost touch the ground with them. And it is a greater imperfection than the former, because some remedy may be applied to them; but there can be none for these: besides it is a sign of little or no strength, such horses not being fit for much fatigue. Some horses, though they be long-jointed, do not bend their pasterns in walking: such horses gallop and run with greater ease to their riders than such as are short-jointed.

Of the four legs, the two before have several parts, each of which has a peculiar name: thus by the name of fore-leg, we commonly understand that part of the fore-quarters that extends from the hough to the pastern-joint, and which is frequently called the shank. The part that corresponds with it in the hinder quarters is called the instep.

In the language of the manege a horse is said to want the fifth leg when he is tired, and, bearing upon the bridle, lies heavy upon the rider's hand.

LEGUMINOUS *Plants*, such as are of the pulse kind, as those of the pea, bean, and other similar sorts.

LENTIL, the name of a plant of the vetch or tare kind, cultivated in some parts of England as fodder for cattle. Lentils grow to a foot and a half high, with stalks and leaves like those of tares, but smaller; and, like them, they bear their seeds, generally three or four, in little pods. These seeds are round, hard, smooth, and flat, but thicker at the sides. There are two sorts of lentils, the white and yellow; but the latter affords the greater quantity of fodder. The seeds of this plant are commonly sown in March, where the land is dry, but in moist ground, April is a better season. The usual quantity of seed allowed to an acre of land is from one bushel and a half to two bushels. If these are sown in drills in the same manner as pease, they are said by some to succeed better than when they are sown broad cast. The drills should be a foot and an half asunder, to allow room for the hoe to clean the ground between; for if the weeds are permitted to grow among them, they are apt to get above the lentils, and prevent them from being properly supported.

This, Mr. Young observes, is a crop not uncommon about Chesterford in Essex, where they sow a bushel an acre on one ploughing in the beginning or middle of March. "It is there the custom to make hay of them, or seed them, for cutting into chaff for trough-meat for sheep and horses, and they sow them on both heavy and dry soils." It is, however, added, that the whole country is of a calcareous nature. It is likewise stated, that attention should be paid not to water horses soon after eating this sort of food, as they are apt to hove them. They are likewise asserted to be cultivated for the same purpose in Oxfordshire, and probably in other districts.

LESSEE, a law term employed in leasing land, to signify the tenant.

LESSOR, a legal term applied to the landlord or proprietor.

LETHARGY, in *farriery*, a disease of the drowsy or sleepy kind, sometimes an original disorder in horses. It is remarked by Gibson, that "sometimes horses are seized with sleepiness in very great colds, especially those that have some degree of malignity; but this symptom generally wears off as the distemper abates. But that a true lethargy seldom happens unless to horses that are old, or growing old, and to such especially that have been worked beyond their strength and keeping." "When," says he, "a horse falls into a lethargy, he generally rests his head with his mouth in the manger, and his poll often reclined to one side, which denotes great stupor and insensibility. As there is seldom any great pain, he will shew an inclination to eat, but is apt to fall asleep with the hay, bran, oats, or whatever else has been given him, in his mouth. These, indeed, he seldom chews, but swallows them down. Except he is roused, and his head kept moving, he presently drops asleep again. When a horse continues any time in this state, he falls, he says, into an atrophy, or universal decay, especially if his lungs, liver, or any other of the principal viscera be diseased, or if he has received any hurt on his head."

It is added that "a lethargy in a horse may be cured, if he be not very old and past his vigour. It is always a good sign if he has a tolerable appetite, and so far retains his smell and taste as to eat up a mash with a relish, and without dozing over it; or, though he eat but little hay, if, at the same time he drink pretty freely, without slabbering, and lie down and rise up carefully, even though it be but seldom, some hopes may be entertained of his recovery. But if a lethargic horse does not lie down; if he is altogether stupid and careless, and takes no notice of any thing that comes near him; if he dungs and stales seldom, and even when he sleeps and dozes, his situation is bad. If he runs at the nose a thick white matter, it may relieve him; but if the discharge be a viscid gleet that sticks to his nostrils like glue, and if this becomes profuse, and changes to a ropy, reddish, or greenish matter, with an increase of the symptoms of stupor, it is an infallible sign that it will prove deadly."

In regard to the cure, "if the horse be young, and the distemper produced by catching cold, or from any hard usage, there may, he says, be great hopes of his recovery, as the disease, in this case, is in some measure symptomatic. The right plan is, he thinks, to begin with bleeding, but not in too great quantity; for lethargic horses are seldom able to bear the loss of blood, unless they be young and lusty. After bleeding, the following drink may be given.

Take of the leaves of Pennyroyal,
Coltsfoot,
Camomile flowers, of each a handful;
Rue,
Hyssop, of each half a handful;
Liquorice root sliced, an ounce.
Infuse them in two quarts of boiling water, in a deep vessel, close covered; and, when it has stood to be cold pour it off.

And,

Take of Assa fœtida,
Russian castor, of each half an ounce;
Saffron, one drachm.

Bruise the assa fœtida and castor, and shred the saffron; then tie them in a rag, and let them steep all night in a pint of strong mountain wine, or in the same quantity of spirit of wine and water, about three parts water to one of the spirit.

And "in the morning give a pint of the first infusion, with a quarter of a pint of this tincture; the same quantity in the afternoon, and also on the day following, squeezing the rag with the castor, and assa fœtida in each dose, leaving it always to soak in the tincture till there is occasion to use it again, taking care that no taste or colour remains in it. The first three or four days let the horse have emollient clysters; for in all these distempers, they are apt to be costive. These are best made of fat broth, or of the leaves of marshmallows, boiled in water or milk, with an ounce of sweet fennel seeds, adding half a pint of lintseed oil, and the same quantity of common treacle, to three pints or two quarts of the decoction."

When "the sleepiness wears off, and the horse begins to move with spirit and vigour," one of the following balls are directed to be given every morning fasting, for a fortnight or more.

Take of Cinnabar of Antimony,
Assa fœtida, of each half an ounce;
Castor, in powder, two drachms.
Beat this mass into a ball with a sufficient quantity of oil of amber.

When the horse comes to feed heartily, two or three mild purges may be proper.

Take of Diapente half an ounce;
Succotrine aloes, half an ounce;
Cinnabar of antimony,
Salt of tartar, of each two drachms;
Oil of amber, a spoonful.
Make them into a ball with treacle, which should be given with the usual precautions.

It is sometimes the practice in these cases to form rowels or issues in the neck, breast, belly, or other parts. During the cure, light mashes, or oatmeal gruel should be given plentifully.

LETTING *Farms*, the practice of providing them with proper tenants, which is a business effected by different methods in different districts. See *Farm*.

LETTUCE, a plant of the esculent kind, cultivated in the field in some districts for its use in feeding sows and pigs in the summer season. Mr. A. Young informs us, in his Calendar of Husbandry, that he "first observed the sowing of lettuces for hogs practised in a pretty regular system, on the farm of a very intelligent cultivator (not at all a whimsical man) in Sussex. He had, every year, an acre or two, which afforded a great quantity of very valuable food for his sows and pigs. He adds, that "it yields milk amply, and all sorts of swine are very fond of it." And he thinks, that "the economical farmer, who keeps many hogs, should take care to have a succession of crops for these animals, that his carts may not be for ever on the road for purchased grains, or his granary opened for corn oftener than is necessary." To raise this sort of crop, "the land should, he says, have been ploughed before the winter frosts, turning in by that earth 20 loads of rich dung per acre, and making the lands of the right breadth, to suit the drill-machine and horse-hoes, so that in this month (March), nothing more may be necessary than to scarify the land, and to drill the seed at one foot equi-distant, at the rate of four pounds of seed per acre. If half an acre or even a rood be tried near the farm-yard, the advantage, he thinks, will not be inconsiderable."

Where the stock of swine is large, it is, he adds, proper to drill half an acre or an acre of lettuce in April, the land having been well manured and ploughed as directed above, being also scuffled in February and March, and well harrowed, repeating it before drilling. And at this period "the crop which was drilled in March (a succession being essentially necessary) should be thinned in the rows, by hand, to about nine or ten inches asunder. If this necessary attention be neglected, the plants, he says, draw themselves up weak and poor, and will not recover it. Women do this business as well as men. When about six inches high, they should be horse-hoed with a scarifier or scuffler," having the hoe about four inches or at most five inches in width. With this sort of green food some kind of meal, or other dry meat, should be combined, as without it, it is apt to prove very laxative. See *Hog* and *Swine*.

LEVEL, an implement employed for many purposes in farming, as draining, watering of land, &c. It is made use of to form a line parallel to the horizon, and continue it out to any distance, so as to find the true level or difference in ascent and descent between different places for the purposes mentioned above, and various other rural operations.

There are a great variety of instruments of this nature differently contrived, and constituted of different materials, according to the uses for which they are more particularly applied; but for the purposes of agriculture, those of the improved *water*, *air*, *spirit*, and *foot* kinds, are the most commonly employed.

The first, or *water level*, is that which shews the horizontal line by means of a surface of water or other fluid; founded on this principle, that water always places itself level or horizontal. And the most simple level of this kind is made of a long wooden trough or canal, which being equally filled with water, its surface shews the line of level. It is also made with two cups, fitted to the two ends of a straight pipe, about an inch in diameter, and three or four feet long, by means of which the water communicates from the one cup to the other, and this pipe being moveable on its stand by means of a ball and socket, when the two cups shew equally full of water, their two surfaces mark the line of level; and instead of cups, it may also be made with two short cylinders of glass, three or four inches long, fastened at each extremity of the pipe with wax or mastic. The pipe is filled with com-

mon or coloured water, which shews itself through the cylinders, by means of which the line of level is determined; the height of the water with respect to the centre of the earth, being always the same in both cylinders. This level is very simple and commodious for levelling small distances.

The *air level* is that which shews the line of level, by means of a bubble of air inclosed with some fluid in a glass tube of an indeterminate length and thickness, and having its two ends hermetically sealed. When the bubble fixes itself at a certain mark, made exactly in the middle of the tube, the case or ruler in which it is fixed is then level. When it is not level, the bubble will rise to one end. This glass tube may be set in another of brass, having an aperture in the middle, where the bubble of air may be observed. The liquor with which this tube is usually filled is oil of tartar, or some similar fluid which is not liable to freeze as common water, or to rarefaction or condensation as spirit of wine. The improved sort with telescope sights are the best.

The *spirit-level* is formed in different methods for different uses; but for the purpose of draining and watering, land it should be as simple as possible.

An improved instrument of this sort is seen at *fig.* 1, plate IV. in which the telescope *aa*, is achromatic and about two feet in length, it has cross wires in the field of view, set in that part of the tube, with respect to the eye-glasses, that the object and the wires may be seen distinctly at the same time;—these wires intersect each other in the axis of the telescope, and the point of the object hid by the intersection is, of course, the point towards which the axis of the telescope is directed.

The small screws *cc*, are two of four screws by which these wires are adjusted to an exact coincidence with this axis.

The button, *a*, adjusts the telescope to distinct vision, by moving out a tube which contains the object glass.

The spirit level, *b*, is attached to this telescope by a joint at *e*, and an adjusting screw at *d*, by this screw the level is placed exactly parallel to the axis of the telescope.

The telescope, with its appendage, is placed on two forked pieces *e* and *f*, the ends of these pieces are inserted perpendicularly in sockets at the extremities of the strong bar *cc*. The piece *e* moves freely up and down in its socket, except when made fast by a small screw at *x*.—The piece *f*, is moveable in its socket, only by means of the adjusting screw, *g*. It will be evident that by this adjustment the object end of the telescope may be elevated or depressed a small quantity (about twelve degrees).

The middle part of this bar is occupied by a magnetic compass, with which the bearings of the work are taken, and may be occasionally used to measure horizontal angles. Beneath the centre of the compass is fixed a strong socket, which is fitted to a cylindrical piece of similar diameter, which forms the head of the tripod staff,—when in use and fixed on the staff, the instrument appears as in the figure.—The whole instrument moves horizontally about this socket on an axis, by means of the adjusting screw *h*,—the screw *i*, clamps the instrument fast at any required position,—the large screws, *kkkk*, adjust the whole apparatus from the socket upwards to its horizontal position. The legs, *lll*, move on joints at *mm*, to any required spread, and are in length about four feet.

And at *fig.* 2, in the same plate, is seen the levelling staff which is composed of two pieces, which slide on each other as *aa*, and *bb*: they are each of about five feet in length, so as to form, when fully extended, a rod of ten feet. They have a graduated line of feet into hundredth parts.—The index, *c*, slides firmly on them; and is moved up or down (by signal,) by the attendant who carries the staff, till the observer finds it coincide with the intersecting wires of his telescope.—Its height on the staff, of course, marks the difference of the level.

It has two horizontal and parallel black stripes, which at considerable distances are of use to direct the eye more readily to the fiducial edge at *x*.

In directing its application in the business of draining, it has been observed, that after it has been properly adjusted, and the staff about ten feet in length, with the moveable vane or sight, has been affixed to it, the instrument should be set up in a situation between the object from whence the level is to be taken, and that to which it is to be directed, provided the distance from the instrument to each of them is not too great. The situation of it should also be no higher than the length of the staff will answer, and so as it may be seen from it both ways; then the man with the staff should be directed to hold it at the main spring, or place from whence you mean to carry the drain; and after directing the telescope to the staff and adjusting it to a level, make a sign to him to move the sight up or down, till it be exactly opposite the cross hair in the telescope. This done, without shifting the instrument from its first position, and cautioning the man to fix the sight to the staff at the point directed, he may proceed forty or fifty yards farther; and after having again adjusted the level, make a sign to him to move to higher or lower ground, till the sight on the staff coincide exactly with the cross hair or wire on the telescope. He may then leave a peg at the place where he held the staff, and proceed in like manner to other stations, till the whole line is finished, leaving pegs, or making pits, at the places where the staff is held

If the length of the line to be levelled requires the instrument to be shifted from its first position, the level must again be taken from the last station where the staff was held, and the sight on it fixed in the proper place, as before directed, proceeding in the same manner at every forty or fifty yards in length till the whole is accomplished. After the line is thus levelled, and ascertained by marks left at every station where the staff was fixed, it may again be examined, and other pegs put in between the first, the better to direct the workmen in cutting

the drain, giving the line such turnings and even small deviations from the course of the level as may shorten or straighten it, and humour the situation of the ground.

For the sake of accuracy, where the work requires it, especially if the water is to be conveyed to any considerable distance, or wanted to supply a house, or for the purpose of irrigation, the levels may be proved by reversing the former line of direction. The spirit level is also necessary for ascertaining how such fall can be obtained from the drain to the nearest outlet where the water can be discharged, the shorter that distance being the better, provided fall enough can be gotten. It is often necessary to level a much longer distance than the length of the drain may require to be cut.

The *foot-levels*, like those of other kinds, are constructed differently, so as to suit different uses.

The *American-level* is an instrument which is formed of two pieces of thin wood of equal length, joined together at top, and connected below by a cross bar; from the angle at top a lead plummet is suspended by a small cord, which, when the instrument stands level on both legs, strikes upon a mark in the centre of the connecting bar, as represented by *a*, *fig.* 3, in plate IV. The manner of using it is simply thus: At the place from where the level is to be taken, drive a wooden peg into the ground, close in to the top, upon which one of the legs of the frame may rest; then bringing round the other leg till it touch the ground, there drive in a second peg, turning round the other leg as before; and where it touches the ground again, drive in another peg, and so on along the whole line to be levelled. Thus, with very little trouble, and with as much accuracy as with the finest spirit-level, will the course of the drain be easily ascertained. But as it is necessary that the drain should have as much declivity as to allow the water to run freely, it will be requisite, in taking the level, to regulate the direction of the line accordingly. Half an inch fall, in the length of the frame, will be sufficient. For this purpose, it will be expedient to have, besides a number of wooden pegs, one iron pin with inches and halves marked regularly upon the sides of it from the top downwards. After having drove in the first wooden peg at the point from whence you mean to conduct the drain, and having rested the one leg of the frame upon it, turn round the other till it be level with the first peg; there put in the iron pin, so that this leg of the frame may rest on the top of it, when level; then drive in a wooden peg so far, as that the top of it may be half an inch lower than that of the iron pin. Place the leg of the frame again upon this second peg, turn it round to a level, putting in the iron pin till the top of it be equal with the foot of the frame; then drive in another wooden peg close by the side of it, till the top of the wooden one be half an inch lower than that of the iron pin. Proceed in this manner so far as you mean to carry the drain, which will have the same degree of declivity all the way along. A line thus set off is marked from *c* to *d* in the figure. When made on a smaller scale it is useful in ascertaining the proper descent along the bottom of a drain, while the workmen are laying it; but when made for this purpose, the cross bar must be fixed to the bottom of the legs, as marked with dotted lines in the plate.

A *watering level*, which is much used in some places, is formed of different pieces of wood, &c. in the manner represented in *fig.* 4, plate IV. the usual length given it being five feet and a half, and the height from four feet to four feet and a half, according to the height of the person who is to make use of it.

The object staff, *fig.* 5, should be made exactly of the same height with the level. The cross piece, *fig.* 6, should be sufficiently large to be seen distinctly at a distance, and must be painted white.

In the experience of Mr. Marshall it has been found "preferable to any other level now in use, as being equally accurate in ascertaining the relative heights of distant objects, as in minutely tracing step by step the required line of communication, so as to give every part of it an equal and uniform descent."

In respect to its use, in setting out a level, so as to fix the fall accurately at one inch, foot, or yard, in a hundred of any of them, on the face of the level, which is found in general to be the most proper; it is directed to measure out one hundred feet on level ground, placing the level at one end, the object staff at the other, and then adjusting their tops to a dead level, by a dead level line exactly drawn on the face of the implement (viz. a line drawn at right angles with the upper edge of the top rail), as shewn at *a*, in the figure, then measuring one foot downward on the staff, and there holding a rule, or other straight edge level across the staff; bringing the top of the level, by raising its hinder foot, to range accurately with the upper side of the rule, and while they remain at rest in this position a mark must be made where the plummet line rests against the face of the level. After this measure out a hundred yards, and proceed in the same manner, in order to prove or rectify the first mark, on which a permanent line must be sunk on the face of the level *b*, in the figure, which in water work is better than the plumb-line. Where the ground to which the water is to be conducted can be seen from the place whence it is to be taken, the staff should be set upon the highest part, to which it is desirable to raise the water and the level at the source, and after having correctly adjusted the top of the latter to that of the former mark, where the plummet rests on the face of the level, where it rests between *a* and *b*, it is necessary to consider the case, as where the extent of land is small, and that of the water unlimited, little fall may be sufficient; but in the contrary circumstances, it would be improper to let it waste by the way more than is necessary; of course where the plummet rests much within the water line the staff must be moved and set lower down on the slope till the requisite fall is gained. But where the plummet is found to rest on the right-hand side of the water line, mark the plan, and draw a pencil line, (which will be sufficiently durable for a single work, and may afterwards be

easily rubbed out on the face of the level, corresponding to the line of the plummet, as the dotted line *c*, and thus *fix* the *fall* in this case, always making due allowance, in tracing and staking out the line with the level thus set, for the crookedness of the course; as from this lengthening the line, the declination of the channel is proportionally lessened.

It is supposed by the same writer that "many *ingenious* additions" might be made to this level; but that "they would be injurious to its present *simplicity*." Any country carpenter may be easily instructed to construct it in its present form, and "any common labourer be easily taught to use it, either in forming *roads* or *water-courses*."

LEVELLING, the art or operation of finding a line parallel to the horizon at one or more stations, to determine the height or depth of one place with respect to another; for laying out grounds even, regulating descents, draining morasses, conducting water, &c. Two or more places are said to be on a true level when they are equally distant from the centre of the earth. Also one place is higher than another, or out of level with it, when it is farther from the centre of the earth: and a line equally distant from that centre in all its points, is called the line of true level. Hence because the earth is round, that line must be a curve, and make a part of the earth's circumference, or at least parallel to it, or concentrical with it.

But the line of sight given by the operation of levels, is a tangent, or a right line perpendicular to the semidiameter of the earth at the point of contact, rising always higher above the true line of level, the farther the distance is, which is called the *apparent line of level*, the difference of which is always equal to the excess of the secant of the arch of distance above the radius of the earth.

It is obvious that the common methods of levelling are sufficient for pavements of walks, or for conveying water to small distances, &c. but in more extensive operations, as in levelling the bottoms of canals, which are to convey water to the distance of many miles, and such like, the difference between the true and the apparent level must be taken into the account, which is equal to the square of the distance between the places, divided by the diameter of the earth, and consequently it is always proportional to the square of the distance; or from calculation almost eight inches, for the height of the *apparent* above the *true* level at the distance of one mile.

Thus by proportioning the excesses in altitude according to the squares of the distances, tables shewing the height of the apparent above the true level for every 100 yards of distance on the one hand, and for every mile on the other, have been constructed.—See *Dr. Hutton's Mathematical Dictionary, article Level.*

By means of which it is now possible to level to almost any distance at one operation, which could not formerly be done but by a great multitude; for being unacquainted with the correction answering to any distance, they only levelled from one ten yards to another, when they had occasion to continue the work to some considerable extent or distance.

Besides this these tables may serve many other useful purposes. *See the above work.*

The practical operation of levelling is performed by placing poles or staves at different parts or points from which the levels are to be taken, with persons to raise or lower them, according to circumstances, when the levelling instrument is properly applied and adjusted; various cases of which may be seen in the useful work just mentioned, and the means of correcting them more fully pointed out and explained.

Levelling *of Land*, the method of filling up the holes, hollows, or other depressions and inequalities that are met with in lands, whether they are in the state of sward, or in that of tillage. It should always be performed in such a manner as the parts thus filled up may at first be somewhat higher than the common surface round them, in order to allow for the settling which necessarily takes place, and should be done with such materials as can be most conveniently procured, and which are proper for the purpose, being filled in in an even and regular manner, and well trodden down at the time.

The ridges of such lands as have been long under the plough, also sometimes require to be levelled down, the proper methods of doing which under different circumstances, will be taken notice of under that head. See *Ridge.*

Levelling *Poles*, long wooden rulers divided into feet and inches, made to slide over each other, serving to carry the marks to be observed in levelling, as well as to measure the heights from the surface of the ground. They are likewise termed *staves.*

LEVER, a term applied to an inflexible straight bar of iron, wood, &c. supported on a prop or fulcrum by a single point about which all the parts are moveable. It is of three kinds, and is the first of those simple machines, termed *mechanical* powers, being highly useful in raising great weights to small heights. This is a power of great importance in many operations of husbandry, and upon which the power of many sorts of implements depends, as all those of the scissar, pincer, and many other kinds.

LEVERET, a young hare, in the first year of its age.

LEY, a term used to signify land in the state of sward.

LIBER, a term applied to the inner bark or rind of a tree or plant, distinct from the cortex, which is the outer.

LIGHT, a subtile fluid, highly necessary to the healthy growth of plants, and from which the flowers and fruits derive their proper colour.

It is remarked, by the author of Phytologia, that the contest for light, as well as for air, which is so visible in the growth of vegetables, shews the former to be of great consequence to their existence as well as the latter. Thus, says he, many flowers follow the sun during the course of the day by the nutation of the stalks, not by the rotation of them, as observed in the sun-flower by Dr. Hales; and the leaves of all plants endeavour to turn their upper

surfaces to the light, which is their respiratory organ, or lungs. The great use of all plants turning the upper surfaces of their leaves to the light is thus, he thinks, intelligible; the water perspired from those surfaces is, he conceives, hyper-oxygenated; and, as it escapes from the sharp edges of the mouths of the perspiring vessels, when acted upon by the sun's light, gives out oxygen; which oxygen, thus liberated from the perspired water, and added to that of the common atmosphere, presents to the respiratory terminations of the pulmonary arteries on the upper surfaces of leaves an atmosphere more replete with vital air. This necessity of light to the respiration of vegetables is so great, he thinks, that there is reason to believe, that many plants do not respire during the night, but exist in a torpid state, like winter sleeping insects. Thus the mimosa, sensitive plant, and many others, close the upper surfaces of their opposite leaves together during the night, and thus preclude them both from the air and light; and the internal surfaces of innumerable flowers, which are their respiratory organs, are closed during the night, and thus unexposed both to light and air. It is, however, observed, that the fungi, which are termed vegetables, because they are fixed to the earth, or to the stones, or trees, or timber, where they are found, can exist without light or much air; as appears in the truffle, which never appears above ground, and by other fungi, which grow in dark cellars; and in esculent mushrooms, which are cultivated beneath beds of straw. The etiolation, or blanching of vegetables, depends upon the keeping of the light from them.

It is further observed, that the element of light, as well as that of heat, is necessary to vegetation. In this climate they both seem, in general, to be injurious only by their defect, and seldom by their excess. But as light acts as a stimulus on the more irritative or sensitive parts of plants, which appears by the expansion of many flowers, and of some leaves, when the sun shines on them; and by the nutation of the whole flower, as of the sun-flower *(helianthus)*, and by the bending of the summits of all plants confined in houses towards the light; there may be diseases, owing to the excess of this stimulus, which have not been attended to; to prevent which the flowers of tragopogon salsafi, and of other plants, close about noon. Other unobserved diseases may be owing to a defect of the stimulus of light; as a mimosa, sensitive plant, which had been confined in a dark room, did not open its foliage, though late in the day, till many minutes after it was exposed to the light. The excess of light has not, however, been observed to be attended by vegetable diseases in these more northern latitudes.

Light, in *horsemanship*, is a term applied to the horse when he is swift in his paces, as well as when he is well made, though he be neither swift nor active.

Light *bellied*, a term applied to a horse that has flat, narrow, and contracted sides, which make the flanks turn up.

Light *upon the Hand*, a term applied to a horse that has a good mouth, and does not rest too heavily on the bit.

LIGHTNING, the flash caused by the discharge of electricity from the clouds. It is frequently attended with thunder.

It is observed by Dr. Darwin, in his Philosophy of Agriculture, that the blasts occasioned by lightning are more frequent, he believes, than is usually supposed; as he is informed by those who purchase extensive woods, that very many trees, on being sawed through, are found cracked, and much injured by lightning. He had last year (1799), he says, a standard apple-tree and a tall apricot tree, in full leaf, blasted at the same time by lightning, as was believed. They both lost all their leaves; the apple-tree, nevertheless, put out a new foliage, and recovered, and bore fruit this year; but the apricot, which was nailed to a high wall, never shewed any returning life.

Mr. Tull, he remarks, ascribes one injury to the health of wheat plants, and frequently their death, to lightning; the effects whereof, he says, may be observed by the blackish parts or patches visible in a field of wheat, especially in those years which have more thunder-storms than usual, and adds, that against this there is no remedy. The erection of frequent metallic points could, as the Doctor thinks, alone secure a garden or field from this misfortune; which probably occurs more frequently on damp situations than on dry ones,

He conceives, that the manner in which lightning destroys the life of vegetables may be similar to that in which it destroys animal life; which is, he supposes, by its great stimulus, exhausting the sensorial power in the violent action it occasions, and thus producing total inirritability to the common stimuli, which ought to excite the vital actions of the system, It may also affect vegetables in another way similar to that, which probably also happens when their young succulent roots are frozen; that is, by bursting their vessels, as it passes through them, by its expansive power; as happens to the large branches of some trees, and to stone buildings, and other bad conductors of electricity, when they are struck with lightning. The expansive power of electricity is not only shewn by trees and towers being rent by lightning, but by the sound which succeeds the passage of it through air; since a vacuum, or nearly a vacuum, in respect to air, must previously be made by the presence of the electric fluid: and the sides of this vacuum rushing together, when the stream has passed, occasions the consequent vibrations of the air, which constitute sound, whether in the audible spark of electricity, or the tremendous crash of thunder. See *Electricity*.

LIGHTS, a vulgar term used to signify the lungs.

LIGS, in *farriery*, a disease of horses, in which little wheals or bladders are formed in the mouth. They may be removed, when necessary, by astringent applications, in the way of lotions.

LIME, a soft friable substance, obtained by cal-

cining or burning various calcareous materials, such as chalk, marble, lime-stone, shells, &c.

This substance is in different states according to the particular circumstances under which it exists. When newly made, from its great power of destroying the texture of bodies, it is termed caustic or quick-lime. It is also sometimes called shell-lime or shells. In this state, when used as a manure, it operates with the greatest violence; dissipating and robbing the soils to which it is applied of their moisture and other fluid matter: but after being exposed to the atmosphere for some time, from its property of quickly absorbing moisture and carbonic acid from it, it becomes mild or effete, and is termed Carbonat of Lime. When applied to land in this state, it acts with much more mildness, only promoting the resolution of the matters in which it comes in contact by forwarding the natural process of putrefaction. It has also less tendency to produce a mortary hardness in the poorer sorts of clayey soils.

Besides these differences, there are others arising from the substances which are combined with the calcareous matters employed, as has been lately shewn by the ingenious experiments of Mr. Tennant, stated in the second part of the Philosophical Transactions for the year 1799. Having been informed that two kinds of lime were used in agriculture, which differed greatly in their effects, one of which it was necessary to use sparingly, and to spread very evenly over the land, as it was said that a large proportion of it diminished the fertility of the soil, and that, wherever a heap of it had been left on one spot, all vegetation was prevented for many years; and that of this kind of lime fifty or sixty bushels on an acre were as much as could be used with advantage, while of the other sort of lime a large quantity was never found to be injurious, and that the spots which were entirely covered with it became remarkably fertile, instead of being rendered barren;—having analysed those two kinds of lime, he found that the latter consisted solely of calcareous earth; but that the former contained two parts of magnesia, with three parts of calcareous earth. He afterwards proved, that though vegetable seeds would grow equally well in both these kinds of lime-stone, when simply reduced to powder, yet that, when they were calcined so as to become lime, and both of them strewed about the tenth of an inch thick on garden mould, the magnesian lime prevented nearly all the seeds which had been sowed from coming up, while no injury was occasioned by the calcareous lime when used under the same circumstances.

This valuable discovery seems in some measure to explain the cause of the variety of opinion that has been maintained respecting the application of lime, which some have supposed to be of little or no advantage, and even injurious to land; which has been owing probably to their having employed the magnesian lime, or used it in too large proportions.

This philosophical inquirer first found magnesian lime near the town of Doncaster, and afterwards at York, at Matlock in Derbyshire, at Breeden in Leicestershire, and at Worksop in Nottinghamshire. He asserts, that the cathedral and walls of York are built with this magnesian lime-stone; and that at Matlock the magnesian and calcareous lime-stones are contiguous to each other; the rocks on the side of the river Derwent, where the houses are built, being magnesian, and on the other side calcareous. He found also that in this situation the magnesian lime-stone was incumbent on the calcareous; for in descending into a cavern formed in that rock, he found a separate vein of calcareous lime-stone, which was full of shells, but contained no magnesia; and concludes that in general the magnesian lime-stone may be easily distinguished from the calcareous by its solution in acids being much slower, and that it contains generally very few shells, but that those, when present, are impregnated with magnesia.

It is remarked by Dr. Darwin, in his Philosophy of Agriculture, that all lime-stone may be divided into three kinds: first, the rocks which remain, where they were formed from shells beneath the ocean, except that they were afterwards elevated by sub-marine fires; secondly, into alluvial lime-stone, as those which have been dissolved in water, and simply precipitated, as the beds of chalk, which contain only the most insoluble remains of sea animals, as the teeth of sharks; and, thirdly, those which, after having been dissolved and precipitated, have been long agitated beneath the sea, till the particles have been rolled so against each other, as to acquire a globular form, which is said to resemble the roe or spawn of fish, and which contain very few shells or none, as the Ketton stone, and that which he has seen on Lincoln Heath, extending almost from Sleaford to Lincoln—Now, says he, as the salts of the sea consist of only two kinds, common salt, or muriate of soda, and vitriolated magnesia, commonly called Epsom salt, which in the sea-waters surrounding this island are found at a medium to exist in the proportion of one-thirtieth part of common salt, and one-eightieth part of vitriolated magnesia, compared to the quantity of water; and secondly, as these salts are believed by many philosophers to have been formed by vegetable and animal matters, which principally grew upon the surface of the dry land, after it was raised out of the primeval ocean; and that, in consequence, the saltness of the sea was posterior to the formation of the primeval rocks of lime-stone; we may understand why those lime-stone strata, which have not been dissolved or washed in sea-water since the sea became salt, are not mixed with magnesia. The chalk, he supposes, must have been dissolved and precipitated from water, as it exactly resembles the internal part of some calcareous stalactites which he has in his possession; yet there is no appearance, he says, of its component particles having been rubbed together into small globules, and may not therefore have been removed from the situation where it was produced, except by its elevation above the surface of the ocean.

But that alluvial lime-stone, which consists of small globules adhering together, called Ketton lime-stone, and of which there appears, he observes, to be a bed ten miles broad from Beckingham to Sleaford

in Lincolnshire, and twenty miles long from Sleaford to Lincoln, he suspects may probably consist of magnesian lime-stone; which is also said in that country to do no service to vegetation; for this alluvial lime-stone, by having evidently been rolled together beneath the sea, by which the small crystallized parts of it have had their angles rubbed off, is most likely to have thus been mixed with the magnesia of the sea-water, which, as has been observed, is said to contain one-eightieth part of its weight of vitriolated magnesia.

It is further remarked, that at the lime-works at Ticknal, near Derby, there appears a stratum of alluvial lime-stone, like Ketton lime-stone, which they do not burn for sale, over the bed of the calcareous lime-stone, which they get from beneath the former, and calcine for sale. It is probable, he thinks, that the superior bed may contain magnesia, which has rendered it not so useful in agriculture. It is still more probable, he says, that alluvial lime-stone has acquired its mixture of magnesia from the sea water; as magnesia in its uncalcined state will precipitate lime from water, as observed by Dr. Alston, who thence proposes to render water pure and potable, which has been long kept at sea free from putridity by having lime mixed with it, by precipitating the lime by the addition of mild magnesia.

The lime from Breedon is magnesian; that from Ticknal (which is sold) is calcareous lime, he believes, and some farmers in the vicinity of Derby assert, he says, that two loads of Breedon lime will go as far, that is, will apparently do as much service to their land, as three loads of Ticknal lime. Breedon lime, he is also informed, is preferred in architecture, and is said to go further in making mortar: which he supposes means, that it requires more sand to be mixed with it. Mr. Marshall, in his Account of the Agriculture of the Midland Counties, speaks of lime made at Breedon, near Derby, as destructive to vegetables when used in large quantities. And in Nottinghamshire, it is asserted, that the lime from Critch in Derbyshire is so mild, that thistles and grass spring up through the edges of large heaps of it, when laid in the fields. Dr. Fenwick of Newcastle observes, that the farmers in that country divide lime into hot and mild; which Mr. Tennant believes to mean magnesian and calcareous lime.

By experiments which were made by Mr. Tennant, by sowing seeds of colewort on various mixtures of calcined magnesia with soil, and of calcareous lime with soil, he found thirty or forty grains of lime did not retard the growth of seeds more than three or four of calcined magnesia; from hence what can we conclude, but that, as they both injure vegetation in large quantities, they may both assist vegetation in small ones? and that this is more probable, as the farmers believe that they find both of them useful, though in different quantities; and as the magnesia would form Epsom salt, if it meets with vitriolic acid, which Dr. Home found, from his experiments, to be friendly to vegetation, when used in very small quantities. More accurate observations and experiments are, however, Dr. Darwin thinks, wanting on this subject.

The most certain way to know whether any sort of stone be fit for making lime is to drop upon it a little aquafortis, spirit of sea-salt, or oil of vitriol. All stones on which the above, or any other strong acid, effervesces or rises in bubbles, are calcareous stones, or will burn to lime; and the stronger the effervescence is, the fitter they are for that purpose.

As in the use of calcareous matter as a manure, much depends upon its being brought into a fine powdery state, it should always, where fuel can be obtained at a moderate expence, be prepared by burning, as that is the easiest and most efficacious mode of reducing lime-stone to powder, Dr. Anderson says, that ever was invented, and therefore ought always to be adopted where necessity does not prevent it. Reducing lime-stone to powder by calcination is also, he remarks, attended with this farther advantage to the farmer, that it considerably diminishes his expence of carriage. Pure lime-stone loses about two-thirds of its weight, by being thoroughly burned; so the man who is obliged to drive this manure from a great distance, will find a very considerable saving by driving it in the state of shells; but if it were reduced to a powder by mechanical triture, he could not be benefited by this circumstance. Many persons choose to drive lime-stone from a considerable distance, and burn it at home; but it is obvious they then subject themselves to a very heavy charge in carriage, which would be avoided by an opposite conduct. This therefore ought never to be practised but where other circumstances may counterbalance this unfavourable one. But as lime-stone is often in its native state, mixed with sand in various proportions, and as sand loses nothing of its weight by calcination, it must happen that those kinds of lime-stone which contain the largest proportion of sand will lose least in calcination, and of course afford the weightiest lime-shells. Hence it is obvious, that those who are under the necessity of driving lime from a great distance ought to be particularly careful to make choice of a kind of lime-stone as free from sand as possible, and to drive it in the state of shells, as they will thus obtain an equal quantity of manure, at the least expence of carriage that is possible; and the lightest shells ought, of course, to be always preferred. When lime is slaked, that which contains most sand falls most quickly, and absorbs the smallest proportion of water. What is pure requires a very large proportion of water, and is much longer before it begins to fall. Hence it happens that those who drive sandy lime-shells in open carriages, must be very careful to guard against rain, because a heavy shower would make the whole fall, and generate such a heat as to be in danger of setting the carts on fire; whereas pure lime-shells are in no danger of being damaged by that circumstance. He has seen a cart loaded with such shells, which had been exposed to a continued shower of rain, as violent as is ever known in this country, for more than three hours, and seemed hardly to be affected by it in the smallest degree. He ought, he says, to ob-

serve, however, that his experiments were confined to only one kind of pure lime, so that it is not from hence demonstrated that all kinds of pure lime will be possessed of the same qualities. Lime-shells formed from the purest lime-stone require more than their own weight of water to slake them properly, whereas some kinds of lime-shells that contain much sand do not require above one-fourth part of that quantity. He has found, by experiment, that pure lime-shells cannot be slaked with less than about one-fourth more than their own weight of water. When slaked in the ordinary way, the same lime-shells took more than double their weight of water.

Hence it is much worse economy, in those who have pure lime-shells, to slake and carry them home in the state of powdered lime, than it is in those who have only a sandy kind of lime-shells to make use of.

It is farther stated, that it is even, on some occasions, more advisable for those who have very sandy lime, to drive it in the state of powdered lime than in that of shells; for, as it is dangerous to give that kind of lime-stone too much heat, lest it should be vitrified, those who burn it can never be certain that the whole of the stone will fall to powder, when water is added, till they have actually tried it; nor do they think it a great loss if some part of it should be imperfectly burned, as it requires much less fuel on a future occasion than fresh lime-stone; and therefore they much rather choose to err on this than on the opposite extreme. But should any one attempt to drive this poor sort of lime in the state of shells, he would be in danger of carrying home many stones that would never fall; which would more than counterbalance the benefit he would derive from the want of the small quantity of water that is required to slake it. On these accounts, he thinks, it may be admitted as a general rule, that those who can have access to lime-stone which is free of sand, will save a great deal in the carriage of it, by driving it in the state of shells;—and that, on the contrary, it will be most economical, in those who can only get lime of a very sandy quality, to drive it in the state of powdered lime. From hence it follows, that the practice which now prevails, of carrying shell-lime by water from one part of the country to another, is only an imaginary saving, obtained at a very high risque, to those who drive shells of a sandy quality; but a real and unequivocal advantage, of very high importance to the community at large, if these shells are obtained from a pure lime-stone. These observations relate only to the saving of carriage to the farmer; which, however, is an article of great importance to him.

There are, however, some other particulars that may equally affect him in this way, and in the application of the lime to his ground. A vague opinion, in general, Dr. Anderson says, prevails in every part of the country, that one sort of lime may be more valuable than another; but it does not appear that farmers have hitherto had any rule to direct them in the choice of different sorts of lime; some esteeming one sort strongest, as they term it, and some valuing another sort more highly, without being able to assign any satisfactory reason for the preference they give in either case. It is of importance that this matter should be elucidated. Although it does not always happen, yet, in many parts of the country, the real nature of lime is so little understood, that the weightiest lime is preferred, as a manure, to that which is lighter; because it is imagined the first has more substance, and will therefore produce a more powerful effect upon ground than the finest and lightest lime. But there seems to be no reason to think there is any difference in the specific gravity of different parcels of pure calcareous matter, when fully calcined; therefore, if there is any difference in the weight of various sorts of lime, it must arise entirely from a variation in the quantity or gravity of some extraneous matter that is mixed with the lime; and as sand is almost the only extraneous body that is ever found in lime-stone, and is always of much greater specific gravity than pure quick-lime, it follows, that the weighty lime only owes its superior gravity to a larger proportion of sand that is mixed with it. But sand is of no value as a manure; so that he who voluntarily purchases this kind of lime in preference to the other is guilty of a great degree of folly; which will be the greater, if he has likewise to drive it from a considerable distance.

Those farmers who have access to only one sort of lime-stone, must, however, be contented with it, whatever may be its quality. But such as have an opportunity of choosing may be benefited by the observation, that pure lime-stone, when fully calcined and slaked, is rduced to a fine white impalpable powder that feels soft between the fingers, without the smallest tendency to grittiness; while such lime as contains sand is never so fine nor so soft, but feels gritty when rubbed betwixt the fingers.

It is observed by the author of Modern Agriculture, that there are few districts where lime is not either in general use, or partially introduced as a manure. With respect to the use of lime, or the benefit derived from it, as a mean of fertilizing the soil, some are, he says, of opinion, that it promotes vegetation, by stimulating, or forcing the soil with which it is incorporated to exert itself: others imagine, it promotes vegetation, by enriching the soil, and thereby adding to the quantity of vegetable food. Various other opinions, different from these, and in some instances opposite to each other, have been entertained respecting the manner in which lime operates upon land; but all that we yet know with certainty on the subject, is, he thinks, collected from practice and experience, whereby it is proved that lime, somehow or other operates so as frequently to produce luxuriant crops on soils, which, before the application of that manure, were comparatively of little value: and farther, that on all soils, which are treated properly after being thoroughly limed, its beneficial effects are discernible by the most cursory observer. Many other modes in which this substance may be useful as a manure, may be seen under the heads *Calcareous Earth* and *Phosphorus*.

The quantity of lime applied to the acre seems

hitherto, the same writer observes, fixed by no certain rule, either in regard to the nature of the different soils, the modes of cropping afterwards adopted, or the superior quality of one kind of lime-stone beyond another,

Some, Dr. Anderson remarks, require that it should be applied in such small quantities as thirty or forty bushels to the acre; and aver, that if more is used the ground will be absolutely ruined; while others maintain, that ten times that quantity may be applied with safety. A great variation may no doubt, he thinks, be produced in this respect, by a difference in the nature of the soil,—in the state of culture it is under at the time,—in the quantity of calcareous matter with which it may have been formerly impregnated; and perhaps a variation may sometimes arise from other circumstances that have never yet been attended to. A difference will likewise arise from the quality of the lime that is applied, and from the manner in which it is employed, some kinds of lime containing, perhaps, ten times more calcareous matter than others: and a very great difference may proceed from the mode of applying the lime itself.

It is common, says the same author, to hear those who have had little experience of lime as a manure, recommend very great caution, lest too great a quantity be employed, for fear of burning the soil, as they express it. This idea of burning has been evidently adopted from what is experienced by applying caustic lime to animals or vegetables in large quantities, as it often corrodes and shrivels them up, and produces other effects, which greatly resemble those of fire; but it cannot produce any such effects, unless there are vegetables growing upon the soil at the time. In that case the vegetables might indeed be corroded by the lime, if rain should fall immediately after it was spread when newly slaked; but as it loses this fiery corrosive power in a few days after it is spread, nothing of that kind can be expected to happen to the soil. Accordingly, we never hear of crops being burnt up with too great a quantity of lime in those countries where it has long been used as a common manure, although it is there often employed in much larger quantities than in other places where it is more rare. He has himself had the experience of lime in all proportions, from one hundred to above seven hundred bushels to the acre upon a great variety of soils; and has always found that its effect in promoting the fertility of the soil has been in proportion to the quantity employed, other circumstances being alike. The expence in most cases prevents farmers from employing this manure in greater quantities than those above mentioned; but accidental circumstances clearly shew, that, if it were applied in much larger quantities, the effect would only be to promote the luxuriance of the crop in a higher degree. A gentleman of his acquaintance in whose veracity he can confide happening to be from home when a large field was limed, and having no occasion for the whole quantity of lime that had been brought for that purpose, and laid down in one corner of the field, his servants, without driving it away, mixed what remained with the soil, although the lime lay there about four inches thick over the whole surface. The effect was that for many years afterwards, the grain in that place was so immoderately luxuriant, that it fell over, and rotted before it came to the ear. After many years this luxuriance abated a little, so as to allow the grain to ripen; but it was there always much more luxuriant than in any other part of the field. An accidental experiment, nearly similar to this, fell under his own observation. It happened, he says, that the servants of another farmer laid, by mistake, a few heaps of lime upon a grass-field that he did not intend should be broken up at the time. The mistake was soon discovered, and no more lime was laid down at that place; and the few heaps (about a bushel in each) were allowed to lie neglected, without being spread. The field was pastured upon for seven or eight years after that, before it was converted into tillage; and the heaps were by that time become so flat, and so far sunk into the ground, that they could hardly be discovered. Before it was ploughed up, the whole of the field was limed, and this part of it equally so with the rest; nor were the old heaps touched till the plough went through them in tilling the field, when the lime was there turned up, with only a very small mixture of soil. The consequence was, that at every one of these heaps, a tuft of corn sprung up with such luxuriance as to be entirely rotted before harvest; and for many years afterwards, these tufts could be distinguished from the other part of the field at a very great distance, like so many buttons on a coat; and perhaps continue so to this day. From these experiments, as well as other considerations, there seems to be reason, he thinks, to conclude, that on soils which do not naturally abound with chalk, or other calcareous matter, there is less danger in giving too much lime than in applying too little, except in those cases where an over luxuriance is to be apprehended.

It is stated by Mr. Donaldson, that, in the counties of Lanark and Westmoreland, from one hundred to five hundred bushels of lime-shells, after being reduced to powder, are applied to the English statute acre, and that the bushel of lime-shells, or calcined lime-stone, generally yields from two and a half to three bushels of powdered lime; the price of which at the kilns varies from four pence to six pence; the general average over the kingdom being rated at four pence halfpenny the bushel. In the county of Nottingham, the ordinary quantity does not exceed seventy or eighty bushels. In the counties of Cumberland in England, and West Lothian, Fife, Perth, Angus, Mearns, &c. in Scotland, from one hundred to one hundred and fifty bushels is the usual quantity; and this last may be stated, he thinks, as the general average quantity commonly used in all the other parts of the kingdom.

Dr. Anderson asserts that he has often heard it urged as an objection to the use of lime as a manure, that although it does indeed promote the fertility of a soil in a higher degree at first, yet, in the end,

it renders it much more sterile than formerly; on which account, they say, it ought not to be at all employed. This, like many other objections to useful practices, takes its rise, he thinks, entirely from the avarice and unskilfulness of those who complain. It is chiefly heard of in those parts of the country where it is not uncommon for a farmer, after once liming a poor soil, to take fifteen or sixteen crops of oats successively, without any other dressing or alternation of crops. It must be a good manure that enables these soils to produce such a number of successive scourging crops of any sort: but it would be a marvellous one indeed, if it should prevent those fields from being exhausted by them. But, says he, is it not well known, that in all the richest and best improved parts of the country, lime has been long employed as a manure? Yet, so far are these soils from being rendered sterile by it, that it is doubtful if any art, without the assistance of lime, or some calcareous matter, could ever have brought these fields to their present degree of fertility. Those, therefore, continues he, who complain of the hurtful effects of lime as a manure, proclaim what they ought to conceal; that they have had in their possession a treasure, which might have enriched their posterity, but which in their own life-time they have idly squandered away.

It is further remarked, that we are not only unacquainted with the mode in which lime operates upon the soil, but we are even in a great measure ignorant of the actual changes that are produced upon the earth after this manure is applied. It is often asked, how long the effects of lime may be perceived on the soil? and, if by this question it be meant to ascertain the length of time that the effects of lime will be perceptible in promoting the luxuriance of the crop after one manuring, it is no wonder that very different answers should be given, as the effects must vary with the quantity or quality of the lime employed, the nature of the crops that follow, and many other circumstances, that it would be impossible to enumerate. But if it be viewed in another light; if lime be supposed to alter the soil, so as to render it susceptible of being affected by other manures in a more sensible degree, so as to make it capable of producing crops that no art could otherwise have effected, and to admit of being improved by modes of culture that would not otherwise have produced any sensible benefit, the answer to the question would be more easy, as in this light, it is pretty plain that its effects will be felt, perhaps, as long as the soil exists. He believes farmers are seldom accustomed to consider lime, or other calcareous manures, in this last point of view; although, when it comes to be inquired into, he doubts not but this will be found to be by far the most valuable effect of these manures. A few facts will, he says, best illustrate his meaning. In Derbyshire the farmers have found, that by spreading lime in considerable quantities upon the surface of their heathy moors, after a few years the heath disappears, and the whole surface becomes covered with a fine pile of grass, consisting of white clover, and the other valuable sorts of pasture-grasses. This shews that lime renders the soil unfriendly to the growth of heath, and friendly to that of clover. It is found by experience, that in all porous soils which are not exposed to too much dampness, in every part of Scotland where lime has not been employed, heath has a natural and almost irresistible propensity to establish itself. In those parts of the country where lime has been much used as manure, we find that the fields may be allowed to remain long in grass, without becoming covered with that noxious plant. Again: It is well known by those who have been attentive, and have had opportunities of observing the fact, that peas of any sort can never be successfully cultivated in any part of the country where the soil is not of a very strong clayey nature, or where lime or other calcareous manures have never been employed. If the ground be made as rich as possible with common dung, although the peas in that case will vegetate, and grow for some time with vigour; yet, before they begin to ripen, they become blighted, usually die away entirely before the pod is formed, and but rarely produce a few half-formed peas. But if the ground has ever been limed, although, perhaps, at the distance of thousands of years before that period, it never loses its power of producing good crops of peas, if it is put in a proper tilth for carrying them at the time. Again, in countries that have never been limed, the kinds of grass that spontaneously appear, if left to themselves, are the small bent-grass and feather-grass. In places where lime has ever been used, the ground, if exhausted, produces fewer plants of these grasses; but in their stead white clover, the poa and fescue grasses, chiefly abound. The soil in either of these cases may become equally poor; that is, may produce equally scanty crops: but the means of recovering them will be somewhat different. In the last case, a fallow seldom fails to prove beneficial In the first, it is often of no effect, sometimes even hurtful. In the last, a moderate dressing of dung produces a much more sensible and lasting effect than in the other. In the last the quality of the grass, as well as its quantity, rather improves by age. In the first, these circumstances are reversed. Several other observations might be made, tending to shew that ground which has been once impregnated with calcareous matter acquires qualities from that moment which it did not possess before, which it ever afterwards retains, and never returns exactly to its former state. In addition to this it is observed, that although lime has such powerful effects on the soil, it does not seem ever to incorporate with the mould, so as to form one homogeneous mass; but the lime remains always in detached particles, which are larger or smaller in proportion as it has been more or less perfectly divided when it was spread, or broken down by the subsequent mechanical operations the soil may have been made to undergo. Hence it happens that, in ploughing, if there chance to be any lumps of calcareous matter in a dry state upon the surface, they naturally tumble

into the bottom of the open furrow as soon as the earth is edged up upon the mould-board, so as to fall into the lowest place that has been made by the plough before the furrow is fairly turned over. In consequence of this circumstance, it must often happen that, in the course of many repeated ploughings, more of the lime will be accumulated at the bottom of the soil than in any other part of it: and as the plough sometimes goes a little deeper than ordinary, the lime that on these occasions chances to be deposited in the bottom of these furrows, will be below the ordinary staple of the soil, it will be useless for the purposes of the farmer. It is commonly thought that the lime has sunk through the soil by its own gravity, although it is certain that lime is specifically lighter than any soil, and can only be accumulated at the bottom of the mould by the means above described: others think that the lime is chemically dissolved, and afterwards deposited there: but this idea is not corroborated by the facts that have fallen under his observation. The following directions are applicable in either case. To obviate this inconvenience, it behoves the farmer, in the first place, to be extremely attentive to have his lime divided into as small particles as possible at the time of spreading; for, if these are sufficiently small they incorporate so intimately with the mould, as to be incapable of being easily detached from it. On this account, as well as others, it is always most advisable to spread the lime when in its dry powdery state, immediately after slaking, before it has had time to run into lumps. It is also of importance to plough the soil with a more shallow furrow than usual when lime is put upon it, especially the first time it is ploughed after the lime has been spread upon its surface; because, at that ploughing, the lime being all on the surface, a larger proportion of it is turned into the bottom of the last made furrow than at any succeeding ploughing; and therefore more of it will be buried beneath the staple than at any other time, if the furrow shall have been very deep. This circumstance becomes more essentially necessary in ploughing grass-ground that has been newly limed; because, in this case, the lime is less capable of being mixed with any part of the soil than in any other. It also becomes extremely necessary, in all succeeding times, to guard as much as possible against ploughing to unequal depths.

The author of The present State of Husbandry in Great-Britain thinks it probable that the propriety or impropriety of repeated limings depends more on the nature of the soil, and the modes of management afterwards adopted, than on any other circumstance connected with it; and that, as in some districts it is repeated two or three times in the course of twenty years, while in others a repetition of liming except in mixture with other substances is found injurious, it is impossible to account for such variations in the practice, or its effects on the soil, without observing in the first place, that although there has been as yet no general rule established, by which a farmer can determine what quantity of lime is best suited to a particular soil, yet in practice, a greater quantity is laid on strong, dense, stubborn soils, than on those of a more open, friable nature. In the second place, that the diversity of measures by which lime is sold at the different kilns, is often so great, as to leave it doubtful whether a farmer in one part of the island, who applies three chaldrons to the acre, does not use less than he, who in another district applies two. And in the third place, that the quality of lime-shells is so extremely different, that in some cases the farmer who lays five chaldrons on the acre, does not apply a greater quantity of effective manure than another who limes an acre with three only.

From various circumstances which have been already noticed, in speaking of calcareous earth, as well as from the great and general advantage of this substance on all soils and situations, except such as are previously replete with calcareous matter, or too moist, the author of The Philosophy of Agriculture conceives, that its effects can only be understood from the idea of its actually supplying the nutrition of vegetables. This is still further confirmed, he thinks, by its contributing so much to the amelioration of the crops, as well as to their increase in quantity, as noticed by millers and bakers.

If it be applied in a large quantity, it likewise kills animals in the soils, and also small vegetables; and from the destroyed and decayed animals and vegetables, the soil is rendered more fertile, by being impregnated with mucilage. The superabundant lime is useful as it becomes mild calcareous earth, by attracting carbonic acid from the atmosphere, and afterwards gradually affording it to plants. By the fermentation it brings on, and the fineness of its particles, the texture of the earth is opened and divided.

Light sandy lands, containing only a small portion of vegetable matter, should not be overdone with lime, unless we san assist them liberally with animal manures. Its great excellence on a sandy soil is its mechanically binding the loose particles, and preventing the different parts of the manure from escaping out of the reach of the crop. On clay, by means of the gentle fermentation which lime produces, the stubborn soil is opened; the manure readily comes into contact with every part of it, and the fibres of the plants have full liberty to spread. It is often said that lime answers better upon sand than clay; but let the farmer treble the quantity, and he will be convinced that lime is better for clay than sand. Clay well limed becomes a marl, falling in water, and fermenting with acids: the air, rain, and dews are freely admitted, and the soil retains the nourishment of each. In consequence of a fermentation raised in the soil, the fixed air is set at liberty, which in a wonderful manner promotes vegetation. It is the nature of lime, in its active state, to dissolve vegetable bodies. Upon this principle we may account for the wonderful effects it produces in the improvement of black moor-land, which consists of dissolved and half-dissolved vegetable substances.

It may be observed in general, that the greatest quantity should be used upon the deepest and richest soils, and the least upon those that are thin and

light. On strong clays and deep loams there is a substantial body for it to operate upon; consequently a considerable quantity will be required to pervade and give due activity to the whole; but as the soil is lighter, the quantity must be less, and the after-management in regard to crops extremely cautious. In liming a single field, an attention to the quantity will often be found necessary; the soil of the higher parts being for the most part more light and free, and that of the lower more deep and compact, where the ground is unequal. On some soils, particularly where the bottom is chalk, limestone, or marl, lime will be pernicious, especially if the soil be thin.

Whatever be the method in which lime produces its beneficial effects upon land, it should always be reduced into as fine a powder as possible, and spread out with the greatest equality upon the soil, as by these means it will be more equally blended with it, and be more extensively useful in promoting the growth of crops.

Considering lime as a substance operating upon the living substances in the soil, as well as mechanically upon the soil itself, we perceive the necessity of applying a sufficient quantity at once, in order to produce these effects: for, if the quantity employed be small, and the soil deep, its effects will be scarcely perceived. Many farmers imagine that lime will not answer upon their lands, because they have laid it on in small quantities, whereas in all probability they would have found a larger dose highly beneficial. On clay four or five hundred bushels are laid on for wheat, but it can scarcely be expected to answer the expence. On moss, bog, moor, &c. to be reclaimed from a state of nature, the more is laid on the better it is. The beneficial effect of lime on sandy land may be explained from its binding quality. But when such lands are first broken up from their state of heath, the vegetable matter is acted upon, and reduced to manure by the corrosive power of the lime. On such lands, the first crop of rye has more than paid the expences. By attracting water, lime has a tendency to lay land dry. By insinuating itself between the particles of the clay, it destroys their adhesion, breaks the stiffness of the soil, and gives readier access to the operation of manures, and to the extension of the growing roots of plants. By attracting carbonic acid or fixed air, and water, and by its corrosive properties, it destroys the texture of bodies, and reduces vegetable matter to a state of manure. It unites strongly with oils, and renders them miscible with water. By being destructive to insects and vermin, it may also contribute to preserve the springing corn from their ravages.

It is, however, remarked by Dr. Anderson, that, from writers on agriculture having been long in the custom of dividing manures into two classes, viz. enriching manures, or those that tended directly to render the soil more prolific, however sterile it may be, among the foremost of which was reckoned dung; and exciting manures, or those that were supposed to have a tendency to render the soil more prolific, merely by acting upon those enriching manures that had been formerly in the soil, and giving them a new stimulus, so as to enable them to operate anew upon that soil which they had formerly fertilized: in which class of stimulating manures lime was always allowed to hold the foremost rank; it would follow, that lime could only be of use as a manure when applied to rich soils; and, when applied to poor soils, would produce hardly any, or even perhaps hurtful effects. He acknowledges that he was so far imposed upon by the beauty of this theory, as to be hurried along with the general current of mankind, in the firm persuasion of the truth of the observation, and for many years did not sufficiently advert to those facts that were daily occurring to contradict it. He is now, however, he says, firmly convinced, from repeated observations, that lime and other calcareous manures produce a much greater proportional improvement upon poor soils than on such as are richer; and that lime alone, upon a poor soil, will, in many cases, produce a much greater and more lasting degree of fertility than dung alone. In direct contradiction to the theory, he adds, that he never yet met with a poor soil in its natural state, which was not benefitted in a very great degree by calcareous matters, when administered in proper quantities. But he has met with several rich soils that were fully impregnated with dung, and therefore exactly in that state in which the theory supposes that lime would produce the greatest effect,—but upon which lime, applied in any quantities, produced not the smallest sensible effect.

And Doctor Darwin, as has been observed, says, that the great and general advantage of lime in all soils and all situations, except some of those which are already replete with calcareous earth, or are too moist, can only be understood from the idea of its supplying actual nutrition to vegetables; and that this seems more probable, as it contributes so much to the melioration of the crops, as well as to their increase in quantity—wheat from land well limed being believed by farmers, millers, and bakers, to be, as they suppose, thinner skinned: that is, to turn out more and better flower; which he supposes is owing to its containing more starch and less mucilage. Hence we perceive another very important use of lime in the cultivation of land may be owing to its forwarding the conversion of mucilage into starch, that is, to its forwarding the ripening of the seed, which is a matter of great consequence in this climate of short and cold summers.

Mr. Young, from various minutes made in his Eastern Tour, concludes that lime agrees with almost all soils; that it fails, however, on a thin loam or lime-stone; that it seems inefficacious on old pasture; that it has a strong effect in killing weeds; and that the greatest effect is on heath and moorlands; where, as in the Peak of Derbyshire, it converts waste soils into fine pastures, without tillage: but the sort is a strong stone lime, burning soft and soapy, and the quantity laid on is very great, rising to three hundred and sixty or even one thousand bushels; but the common quantity is about four hundred bushels. There is great reason to attribute much of the benefit to quantity: in wastes especially,

too much can hardly be laid on, because dissolving the roots of heath and other spontaneous growth requires a powerful agent. Of their strong lime three hundred and sixty bushels are probably equal to five or six hundred bushels of chalk lime. What then are five or six quarters, which is no uncommon quantity, laid upon an acre?

The mode of using lime, in improving their heaths or moors, is first to pare the ground in the beginning of March about an inch and a half thick, to turn it about in dry weather, when dry to gather it into heaps, and burn it into ashes, to spread them even over the ground, to set on their lime, to spread and harrow it altogether, to plough the ground very thin, and to sow it with turnips or rape: then the spring following to sow with oats or barley, and good grass seeds: another good dressing with lime after the first crops of seeds is got; and then it may lie for pasture. Spreading the lime in a slaked state is by far the best method. The summer months are preferred, because fewer coals are necessary for burning; in other respects, the winter months are just as good for laying the lime upon the ground.

In its application upon fallows it is found to produce the best effects when laid on early in the season, and well incorporated with the soil.

The assistance of this manure has been highly useful in the cultivation of turnips; whole districts, formerly useless, having been made to produce not only good crops of them, but also valuable ones of corn and broad clover. Its greatest utility would seem to be upon light soils for these crops; as, where lime is the principal manure, they seldom sow turnips, clovers, peas or beans, except upon lands that have been previously limed. Instances of this sort are often met with on the uplands; where if any of the broad-leaved crops are sown, where a part has been limed, and a part not, the parts where the lime has been laid will produce, it is said, a valuable return, while that which has been dunged only will hardly repay the expence of seed and labour. The methods of using lime upon turnip-lands are various. Some farmers lay it on only before the last ploughing, and plough it in without harrowing: they also lay it in heaps, hot from the kiln, without being slaked. But probably the sooner it is laid upon the land, and the more perfectly it is mixed and incorporated with the soil before the seed is sown, the more certain and extensive will its effects be.

The application of this substance upon clover-ley for oats is a mode of practice which ought not to be attempted. It is generally laid on in this way in the autumn, and ploughed down in the spring, but the crops seldom repay the expence.

Lime is used as a top-dressing in spring upon grass, or wheat and other grain; but upon the latter it is said to be dangerous, unless the lime be made into a compost with dung or earth; in this form it will not only be safe but highly useful. Upon the former it is not more useful, except upon coarse meadows abounding with rushes, and other trumpery, which it destroys by absorbing the superabundant moisture.

Upon light soils, if several white crops be taken in succession after liming, the land will be worn out. A white and a green crop should be taken alternately. Upon clay lands a summer fallow is sometimes indispensable: in that case the lime should be laid on in July or August, and completely harrowed in before ploughing: two or three ploughings at least are required to incorporate it well with the soil, and a suitable harrowing after each.

About Perth in Scotland, according to the excellent Report of that county, the quantity laid on stiff land, by skilful improvers in the low country, is from forty to fifty bolls to the acre; on light land, with a gravelly subsoil, thirty or thirty-five bolls are accounted a sufficient dose. In some parts of the Carse or clay land, which is not easily stimulated, they lay on eighty or ninety bolls. It is sometimes laid on fallows, immediately before the seed furrow; on barley and grass seeds, either before or after the barley is sown; and in some cases with the preceding crop, where turnips are cultivated, to prepare the ground for barley. Lime is in some instances mixed in compost dung-hills, in others it is spread on the green sward, before the land be broken up from grass. One infallible maxim with regard to lime is, that the longer it is kept near the surface, at least within reach of the plough, until it be intimately mixed with the soil, and its virtues imbibed, so much the better. The first liming of land has always a more powerful effect than it has at a future but no distant period, the quantity being equal. Quick lime intended for wheat, after a fallow, or for barley and grass seeds, might be ploughed in with a very shallow furrow, before the seed is sown: for oats after ley, it ought to be laid on during the preceding autumn; and for pasture or a top-dressing, early in spring or in autumn, rather than in summer or in winter; because, if the summer be dry, the grass is burnt up by the lime, and in winter its virtues are lessened by the frost, nor does it so powerfully attract the influence of the air. It is common, but perhaps difficult to be accounted for, when lime is spread on short heath or other barren ground, which has a dry bottom, to see white clover and daisies rising spontaneously and plentifully, the second or third spring afterwards, where not a vestige of either, nor even a blade of grass, could be discovered before it was applied. And Doctor Darwin says, that he has been informed, that if a spadeful of lime be thrown on a tussock, which horses or cattle have refused to eat for years, they will for many succeeding seasons eat it quite close to the ground; which is owing, he suspects, to the grass containing more sugar in its joints, or to the less acidity of all its juices.

If the lime is to lie in a heap for any length of time, it should be covered with earth, to preserve it from the air and rain. It has been observed that the benefit of lime is not apparent in a dry summer, and that it does not act fully as a manure till it has been thoroughly slaked in the soil, by continued rains.

In Essex an excellent practice prevails, of forming a compost of lime, turf, and ditch earth, at the gate

of every field, ready to be applied as a manure when wanted. Twenty bushels of lime mixed with forty bushels of sand form an excellent top-dressing for an acre of wheat, if laid on yearly in the spring.

Lime is apt to subside beyond the depth of the common furrow; deep ploughing in this case is the only remedy applicable. In some midland counties a fallow is seldom made without being dressed with lime, under an idea that it mellows the soil, and makes it work well, while in tillage; and sweetens or improves the quality of the herbage, when laid down to grass. For this purpose it is fetched eighteen or twenty miles.

Two sorts of lime are in use in some districts, as about Derby. The Breedon lime, burnt from a very hard stone, and of singular strength as a manure; and the common lime, burnt from common stones, and called Ticknall or Walsal lime. The load heaps are generally watered as they are thrown down from the waggon; and always turned over to complete the falling more effectually. If a quantity of lime be fetched in autumn or early in winter, to be used in the spring, when team-labour is more valuable, it is thrown up into a regular roof-like heap or mound, and thatched as a stack; a small trench being cut round the skirts to catch, with an outlet to convey away, rain water. Thus the heap is prevented from running to a mortar-like consistence by the snows and rains of winter, and thereby rendered useful as manure.

It is stated by Mr. Marshall in his Rural Economy of the Midland Counties, that a turnip fallow was manured with Breedon lime, in general five quarters to an acre; part had double that quantity, and part had none. The turnip crop received no obvious advantage, but its effects on the barley were evident. The part not limed was the worse crop, nearly in the proportion of four to three. But the part limed with ten quarters to an acre was the best crop. Whence the common notion that more than five quarters of Breedon lime to an acre is ruinous to crops, seems to be ill founded. And in his Economy of Norfolk, he says lime is in good repute, though not in general use as a manure; different opinions being entertained respecting the value of it. This difference of opinion will, he thinks, ever remain, while general conclusions are drawn from particular incidents. It is used by many judicious farmers even after marl, with success. Upon hot burning soils it is generally found of the greatest efficacy, and is perhaps the most effectual cure of scalds or burning patches of land that has yet been discovered: from these and other circumstances lime is there considered as a cold manure. The general method of applying lime is to let it fall in large heaps, and to spread it out of carts upon fallowed ground either for wheat or barley. The quantity set on is about three chaldrons an acre: the price 9s. or 10s. a chaldron. From experiments made on turnips, barley, and wheat, it appears that lime does not act as a manure until it has been thoroughly slaked in the soil; and it seems as if the rains of summer were necessary to promote its operation.

In some parts of Yorkshire lime is used invariably on every species of soil; and in most cases with great success. On the higher and more dry lands its utility is evident. At Malton, it is laid on the calcareous quarry soil with success. Its use to the loose sandy soils is fully established. The prevailing crop is wheat on fallow. It is also pretty generally set on for rape, turnips, or other crops, after sod-burning, and spread among the ashes. It is also sometimes set on for barley. But its effect on the first crop, except of wheat or rape, is seldom perceptible.

The benefit of lime to grass is a matter of dispute; it is even thought by some to be detrimental. It seems, however, to be a generally received idea, that lime laid on grass is not thrown away; for, whenever the land is turned up again, its benefit to corn will have full effect. The methods of liming are various. The worst is, laying it in large heaps, and suffering it to run to a jelly before it is spread. Next to this, is setting it about the land in small hillocks: for, although they are spread before they approach to a state of mortar, yet this method is injudicious. Lime falling in the open air breaks into small cubical masses, which being once buried in the soil, remain in it for ages, without being mixed intimately with it. Lime ought therefore to be spread in a state of perfect powder. It is therefore the practice of judicious husbandmen to set lime upon the land in load-heaps, and spread it over the soil out of carts, as soon as it is sufficiently fallen. Or the load-heaps are turned over, not so much to finish the falling, as to gain an opportunity of burying the granulous surface of the heaps; by which means the fragments are at least lessened, if not reduced to powder. In the moorlands the heaps are interlayered and covered up with moist turf or peat-mould, which bringing on a rapid fall, the whole is set on fire, and the surface kept free from granules by a covering of dry ashes. The heaps, therefore, whether great or small, should be covered up with soil, either of the field they are set in, or that of lanes or ditches carried to them for the purpose; and if a speedy fall be required, water thrown over this covering. If lime be used on fallows for wheat, it is, according to Mr. Marshall, generally spread in July, harrowed in as fast as it is spread, and ploughed under with a shallow furrow as soon as convenient. The usual quantity is three or four chaldrons to an acre.

Dr. Anderson observes, that "much depends upon the mode of applying the lime to the soil after calcination. If it is spread as soon as it is slaked, while yet in a powdery state, a very small quantity may be made to cover the whole surface of the ground, and to touch an exceedingly great number of particles of earth; but if it is suffered to lie for some time after slaking, and to get so much moisture as to make it run into clods, or cake into large lumps, it can never be again divided into such small parts; and, therefore, a much greater quantity is necessary to produce the same effect, than if it had been applied in its powdery state. But if the soil is afterwards to be continued long in tillage (as these clods are annually broken smaller by the action of the plough and harrows), the lime must continue to exert its

influence anew upon the soil for a great course of years: it will produce an effect nearly similar to that which would be experienced by annually strewing a small quantity of powdered lime over the surface of the soil: but as the price of the lime must, in the first case, be paid by the farmer altogether at the beginning, which only comes to be successively demanded in the other case, this deserves to be attended to, as it may become a consideration of some importance where lime is dear, and money not very plentiful."

It is always an object worthy of attention to remove the shells as soon as possible after the lime is drawn from the kiln; for it is known from experiment, that a ton of lime exposed twenty-two days to the air, after calcination, is augmented in weight to thirty hundred weight, and some kinds of lime even to thirty-five; which is little less than double.

In order to understand the goodness of lime, it is remarked by Dr. Anderson, that the lime from pure lime-stone is always of a bright white, when perfectly calcined without a tendency to any colour. When it has any colour, it proceeds from the sand, or other uncalcareous matters in its composition. There are, however, some sorts of sand that are of such a pure whiteness, as not to debase the colour of the lime in the smallest degree; but these are rare: and there are some matters that alter the colour of the lime a good deal, without debasing its quality in any considerable degree; but these are still more rare than the former. Hence it follows, he says, that the best lime for the purpose of the farmer, is that which is lightest, softest to the touch, and whitest. Softness to the touch is not, however, he conceives, an unequivocal proof of the purity of lime. He has seen *one* kind of lime, that contained a large proportion of an uncalcareous impalpable powder, that was as soft to the touch as the purest lime; but this was, he thinks, a singular exception to a rule that is very general. The more they deviate from either of these tests of purity, the worse they are for the purposes of agriculture. But if the lime-stone loses much of its weight in calcination, and the lime-shells are extremely light; if the shells require a very large proportion of water to slake them fully; if it is long before they begin to fall; if the lime-stone is not apt to run (or be vitrified) in the operation of burning; if it falls entirely when it gets a sufficient quantity of water, after it has been properly calcined: if it swells very much in slaking, and if the lime is light, fine to the touch, and of a pure white, he may be satisfied that it is extremely good, and may use it in preference to any other lime that is inferior to it in any of these respects. These rules are, he thinks, perfectly sufficient to decide as to the comparative value of any two kinds of lime that may be opposed to one another, and may be relied upon as sufficiently accurate for the ordinary purposes of the farmer.

There are other methods by which the qualities or goodness of lime may be ascertained with exactness, but which are best performed by an expert chymist.

In addition to what has been already observed, in regard to the application of this material to land, it has been suggested in The Farmer's Magazine that the farmer should consider well the state of his ground, and its management previous to putting on a dressing of this sort, for "if it has been ploughed out of grass, either having lain long in meadow or pasture, a heavy dressing, of from 250 to 300 bolls per acre, put on a good summer-fallow, will be of very great benefit, as, upon such soils, it will meet with abundance of vegetable matter, upon which it will act in such a manner as to increase its fertility. It may also be used with advantage, every eight or ten years, upon land that is kept under the plough; provided it be well manured with stable-dung, bones, or rape-dust, especially if such lands are under a proper rotation, such as, that of turnips; barley, with grass-seeds; pasturing with sheep, and wheat. Where it is used in this manner, it is recommended to be laid on in the early part of winter; as in that way, it will become perfectly effete before the turnips are sown; a matter of more importance than is generally imagined." And it is further stated, that "it will be highly beneficial upon strong and wet soils, where a suitable rotation of crops is followed. The rotation which is recommended, is wheat or barley after fallow, broad clover, white clover and grass seeds; pasturing with sheep as much as possible; afterwards wheat. This is asserted to be, at present, the practice of the best farmers. It is stated that the lime-husbandry of Yorkshire, in respect to its application, appears very imperfect; and it is supposed, "that much of it is used, not from a conviction that it will produce beneficial consequences, but merely because the tenants are bound to lay on a certain quantity each time their land is fallowed. As two crops, or at most three, are only allowed to be taken after one fallow, and as the arable lands are generally kept constantly under the plough, it necessarily happens, that lime is often applied when the ground is exhausted, or when it is in an improper condition for receiving benefit from calcareous manures." The money, therefore, expended in the purchase of this article, must, in many cases, be considered as misapplied, which would not probably happen, were it left to the judgment of the possessors, how often, and to what extent, the soil required the application of such a stimulus. "It will be generally acknowledged, it is believed, that the most beneficial mode of liming land, is, to give a sufficient dose at once, when the soil has been enriched by a quantity of dung, or has been recently refreshed, by remaining several years in grass, which precludes the necessity of a repetition for a considerable number of years. The old grass-lands of Yorkshire would therefore be a fine subject for the operation of this article, which is justly regarded as the basis of good husbandry; while the lands at present in aration would be equally benefited by throwing them into grass. It is evident, however, that these things cannot take place, till the nature of the connection betwixt landlord and tenant is materially altered; for, under the present system, it is highly improbable that any such improvements

should be practised. The errors of the Yorkshire *lime-husbandry* may therefore be justly attributed, it is supposed, to the restrictive covenants imposed by the proprietors, and not to any fault of the tenantry, who are seldom allowed the exercise of their own judgment in such matters. It is impossible that these covenants can be regulated with such propriety as to meet every case; therefore it may safely be admitted, that when the tenant is bound to fallow every third or fourth year, and to dress that fallow each time with a certain quantity of lime, that the fallow is often repeated, when the condition of the ground does not require it; and that lime is often bestowed, when circumstances prevent it from proving in the least degree beneficial. The proprietors seem to consider the tenants as very ignorant of practical knowledge, otherwise they would not hedge up their management with numerous rules, mostly inapplicable to the present state of British husbandry, and consequently deserving to be proscribed as obsolete, and improper to be executed. The writer has heard many excuses for such instances of arbitrary interference; but few are of a nature calculated to produce conviction. If a farmer does not know when his land is to be benefited by the application of lime, he is not fit for the post he occupies."

With respect to the most proper period of applying lime to lands, there seems some difference of opinion among farmers, as well as to the state in which it should be used: some supposing the best time to lay it on dry soils intended for turnips, is in autumn, while others think the beginning of summer, as May and June, better. Some likewise contend that it should be applied before it has been slaked, while others think it may be employed when even in a state of considerable moisture. The author of the Farmer's Calendar, after putting the question, whether lime burnt in January should be then used or kept till the spring, observes, that "there are two motives for burning stone or chalk: one is, for the sake of reducing the material to powder, for accuracy in spreading: the other is, for the application of a caustic body destructive of living vegetables. For the former purpose, the lime had better be kept; for the latter, it is usually laid on in such large quantities, that it is not very material at what season it is spread, provided it be done fresh from the kiln. It will have a greater effect in spring and summer, but the superiority is not such as to induce delay from a time in which the teams have little to perform, to a season in which there is much work for them." And he further states, that "the grand effect of this manure is on uncultivated waste land. On moors, mountains, bog, and boggy bottoms, the effect is very great, but the quantity applied is considerable. The more the better. In Derbyshire, as far as 600 bushels an acre have been used; or 20 one-horse cart loads of 30 bushels: such a dressing, when the space to be improved is large, demands the employment of regular teams to be kept continually at work. In such undertakings, it is idle to be nice about the season of applying the manure; convenience demands that the work should go on at all seasons, but in the counties where lime is most used, the common season is summer, and on fallows."

And there cannot be any doubt, but, that it is the best practice to apply it either in the spring, summer, or early part of the autumn, and in a state as little moist as possible, as under such circumstances it may not only be laid on with the greatest convenience, but be spread out in the most even and regular manner, which is a point of considerable importance in this husbandry, and be laid on with less injury, from treading the land. See *Manure*.

Mr. A. Young remarks, that, "liming is, in many districts, connected with paring and burning, and it is one of the best methods of applying this manure. From a peck to a bushel, according to its plenty, is added to and mixed with every heap of ashes, and they are then spread together. The effect generally is considerable, but proportioned to the soil. The greatest effect of this manure is upon land that has been long in a state of nature, and particularly upon all peat-soils, moors, mountains, and bogs. But upon all on which it is known to have effect, it is well applied in the ashes of paring and burning."

Though the application of this substance properly belongs to the occupiers of lands, it is necessary, Mr. Marshall remarks, that the proprietors of them should render it as easy and convenient as possible, "either by searching for raw materials, opening quarries, and erecting kilns, upon the estates under their care; or by bringing, from a distance, materials, fuel, or lime itself, at the least possible expence, through the means of improved roads, railways, or water carriage." And that the same principle holds good "with respect to marls, and other gross substances, to be used in their raw state; as the advantages arising therefrom will always, eventually, find their way into the rent-roll."

It may be necessary to observe, Dr. Anderson says, that when farmers employ a great deal of lime, it sometimes happens that their horses' feet are burnt by it; which is extremely troublesome, and sometimes proves even fatal to the poor animals: a method of preventing or remedying that inconvenience will therefore be of use.

The best method of preventing any inconvenience of this sort is to spread the lime when in its powdery state upon the field as evenly as possible, and allow it to lie in that state for some time before you begin to plough it. If the lime has been in fine powder, it will have become perfectly *effete* in a week, or so; after which time it will be as little corrosive as any kind of common earth, so that the horses may work among it with perfect safety. But if it has been suffered to run into clods before it was spread, these, if not broken small, will be longer in absorbing their air, and, of consequence, will remain longer in an acrid state, to that the ploughing may, in that case, be deferred for a week or so longer, nor will it be even then so perfectly safe as the other.

But if it becomes necessary at any time to plough in the lime immediately after it is spread, take care, says he, to do it only when the soil is perfectly dry,

and in leading your horses to the plough, take care to prevent them from going through any wet place, so as to wet their hoofs or ancles; for lime acts not at all upon any dry substance; but when it is in its acrid caustic state, it will corrode the hair and flesh in a moment if it has access to water. As soon as the horses are unyoked, keep their feet dry till you have got them carefully brushed, so as to wipe away all the dry powdery lime that may adhere to them; and if the least shower should fall, unyoke your horses immediately, and take them off the field. With these precautions they may, he says, work among caustic lime for any length of time without receiving any damage.

But in case of any accident, by which a horse or man that is working among lime should be scalded by it, it is always advisable for every farmer who has work of that kind going forward, to keep a tub of very sour milk or whey in some place ready to wash the part affected well with, which will quickly destroy the poignancy of the lime, and prevent the mischief that would otherwise arise from it. The sourer the milk or whey is, the better it will be for this purpose; it ought therefore to be long kept. For want of this, vinegar may produce the same effect, or very stale urine will be of use; but the milk or whey is the cheapest and best remedy, and ought to be always in readiness where lime-husbandry is going on.

Lime *Burning*, the process of converting lime-stone, chalk, and other calcareous substances into lime, by means of heat in kilns properly constructed for the purpose. See *Kiln*.

The calcination is effected by different sorts of fuel in different situations, but principally by fossil coal, peats, or wood; these being laid in layers alternately with those of the calcareous materials, in the kilns, and the process of burning continued for any length of time, by repeating the applications of fuel and calcareous matters at the top, and drawing out the lime from below.

Fossil coal, or culm, are unquestionably the most convenient and suitable materials for effecting this business, where they can be procured in plenty and at a sufficiently cheap rate, as they burn the stone or other calcareous matter more perfectly, and of course, leave fewer cores in the calcined pieces than when other sorts of fuel are employed.

Mr. Dodgson, however, has had much success in burning lime by the use of peats; as, he observes, in a paper in the third volume of The Farmer's Magazine, that he is "convinced, from experience, that lime-stone can be burnt to better purpose, and at less expence, with peat, than with coal. When coal is used, the lime-stones are apt, from excessive heat, to run into a solid lump; which never happens with peat, as it keeps them in an open state, and admits the air freely. The process of burning, also, goes on more slowly with coal. No lime can be drawn for two or three days; whereas, with peat, it may be drawn within twelve hours after fire is put to the kiln; and, in every succeeding day, nearly double the quantity of what could be produced by the use of coal. The expence is, he says, comparatively small. A man and a boy will dig as many peats in one day, as will burn 60 Carlisle bushels of lime, (the Carlisle bushel is equal to 3 Winchester ones,) and the expence, including drying, will not exceed four, or, at most, five shillings; while the coal necessary for burning the same quantity of lime, would have cost twelve shillings at the pit. The wetness of seasons, he says, is no argument against the use of peats, as they can be stacked near the kiln, when half dry, at any time of summer; the moisture will be exhaled from them during winter, and they will be in a fit state for burning in the months of April or May. He lives in the north-east district of Cumberland, where the farmers, in general, burn their own lime; and though there is coal in the immediate neighbourhood, he gives a decided preference to peat, for the reasons above mentioned."

This kind of fuel has been occasionally used in many parts of the kingdom for the same purpose from a very early period.

In Mr. Dodgson's practice, no particular form of kiln was found necessary, nor any particular sort of management in the process of calcination; the proportion of peat depending upon the nature of the lime-stone employed, and other circumstances.

Mr. Marshall justly thinks, that "the manufacture of lime is an art of which the manager of an estate ought not to be ignorant." He conceives, that "he ought to have, at least, a sufficient knowledge of its theory, to enable him, when occasion requires, to superintend or direct its practice. For it seldom answers, unless where materials are plentiful, and fuel cheap, for every tenant upon an estate to manufacture his own lime. A full sized kiln accumulates a stronger heat, with a given proportion of fuel, than a small one of the same form," which is a great advantage.

It is further supposed that "the chief or sole intention of burning lime-stone, for manure, appears to be that of reducing it, in the readiest and cheapest manner, to an impalpable powder. For experience sufficiently shews that *quick lime* is injurious, rather than beneficial, to vegetation; and that burnt lime-stone does not operate as a manure, until it has regained the fixed air, of which the fire deprived it. If it could be reduced, by mechanic powers, to powder of equal fineness, its effect, as manure, would doubtlessly be, he supposes the same as that of dead lime (*effete*). It is in the *perfect solution* which well burnt lime-stone has received, by the expulsion of its fixed air in the fire, so as to have completely loosened its texture, and unbound its every atom, we are, he thinks, to look for its prompt effect, and the shortness of its duration, comparatively with unburnt calcareous substances. Hence, says he, the main point to be attained is to expel the whole of the air. For, unless this be accomplished, the solution becomes imperfect: the stones, instead of completely dissolving into impalpable atoms, break into granules, or flakes; leaving, perhaps, a firm core in the centre, to encumber, rather than to fertilize, the soil" on which they are applied. "There is, however, an opposite

extreme to be avoided and with greater care. For an unburnt stone may be returned to the kiln; but one, which by too intense a heat is vitrified, or changed to a state of impure glass, is not only rendered useless, but has incurred an extraordinary waste of fuel. Consequently, stones that are prone to vitrification ought to be broken down into small pieces; otherwise, the fire is required to be so intense, that the surface becomes vitrified, before the air from the centre can be expelled" in a complete manner.

And he conceives that "another suggestion, respecting the proper size of the stones to be burnt, may have its use. Where fuel is weak, or dear, the materials require to be broken into smaller fragments, than where a strong fire can be kept up at a small expence:—while, under the latter circumstance, and where the stone is not prone to vitrification, much of the labour and expence of breaking may be saved, by using an extra quantity of fuel, and keeping up a strong fire in the kiln" or place where it is burned; the form or construction of which, depends partly on the qualities and value of the materials, and partly on the kinds of fuel that are made use of, and the differences of their prices at the places where they are employed. See *Kiln*.

The process of burning lime should go on during January and February, as well as most of the winter, and also in the summer months. Perpetual kilns are wrought in many districts, especially the northern ones, and in Ireland; the lime, when not taken away, being preserved in sheds, erected for the purpose, from the wet. The usual mode of managing with them is, for the farmer to contract for some sort of measure, according to the custom or practice of the particular district; and he should be careful that it is well burnt and of a proper quality.

Lime *Husbandry*, that sort of management which relates to the application of lime. See *Lime*.

Carbonat of Lime, a term applied to lime when slaked or in the state of lime-stone. See *Lime-stone*.

Effete Lime, the same as the above, or that which has been slaked by the air and moisture of the atmosphere.

Quick Lime, a term applied to lime in its most powerful or caustic state, before it has been rendered mild by the absorption of carbonic acid gas, or fixed air, from the atmosphere.

LIME-KILN, a sort of kiln, constructed for the purpose of burning lime. See *Kiln*.

LIME-STONE. a kind of calcareous stone which is capable of being converted into lime by means of calcination.

The remarks that have been already made, in speaking of the nature of lime, seem to shew that this sort of stone exists in different states of purity, and consists of different sorts of substances in different situations, from which much diversity in its effects, when converted into lime, is produced; some sorts being more proper for the purposes of agriculture, while others are better adapted to those of building, &c. &c. See *Lime*.

It may indeed be remarked, that all such sorts of lime-stone as contain impurities, such as clay, sand, or stony matter, in their compositions, are more proper in general for the purposes of agriculture than for those of building with. Where lime-stone is plentiful, and fuel scarce, it might be employed for the purpose of husbandry with great advantage in its uncalcined state, after being pounded or ground into a fine powdery form, by means of mills or other machines.

It is observed in the able Survey of the County of Perth, that in Rannoch, a district of that county very remote from coal, a machine was erected by the late commissioners of annexed estates for this purpose, which was driven by a stream of water. Mr. Stewart, of Crosmount, who saw the machine, the pounded lime-stone, and its effects on the land, favoured the author with the following remarks: "There were two pounders, and a third was afterwards added, all from Carron, at a small expence. The pounded lime-stone was carried from the machine by a small run of water to three different ponds, one above the other. The upper pond contained the grossest particles, and the lower pond the smallest or finest parts of the lime-stone, which resembled clay or marl from its smoothness." The middle pond contained that which it would appear Mr. Stewart thought to be properly pounded; because he adds, "the run of water might have been stronger, which would have enabled the mill to double the quantity grinded, which would serve the purpose of manure equally well, if not better, than by being pounded so very small. All that was pounded before the machine was carried off by a flood, or the most of it was used by colonel Alexander Robertson, uncle to the present colonel Robertson of Struan, who had a farm in the neighbourhood of the mill. The effects of it were visible upon the ground, which were shewn by the colonel to different gentlemen, and approved of." It seems, however, that before its virtues could be fully ascertained by repeated and varied experiments, a torrent in the brook that drove the mill carried all the machinery away, or at least deranged it so that it was never restored. There is, it is supposed, little doubt of its beneficial effects on land; or of its effects being more powerful, in one shape or other, than those of the same quantity of calcined lime-stone, because the virtues must be in proportion to the quantity of calcareous earth in each. Any given quantity of raw lime-stone loses one third of its weight when burnt into shells. Nothing is dissipated except the water: all the calcareous earth remains. It is also found, that any given quantity of shells produces double that quantity of powdered or slaked lime. Therefore a quantity of raw lime-stone, a bushel for instance, has double the quantity of calcareous earth which is in a bushel of slaked lime; consequently its influence, as a manure, must be double. What is commonly supposed, and the writer thinks with probability, by those who used both kinds, without making any accurate experiments, is, that the effects of the raw lime-stone are slow, but more lasting; of the calcined lime, more immediate, but less durable.

And it has been stated, in an useful periodical work,

the Farmer's Magazine, published at Edinburgh, that "the difference between lime-stone, fresh from the rock, and that which has been calcined, consists in the former possessing, as one of its principal component parts, a very considerable proportion of fixed air or carbonic acid, a principle, of which it is entirely deprived in the burning, if the operation is properly conducted; a circumstance well worth the attention of proprietors, as, in that state, its beneficial effects consist chiefly in the power it possesses of neutralizing acids, or decompounding metallic oxyds; but upon the animal or vegetable substances it meets with in the soil, it can produce no alteration." It is likewise added, that "many years ago, an attempt was made by Lord Kames to use unburnt lime-stone as a manure; the success of which, it is believed, has not been recorded; indeed, the trial would probably, it is supposed, prove abortive, if made upon moss, or moorish lands, which, owing to the great quantity of inert vegetable matter they contain, cannot possibly be benefited by any substance possessing less activity than quick or caustic lime."

At fig. 2. pl. III. is represented a machine for this use, that admits of being wrought by *steam*, *wind*, *water*, or the power of horses. In which *a*, represents a beam, supported by four strong posts joined together by transverse pieces of wood, as shewn in the figure, and, at the top, sufficiently separated to allow the wheel to work. *b*, a wheel, with a groove on the circumference, sufficiently deep to receive the beam, *a*, with a large iron spindle, or axis, moveable in a bush made of bell metal. *c*, a weight of a conical shape, of cast-iron; the base studded with knobs, or protuberances, about two inches long, of a diamond shape, terminating in a blunt point, and about five inches in circumference at the bottom. *e*, the face of the weight, or pounder, which is hidden from view in the cut. *f*, a circular building, sunk below the surface of the ground; the bottom prepared by a stratum of clay, well tempered, and mixed with a proportion of burnt lime-stone, powdered, without being slaked, and forge ashes beat very small. When this is properly dried, a bed of sand, about 18 inches in thickness, is laid about it, and paved with common paving stones, of the kind used for streets: which, after being well beaten down, is covered with another bed of sand, of the same thickness, which should be paved in the same manner, and afterwards well beaten down. The foundation of the building should be, at least, six feet below the common surface: which allows 18 inches for the clay, 36 inches for the two beds of sand, and 18 inches for the two courses of pavement. And the "circumference should consist entirely of hewn stone, at least the uppermost three feet of it; the stones of which should be strongly batted together with iron, and secured on the outside with numerous wooden posts drove into the earth, and different courses of pavement, extending at least six feet allround, carefully laid, and well beaten down. A floor prepared in this manner, if it is not used too soon, will resist any force that can be let fall upon it. The lime-stone laid into it, should not be too small, and should have a light bedding of sand, in soil, to give it stability. The building may be of any size, according to the powers of the machinery, and the weight of the beater."

It is suggested, that the pounding of lime-stone may be greatly facilitated by a very simple contrivance; merely that of kindling a fire, either upon the surface of the rock, or round any quantity of the lime-stone, after it is quarried, and exposing the stone to the heat of it for ten or twelve hours. During the heating, a great deal of it flies to pieces, and the remainder very readily gives way to the stroke of the hammer. It is also supposed, that considerable advantage may be derived from a machine of this kind, in reducing burnt lime-stone to a powder, before it is slaked by the action of the air, or moisture, as in that state, its operation upon the substances it meets with in the soil is much more considerable than after it has absorbed fixed air; and when employed in building, it cements immediately, and may be used with superior advantage in the construction of aqueducts, harbours, and other situations exposed much to water, and where hasty drying is of importance.

The expence of such a machine will vary according to circumstances, but it cannot be great, and in many places it may be added to threshing and corn mills, and the expence be greatly lessened.

The analysis of lime-stone may be effected in the same way as those of other calcareous materials, except that where the stone is of a hard and firm texture, it should be reduced into a state of powder in order to expedite its solution.

Where the lime-stone subjected to analysis, does not yield more than two-thirds of its weight of pure chalk, it can seldom be burnt, with profit; unless in a country where fuel is cheap, and lime is dear. Good lime-stone yields upwards of ninety per cent. That of particular quarries is almost wholly calcareous.

Lime-stone *Gravel*, a hard sort of calcareous marl, that assumes the appearance of small stones, or gravel, which, when spread upon the ground, and mixed with it, gradually falls into smaller pieces, and fertilizes the soil in proportion as it breaks down and mixes with it. It is a sort of manure little known in Britain, although it is common in many parts of Ireland.

After what has been already observed, little need be said as to the qualities or mode of applying this manure. The farmer will easily be able to perceive, that if the pieces of which this gravel consists are large, and dissolve but slowly, the quantity applied at one dressing ought to be great, and the effects will be slow and lasting; but, if the gravel be small, it will require a smaller quantity, which will operate more quickly, and last for a shorter time, like all other calcareous substances in the same circumstances, or which are applied in the same manner.

Lime-*work*, such works or kilns as are constantly employed in the manufacturing of lime. Mr. Marshall thinks it necessary, that the managers of estates should understand the nature of this sort of manufacture, though it is seldom necessary or eligible for a large proprietor of land to carry on his own lime

works, "unless during a limited time, at the outset of new works, to ascertain their value," as there are always enterprising men who will give more rent for a work, than the profits arising from it to a proprietor, even when under the direction and management of the most faithful person. They and the lands attached to them should rather, he thinks, be considered by such proprietors as farms, the building of kilns and sheds as erecting farm offices, and the laying out and constructing of roads, railways, &c. as general improvements of their estate; the tenants agreeing to work the quarries agreeable to articles, and to keep the kilns, building, and roads in states of proper repair.

LIME-TREE, a tree of the deciduous kind proper for walks and other decorations in parks, &c. and of which Miller has enumerated four species; all of which are easily propagated by layers, which, in one year, generally take good root, and may then be taken off and planted in a nursery, at four feet distance row from row, and two feet asunder in the rows. The best time to lay them down and to remove them, are when their leaves begin to fall, that they may take root before the frost comes on, though they may be transplanted any time from September to March, in open weather; but if the soil be dry, it is much the better way to remove them in autumn, because it will save a great expence in watering, especially if the spring should prove dry. In this nursery they may remain four or five years, during which time the ground between them should be dug every spring, and constantly kept clean from weeds, and the large side shoots pruned off, to cause them to advance in height; but the small twigs must not be pruned off from the stems, as these are by some thought absolutely necessary to detain the sap for the augmentation of their trunks, which are apt to shoot up too slender when they are entirely divested of all their lateral twigs. If the soil in which they are planted be a rich loam, they will make a prodigious progress in their growth, so that in three years' time they will be often fit to plant out where they are to remain. They may also be propagated by cuttings; but as this method is not so certain as by layers, the other is generally practised. In order to obtain proper shoots for laying down, a lime-tree is cut down close to the ground, from the roots of which a great number of strong shoots are produced the following year; these will be large enough to lay down the succeeding autumn, especially if the smallest of them are cut off close early in the spring; for, when too many shoots are suffered to grow during the summer, they will be much weaker than if only a sufficient quantity be left. The manner of laying down these shoots is merely that of pressing them down close to the ground, and covering the middle of them well with earth.

According to Mr. Nicol this sort of tree succeeds in the most perfect manner, in "low, deep, sub-humid loams," and that "in dry gravelly soils, it loses the beautiful gloss of its foliage for which it is so much admired in the early summer season."

The timber of the lime-tree is used by carvers, it being a soft light wood; as also by architects for framing the models of their buildings; &c. The turners likewise use it for making light bowls, dishes, &c. but it is too soft for any strong purposes. See *Planting*.

LINHAY, a provincial word applied in Devonshire to signify an open shed.

LINDEN-TREE. See *Lime-tree*.

LING, a provincial term applied to the plant usually known by the name of heath. See *Heath*.

LINIMENT, in *farriery*, a thin sort of ointment, or a soapy or oily composition, to be rubbed into or upon a diseased part.

Mr. Taplin directs the following for old spavins:

Take of cantharides, in fine powder, one drachm;
Olive oil, two ounces.
Mix them together.

Take of oil of origanum,
Oil of turpentine, of each half an ounce;
Camphorated spirits of wine, one ounce.
Mix them together by shaking the bottle.

This, he advises for wind-galls:

Take of soft soap,
Venice turpentine,
Fuller's earth, each a suitable quantity;
Brandy, enough to make the whole of due consistence.

Mr. Lawrence recommends this to be applied on tow:

Take of oil of turpentine,
Oil of bay, each four ounces;
Camphor, rubbed fine, one ounce;
Rectified oil of amber, three ounces
Tincture of cantharides, one ounce.
Mix them well together.

Or,

Take of Soap liniment, four ounces;
Spirit of sal ammoniac,
Tincture of opium, each one ounce.
Mix them together.

LINSEED, the seed of the flax plant. See *Flax-seed*.

Linseed *Cakes*, such cakes as remain after the expression of the oil from flax seed. They are at present much used in the fattening of cattle, sheep, and other sorts of live stock, and of course of great value and importance to the farmer. See *Oil-cake*.

LIPPITUDE, in *farriery*, a defluxion of a sharp humour from the eyes of horses, attended with a violent itching, pain, and redness; the eye-lid swelling, so as to turn the inside as it were outward: when the disease continues long the sight grows dull, and the eyes are frequently closed up. It usually attacks young horses at about five or six years of age; it comes and goes occasionally, and continues each time, more or less, from a week to a month; perhaps for two years or more, if neglected; when all the symptoms cease, but frequently end in a cataract. The humour often runs down the cheeks in greater or less quantities, and is so corrosive as to scald and destroy the hair: the veins in all the parts about the eyes are very turgid, sometimes the eye appears dull,

at others cloudy, then again clearer; but it is rarely sprightly. At other times the humour that distils is so thick as to close up the eye-lids for some time. The seat of this disease is in the glands on the inside of the eye-lids; and it may be observed, that if the eyes are of a good size, and well shaped, if they are clear, and the sight is good as soon as the sharp humours abate, if the returns are less violent and more rare, some hopes of recovery may be indulged; but if the eye shrink and grow dull, a cataract will certainly ensue.

In order to the cure, if the eye is not in a perishing state, and the horse in low condition, bleed; then, once in eight days, give a cooling purge; and, on the days free from purging, give diuretics, particularly nitre, to the quantity of two ounces in a day: and, in order to strengthen the relaxed glands and membrane of the eye-lids, many light scarifications may be made, with a lancet, on the inside of them, which turns outwards; then the whole eye may be washed two or three times a day with the following lotion:

Take of sugar of lead, half a drachm; camphire, one drachm; rub them well together with a little rectified spirit, then gradually mix them with a pint of water.

When by these means the sharp humour decreases, give the following alterative powder, every morning, for two or three months; then, after an interval of the same length of time, repeat it as before:

Take of crude antimony, half an ounce; calomel, one scruple; gum-guaiacum, in powder, two drachms; mix them for one dose.

When the blood-vessels of the eyes and the adjacent parts are extremely turgid, they may be well bathed, two or three times a day, with strong vinegar or a saturnine wash: and blood may sometimes be taken from the swollen vessels with great benefit.

If the eye seems to shrink, the following collyrium may be used two or three times a day:

Take of crude sal-ammoniac, two drachms; brandy, four ounces; lime-water, one pint; mix them to form a wash.

With this collyrium a more full and better diet may be employed, a moderate quantity of oats being allowed; as good nourishment and moderate exercise may give a favourable turn to the complaint; but hard labour should be universally avoided. Low keeping, after good and plentiful feeding, hurts the sight greatly; and hard labour, added to the sparing diet, aggravates the disadvantage very much. Colts are often made to go blind, by full feeding and too early hard working.

LIPS, the parts of an animal that form the mouth.

LIPS *of a horse*, the parts that constitute the mouth. It is observed by horse-jockeys, that if these be thin and small, they contribute to a good mouth; but that if they be large and thick, the contrary.

LIQUORICE, a plant of the long tap rooted kind often cultivated for medicinal and other uses in the field. It grows to about four or five feet in height; its stalks are hard and woody; its leaves small and roundish, standing together on the two sides of a rib, and making what botanists call a winged leaf. There are two species of this plant in cultivation, the *smooth podded* and the *prickly podded*; but they differ little, except in the seed-pods of the latter being armed with prickles. It is remarked by the authors of the Universal Gardener, that both these species are very hardy perennials, but that the first is the sort commonly cultivated for use, its roots being fuller of juice and sweeter than the other.

It is chiefly cultivated for the root, which is perennial, but the stalks rise in spring, and decay in autumn.

This plant delights in a deep light soil, in which its roots may run down three or four feet deep, and attain a large size, especially when permitted to stand three or four years. From the main root smaller ones generally run off horizontally; and from these horizontal roots, that run near the surface, cuttings for sets or young plants are taken for propagation, which are generally procured at the time when the liquorice is taken up for use, which is in about three years after planting. But cuttings for planting may be occasionally taken off before that period, if wanted.

At the time of planting the cuttings should be divided into lengths of six or eight inches, each having one or more good buds or eyes, being put into the ground any time, in open weather, from October till March; but from the middle of February till the middle of March is the best season for this work.

An open situation is always the most proper for a plantation of this kind.

In a paper in the *Museum Rusticum* it is observed, that this plant thrives best on a deep, loose, rich mould; and if it is fresh land, that has not for many years borne corn, the profit will be the greater, as the crop will be larger, and the roots of a finer quality. A rich sandy soil, provided it is deep, will do well for this plant; and it must always be remembered, that too much moisture is its greatest enemy; let no one therefore, says the writer, attempt to plant it on a damp clay, lest the whole crop be cankered.

The ground intended for liquorice should be trenched two or three spades deep, if the depth of the soil will admit: then having the sets ready, proceed to plant them by line and dibble, planting the sets a foot distant in each row; putting them perpendicular into the ground, with the tops about an inch under the surface, and let the rows be a foot and a half asunder; though some scarcely allow more than twelve inches between row and row. A crop of onions is also sometimes sown on the same ground the first year, which, as the roots of the onions are slender, and the stems spread but little at top, may be done without any detriment to the liquorice, or the onions, as the former seldom rises above ten or twelve inches high the first summer. The ground must be kept clean from weeds during the summer season by hoeing; and if there is a crop of onions, the small hoe should be employed, cutting them out to four or five inches distance, and clearing away all such as grow immediately close to the liquorice plants; and when they

are gathered, give the ground a thorough hoeing with a large hoe, to loosen the surface, and destroy all weeds effectually. In autumn cut down the decayed stalks of the liquorice, and nothing more is necessary till spring. But in February or March a slight digging should be given between the rows, and, during spring and summer, all weeds kept down by broad-hoeing; and in autumn, when the stalks are in a decaying state, they must be again cut down to the surface of the earth, as has been just observed. The same management must be repeated every succeeding year; but after the first or second year, the stalks of the liquorice will shoot strongly, and soon cover the ground, so as to retard the growth of weeds in a great degree. Likewise every autumn, about October, when the stalks begin to decay, and they have been cut down to the ground, as has been advised above, they should be wholly cleared away. It is remarked, in the paper quoted above, that land cannot be made too fine, or dug too deep for liquorice; that it should be, at least, moved with the spade to the depth of two feet and a half, and if a little deeper so much the better. And that if the land on which the liquorice sets are to be planted is fresh, rich, and in good heart, it needs no manure for the first crop; but that if it has been for some years in tillage, the planter will do well to give it, in the summer time, a good dressing of very rotten dung, lime, and coal-ashes or soot, mixed together, some months before, into a compost; the quantity must be regulated by the state of the land, always remembering that this plant requires a great deal of nourishment, and is a great impoverisher of the soil, though it extracts much of its nourishment, or food, from a considerable depth.

When the ground has been properly prepared, and reduced to a very fine tilth, and laid level, some sets are to be procured. These, according to another writer, must be planted in rows, with dibbles armed with iron points. He makes his rows two feet asunder, puts his sets fifteen inches from each other, and when three rows are planted on a six feet bed, he allows two feet more of interval betwixt bed and bed. And when he puts in sets with a dibble, he leaves the upper end of each set just level with the surface of the ground: and when the whole spot of ground is planted, he makes his labourers dig up the intervals one spit deep, and spread the earth on the beds; which raises them about two inches above the heads of the sets, which by lowering the intervals, serves in wet seasons to drain the beds. He generally contrives to get this work done by the last week in September; but in favourable years, the middle of October is not too late. If the weather proves mild, he has no further trouble with them during the winter; but if it is likely to freeze hard, he covers the beds with pease-haulm, or long dung, or some such matters, to forward the growth of the roots in the spring, and protect them during the winter from the frosts. Early in the spring, on the first appearance of the weeds, he allows his liquorice a thorough hoeing, and this is several times repeated in the dry weather of the summer. The winter following he again covers them with long dung, and in the spring, before the roots begin to shoot, he has the spaces betwixt the rows on the beds loosened with a spade, and the intervals well dug; immediately after which, he gives the land a slight dressing of coal-soot, sown by hand: this, he says, should be thick enough to make the land look black; which, by the first rains washing it in, greatly warms and invigorates the plants. The second and third summers it is only necessary to keep the crop clear of weeds.

About the third year after planting, the roots of the liquorice will be in a state to take up; and the proper season for this is any time from the beginning of November till February, as they should neither be taken up before the stalks are fully decayed, nor deferred till late in the spring; otherwise the roots will be apt to shrink and diminish in weight.

The mode of taking up the liquorice roots is by trenching the ground, beginning at one end, and opening a trench close to the first row three spades deep, or to the depth of the roots; at which work, three or four spadesmen are generally employed at each trench; one goes on with the top spit, a second with the next spit, another with a third spit, and the fourth spadesman commonly gets to the bottom of the roots, having a mattock to assist him occasionally in clearing them, and, as he takes them up, throws them on the top of the ground. In this way they proceed from row to row, till the whole plantation is taken up. The small side-roots are then trimmed off, and the best of them divided into lengths proper for fresh sets, and the main roots tied in bundles for the purpose of sale. It is of much consequence to sell them as soon as possible after they are taken up, as they are apt to lose much of their weight by keeping.

After a crop of this root has been taken up, if it was planted on fresh land, the same writer generally prepares the same ground to yield another crop; and this takes up nearly a year.

He first gives it, during the winter, a thorough good dressing of well-rotted dung, mixed with lime; of this he lays on large quantities, still having regard to the condition of the soil, and ploughing it well in the ensuing summer. In such loose soils as are proper for this plant, there is no occasion to dig the land for this crop a second time, the taking up the roots having stirred it to a sufficient depth: this, with three or four summer ploughings, is as much as is necessary. In other respects he manages it the same as for the preceding crop.

But if the land which has borne a crop of liquorice-root was not fresh when it was planted, but had been some time in tillage, he scarcely ever chooses to plant it again with the same crop, without allowing several years to elapse.

In whatever way this crop is cultivated, it should be kept perfectly clean by effectual hoeing in May and June, and for this reason it is better not to sow onions, or any other small plants upon the land with this sort of plants. In the liquorice husbandry the land should likewise be very highly manured, and be kept well water-furrowed, for the spring months.

In order to discover how much liquorice-root is

wasted by being kept in dry places, the writer quoted above made choice of a piece of single root 13 inches long, and full $\frac{3}{4}$ inch diameter throughout, which weighed five ounces; and nine small roots, 13 inches long each, and from $\frac{1}{4}$ to $\frac{3}{8}$ of an inch in diameter; they weighed also five ounces. All these were put into a drawer in a dry room the beginning of February, and were weighed the beginning of August following, when the largest single root weighed two ounces and three quarters, and the nine small roots also weighed full $2\frac{3}{4}$ ounces; so that in six months these roots lost almost half their weight. They were green and juicy when put into the drawer, and were now pretty dry and hard, but not quite so dry and hard as some of the same liquorice that had lain all that time in the open room. But liquorice may be kept in moist sand, or laid in the earth as long, with very little waste or loss of weight.

As liquorice is an upright growing plant, and not apt to lodge, and its roots descending deep, it is very proper for the horse-hoeing culture, in which it will probably arrive to greater perfection than in the usual method of cultivating it, as described above.

In Yorkshire, where liquorice is cultivated in rich sandy soils, its roots sometimes penetrate to the depth of three or four feet, sometimes more; but the digging of the ground all over to that depth, when it is taken up, is very expensive. As a saving in this respect, the planters, in digging up the ground, lay it in a proper form, and replant it, making one digging serve for both purposes, which is a good method; but they set the plants much too close, whereas, if they planted them in rows, at about four feet distance, and horse-hoed it, the weeds might be destroyed, and the land greatly improved, especially if trench-hoed; and the produce would probably be very great, after so full a preparation of the land. And in addition to this, it may be observed, that this method of cultivation is much cheaper than by hand-work.

LITTER, the straw, fern, or other dry substances, that are placed under horses, cattle, &c. in the stables, cow-houses, farm-yards, or other places for the purpose of keeping the animals clean, and the providing a large supply of manure. In this last view, all sorts of dry materials should be carefully collected, and stacked up for winter use. And it is of vast importance, in different views, to have it properly employed in foddering the cattle as well as in littering them down in the stalls and yards, as without proper economy, much disadvantage may arise to the farmer in the way of converting it into manure. See *Soiling* and *Farm-yard*.

Merely as litter, wheat-straw is always to be preferred for horses; but for cattle and other animals, the other sort of straw, fern, &c. may answer equally well.

LIVE HEDGES, such as are constituted of living materials, such as white-thorn plants, &c. See *Fences*.

LIVE STOCK, that sort of animal stock which is raised or kept upon a farm, either for the purpose of use or profit. It comprehends all sorts of domestic animals, whether those of the cattle, horse, and swine kinds, or those of the rabbit and poultry sorts.

It has been well observed, by the able writer of one of the Reports of the State of Agriculture for the Board, that this subject "is, perhaps, the most important in the whole range of rural economics. The poorest and most backward nations, says he, contrive to raise bread for their consumption, equal to the demand; and to increase the quantity with the increase of their mouths. Their wheat, in the most miserable husbandry, is nearly equal, and much of it superior, to that of our highly cultivated fields; and we feel constantly in our markets the effect of their competition: but with all that concerns live stock, the case is abundantly different; it is by great exertions only, that a people can be well supplied, and for want of such exertions, many nations are forced to content themselves with such meat as others would not touch. Look, continues he, at a sample of French and Swiss wheat, no difference is found; but examine the cows of Swisserland and Lorraine, what a difference! Compare the mares of Flanders with the ponies of Bretagne, the sheep of England and of France; nay, let us come nearer home, and reflect on the wool in competition; examine the fleeces of Segovia and of Italy, in the same parallel of latitude." And it is added that, "next to the cultivation of waste lands (which, by the way, much depends on the well ordering of live stock), this, he conceives, is the greatest desideratum in the agriculture of Britain."

It has likewise been remarked by the author of Practical Agriculture that there is scarcely any branch of husbandry that is of more consequence to the farmer, or which, of late, has been more attended to and improved. He supposes, indeed, that it might easily be imagined, that as the means of supporting domestic animals became more perfecly known and more extensively provided, great and beneficial changes would take place in the nature, form, and other properties of the animals that were to be kept for the purposes of the farmer, and consequently advantages be derived both in the amelioration of the land and the improvement of the live stock, which it supported. It is also conceived, that the greatly increased demand for this sort of stock, either for the purposes of food or labour, may have likewise had much effect in promoting and forwarding their improvement; but that, though much has lately been accomplished in this important department of rural economy, much still remains to be done, which may in some measure be effected by the judicious combination of proper improved breeds of animals of different kinds, with the various improvements in the cultivation and management of herbage or other sorts of green food by which they are to be supported.

It has been justly contended by Mr. Middleton, that, where it is intended "to attempt any considerable improvement in the nature of the live stock of a farm, care should be previously taken, that there is a sufficient degree of shelter, shade, and warmth, as well as a high degree of fertility of the land, and a

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suitable state of drainage, as it is only by the richness and abundance of food that such changes can be effected in the most advantageous way, or the stock be brought to any high degree of perfection." The circumstances which are to be more particularly considered, in undertaking improvements in the nature of live stock, especially in what relates to themselves, are those of the shape, the size, the disposition, the hardiness, the arriving quickly at maturity, the peculiar nature of the flesh, the property of fattening with expedition, the affording milk in sufficient plenty, the quality of the hide, the fitness for performing labour, and the particular quality or nature of the breed, of whatever sort of animal it may be. All of which will be particularly considered in explaining the nature and methods of management that are the most proper to be adopted in breeding, rearing, and bringing to perfection different sorts of animals of the domestic kind for the uses of the farmer. See *Breeding*.

In the introduction of all sorts of live stock upon a farm, the cultivator should constantly and carefully consider the nature and extent of his keep, or the means which he has of providing them with proper supplies of proper kinds of food, as on this, the size and other properties of the animals must in a great measure depend. The idea of good keep is constantly necessary to be kept in view, as without it, little can be effected in this part of husbandry. It has been forcibly remarked by the writer of the Staffordshire Agricultural Report, that "all good stock must be both bred with attention and well fed; and that it is necessary, that these two essentials in this species of improvement should always accompany each other; for without good resources for keeping it would be in vain to attempt supporting a capital stock, and with such resources, it would be absurd not to aim at a breed somewhat decent in quality." This sort of improvement must, however, be much regulated by the circumstances of the farmer, and be often only gradually effected on account of the want of money for the purpose of making a more full change in the stock of the farm.

The intelligent author of the Agricultural Report for the county of Perth, has stated, that "there is one circumstance, relative to the introduction of all new breeds, which must not be passed over in silence, because no farmer can neglect it without certain loss. Every kind of pasture is fitted to raise animals to a particular size. When beasts of a larger size are brought in, than the quality of the food is calculated to support, these animals, whether cows or horses or sheep or any other kind, will degenerate apace, and never prove useful, until they come down to that standard or size adapted to their situation and suited to their food." And that, "on the other hand, when a smaller breed than ordinary is brought in, they continue to increase in bulk, until they come up to the pitch which is suited to their nourishment. But there is this remarkable difference betwixt these two progressions, in respect of profit, that in the retrograde progress, when animals are brought from rich pasture and a comfortable situation to the reverse, they are in every instance worse than the indigenous breed; whereas the animals, which are brought from worse to better, continue to improve, till they arrive at that perfection, which the change in their situation is calculated to produce. These causes may not, he says, immediately have their full effect; but in a few years they certainly and evidently shall. He makes, for this reason, a much safer experiment, he thinks, who brings cattle from worse to better, than he who brings them from better to worse.—This reasoning, he says, applies to all plants, as well as animals. —Highland cattle rise to a great size, not only by the keeping in South Britain, but in rich pastures at home." And he adds, that it is "in vain to attempt to improve a breed of animals beyond the circumstances of the country as to climate and pasture; while, at the same time, it is no easy matter to discern, without proper trials, how far these circumstances can support a better stock. Here is great room, he supposes, for the ingenious to exercise their judgment in improving the breeds of different animals. One species has evidently, he says, degenerated in this country, by a change in their situation to the worse. The red or forest-deer is but a puny animal in comparison of those of former times. This will be apparent to any person, who compares the horns of a deer that is killed at present to those of the same species, which are in different places dug out of the mosses. The cause is obvious." It is therefore conceived that "the improvement of the soil ought to go hand in hand with the introduction of a larger breed of cattle; and a large breed ought, for the same reason, to be introduced, in that degree, in which the style of agriculture is improved."

And in support of this, it has been stated by Mr. Middleton in the Agricultural Report of Middlesex, that the "richest grazing land and the most nourishing artificial food, will certainly pay more in feeding large bullocks, sheep and swine, than it would do in feeding the smaller sizes of the same species," and that "it is equally obvious that the smaller breeds will answer better on the poor pasture than the large."

The particular qualities which the farmer has in contemplation, is likewise a point which must be attended to in the fixing upon breeds of domestic animals for particular farms.

In considering the various breeds of domestic animals, as the machines by which the farmer is enabled to send his herbage and other sorts of food to market, Mr. Donaldson thinks he ought, by the study of every proper mean, to advance their improvement, in respect to form as well as the disposition to fatten, that the produce of his farm may be disposed of in the most advantageous manner; and that besides the benefit he would derive individually, from their being thus rendered less tedious in the process of fattening, and less productive of offal, the community would gain vast advantage in the great increase of animal food.

When proper sorts of live stock have been intro-

duced according to the particular circumstance of the land, the farmer should be extremely careful in the management of them, whether they be of the cattle, sheep, or other kinds, in the providing them with due and full supplies of food, whether in the changes of pasture during the summer season, or in that of other sorts in the winter, so as to keep them constantly in a proper thriving condition; in affording them suitable degrees of shelter and warmth, and in having them properly littered down, when confined to the yards or stalls; and under all circumstances well supplied with good water; as all these have much effect in promoting the improvement of the stock, and of course that of the advantage of the farmer: different methods are pursued in different districts, with this view, in animals of different kinds, which will be particularly noticed under the head of live stock to which they belong. See *Cattle*, *Sheep*, *Horse*, &c.

In various districts of the island, great advances have been made to a more perfect state in the nature of different sorts of live stock, by selecting and employing the best and most perfectly formed animals, both male and female, but especially the former, as stock to breed from; and in the midland as well as some other counties, vast advantage has been gained in the same view, by the practice of the large and more opulent breeders and graziers letting their superior male stock, of different kinds of animals; and it would probably still further promote this material object, if the more extensive proprietors of lands were attentive to the circumstance, by either providing such male stock themselves, or enabling their tenants effectually to do it, where their situations render it impossible. By some well concerted plan of this nature, a great and general change, so as to render the different sorts of domestic animals much more perfect than they are at present, as well as better adapted to their situations, might be effected. But without some sort of aid of this kind it does not seem probable, from the great expence attending the business, that any *general* improvement of them can take place, though it may be carried to a considerable extent in particular cases.

LIXIVIUM, the liquor made by the solution of pot-ash, or ashes of any burnt vegetable, in water, which is more or less pungent and penetrating in proportion as it is impregnated with the saline matters.

LIZENED *Corn*, a term provincially used for shrunk or lank corn.

LOAM, an earth or soil composed of dissimilar particles such as are hard, stiff, dense, and rough to the touch, mostly constituted of sand and a tough, viscid, earthy substance, in different proportions. According as one or other of these ingredients predominate, we have loams of different qualities, as friable or mellow, middling and heavy loams. See *Soil*.

LOAMY *Soil*, that sort of soil into which loam enters in a considerable proportion. They are distinguished by many different names and colours. See *Soil*.

LOBBY, a sort of narrow confined place, formed either by hedges and trees, or other kinds of fencing, near to the farm yard, for the purpose of confining live stock. It is observed by Mr. Marshall, in his Minutes of Agriculture in the Midland Counties, that "every farmery ought to have a lobby and a croft appending to it, serving as a double fence; thereby preventing stock from running over, poaching, and injuring the farm: the latter for calves, a saddle horse, and invalids. He found, he says, the conveniency of a lobby in Surrey, and the want of one in Norfolk, and in this district; he can foresee the use of that which he is forming, with a skreen of planting;—embosoming the entire farmery, in such a manner as to shelter it effectually from the north and east winds."

LOCK, a well-known contrivance for securing doors, gates, &c. which is formed in various ways.

LOCKED JAW, in *farriery*, a disease of the tetanic or spasmodic kind, to which horses of all ages are exposed. It is more frequent and severe in hot than in cold climates. The most common causes of it are, punctures of different tendinous parts accompanied with some injury of the nerves supplying such parts, and producing an universal irritation of that system, attended with a greater or less degree of spasm in the whole of the muscular powers. The operations of nicking and docking also occasion it, especially the latter, and particularly in frosty or other very cold weather. The other causes are, cold applied to the body when hot; and journeys in bad weather, after having been indulged a long time with a hot stable and hot clothing. Such horses as are pricked in shoeing are also liable to the disease. And from the sympathy known to exist between the stomach and the brain, botts and other worms have been supposed sometimes to give birth to this disease, by adhering to and wounding the nervous coat of that organ. But the disease frequently happens without any apparent cause. It sometimes proceeds to a high degree suddenly; at other times very gradually. But previously to an absolute state of locked jaw, some rigidity is mostly perceived in the muscles of the neck: as this proceeds, the extremities begin to undergo a similar effect; the legs become stiff, and are drawn much apart; the ears and tail are erected, the nostrils expanded, and the eyes fixed, displaying, in appearance, an unusual and considerable fire and animation. Much difficulty seems to be experienced in swallowing, the muscles of the belly are strongly affected with spasm, and the body is drawn or tucked up. The bowels are generally obstinately costive, and the respiration is usually more or less affected. There is a deficiency in the secretion of the urine, but no diminution seems to take place in the state of the appetite.

In the cure of this disorder, the greatest extremes of heat and cold have been recommended; such as supporting a high state of perspiration in the animal for several hours, by covering the body with blankets, &c. or immersing it for some time in snow or cold water. But these means have not been attended with much success. The most effectual remedy is probably opium, in large doses. It may be given in very

large quantities, in these sorts of diseases, without being attended with any hurtful effects. The doses ought to be often repeated, as the power of them appears to wear off, and be varied with other powerful stimuli. In the early state of the disease, when there is an inflammatory propensity, bleeding is required; but without this precaution the practice is improper. A costive state of the bowels tends to aggravate the complaint; so that, by relaxing them, a relaxation in other parts may be perhaps induced. Therefore when not prevented by the closeness of the jaws, or the difficulty of swallowing, and costiveness exists, the following drench may be given at short intervals, until it operates:

Take of thin gruel of oatmeal, one pint;
Castor oil, or
Olive oil, twelve ounces;
Glauber's salt, four ounces;
Dissolve the salts in the gruel, while warm, and afterwards mix the whole into a drench.

And as no time must be lost in this sort of disease, the following ball should be given every three or four hours, or as found requisite.

Take of purified opium, three drachms:
Salt of hartshorn,
Camphire, each half an ounce;
Syrup, sufficient to make a ball.

Laxatives are also beneficial in counteracting the astringent quality of the opium. In the more severe states of the disease, when the jaws are so closed as to prevent the admission of medicines, the only means are those of the introduction of them in clysters. Of these, a laxative one, such as the following, may be given, as there may be occasion:

Take of thin gruel, four quarts;
Common salt, six ounces;
Olive oil, or
Hog's lard, four ounces.
Dissolve them together, and administer them in the usual manner.

The quantity of opium that may be safely employed in this form has not been well ascertained, but it may probably be pretty large.

Take of Oatmeal-gruel, one quart;
Purified opium, six drachms;
Spirit of hartshorn, one ounce and a half;
Camphire (previously rubbed into a soft state with a little spirit of wine), one ounce.

First, dissolve the opium in the gruel, and then mix the whole well together.

It should be contrived that these opposite sorts of remedies should interfere as little as possible with each other, as they cannot be properly employed together.

With respect to the use of cold water, the most efficacious method would probably be that of pouring large streams of it on the animal. This process should be continued for a considerable length of time, perhaps ten or fifteen minutes. And when the complaint returns with any degree of violence, its application should be repeated: immediately after the application of the cold water, the skin should likewise undergo a diligent and general friction until it is dry; the animal being then moderately clothed. As horses in this state, have generally the inclination, though perhaps not the power to eat, they should be supported by substantial gruel, given, when they are incapable of swallowing, by the anus.

It is, however, probable that in many cases at least milk, gruel, broths, and even porridge, might be conveyed by injection between the intervals of the teeth, and be drawn in, in some quantity, by the animal, provided the power of swallowing be not impeded.

It has been thus endeavoured to direct such means of relief as have appeared to offer the greatest prospect of success. All rational experiments to effect the removal of a malady, usually fatal in its termination, are certainly deserving of attention; and he who is fortunate in such researches will have a weighty claim on the gratitude of society.

The use of strong ointment of quicksilver, so as to produce and support a degree of salivation, is, we believe, an experiment that has not yet been tried on the horse, or other animal, though it has been found useful in man.

The warm bath, if it could be used extensively, might be of benefit. Where locked jaw is supposed to have arisen from the operation of docking, it is usually the practice to remove another portion of the tail; afterwards applying such dressings as are most likely to hasten a free discharge of matter from the stump. And the same dressings may be recommended when nicking is suspected to be the cause of the disease, and the extremity may also be surrounded with a large poultice. Where the disease arises from the foot having been pricked in shoeing, the wound should be opened freely to the bottom with a drawing knife; the actual cautery may then be applied, and the part scalded with a little turpentine as a dressing. All punctures should also be laid tolerably open, and a digestive be applied; and, where an inflammation and swelling attend, fomentations are sometimes requisite. But these topical means alone are never to be fully depended upon; but must be invariably assisted by the remedies recommended above.

Should it be believed that botts, or other worms, lodged in the stomach or intestines, have produced the disease (a circumstance which is, perhaps, difficult to determine), a drachm of calomel may be given in one of the balls, or an ounce of the strong mercurial ointment may be dissolved in the first anodyne clyster, and be injected.

Mild cases of this sort are said to have been removed by exposure to cold air alone, but we believe that in general the disease proves fatal.

Locking *of Wheels*, the means of fastening them so as to prevent their running too swiftly upon the horses, when coming down steep hills. This is effected in various ways; as by chains, sledges, friction, bars, &c. See *Cart*, *Wheel*, and *Waggon*.

LOCUSTA, a term applied to the outer covering of the flower and grain of corn, which incloses the chaff. It also signifies the grasshopper.

LODE, a provincial term applied to signify *Ford* in some districts.

LOE, a term used to signify a little round hill, or a heap of stones.

LOG, a large shapeless piece of wood.

LOKE, a provincial word used in Norfolk for a close narrow lane.

LOLIUM, a genus of grasses, of which there are several species, some of which are highly useful to the farmer.

Lolium *perenne*, the botanical name of darnel or ray-grass: it has a perennial fibrous creeping root. The stems, several from the same root, prostrate or oblique at the base, but the flowering stem upright, smooth, from six inches to eighteen, twenty and twenty-four inches in height, according to the soil: they have several joints near the base, at a small distance from each other, but on the upper part only one or two.

On a great number of plants of a middling size three joints, and never more than four, were counted by Miller, the flowering-stem running up from eleven to fourteen inches above the last joint. They are frequently russet-coloured at the joints; the leaves are four or five inches long, and from two to four lines wide, lengthened out into a point; the leaf on the stem above twice as broad as those next the root and on the runners. The sheath covers the stem for several inches above the upper joint; both that and the leaves are smooth. The flowers are in a spike, which is from four to six or seven, and even nine inches in length, composed of many (ten to eighteen) spikelets, ranged at a little distance from each other, in two rows alternately along the rachis or common receptacle. The spike is generally flat, but sometimes nearly cylindrical; and it sometimes shows a disposition to become branched, particularly towards the bottom. The rachis is flexuous, or changes its direction in a curve line from one spikelet to another; and each spikelet being ledged at the base in a hallow of it, has no occasion for an inner valve to the calyx for protection, and therefore is not provided with one. The number of flowers in each spikelet varies from three or four to six, seven or eight, and even sometimes nine, ten or eleven; but six or seven is the most common number. The valve of the calyx tapers to a point; and the terminating calyx is two-leaved. The two inner husks, which are the valves of the corolla, are both of the same length, or nearly so. The germ is placed between the upper of these, and two small white semitransparent substances, which Linneus terms the nectaries: the seed easily quits the chaff, or covering. It is called in English *Ray-grass*, from the French *Ivraie*, which is their name for another species, this being termed *Fausse Ivraie*. It is corruptly termed by farmers Rie or Rye-grass, but it bears no resemblance to Rie, or Rye, that being a name appropriate to a very different grass (*Hordeum pratense*). It has likewise by Ray been distinguished by the title of *Red Darnel-grass*; and in some places it is called *Crap*, in Devonshire, *Eaver*, in Norfolk, *White Nonesuch*.

There are several varieties of this grass, which differ chiefly in the size or colour of the stem and spike as well as the number of flowers in each spikelet. Also the flowers are now and then found with awns or beards; and the spikelets are also sometimes clustered, and sometimes branched, or divided.

It is a sort of grass that has been long in cultivation as an early pasture and hay grass. See *Ray-grass*.

LONG-HORNED *Cattle*, a breed of neat cattle, which is chiefly distinguished by the length of the horn, the thickness and firm texture of the hide, the length and closeness of the hair, the large size of the hoof, and the coarse leathery thickness of the neck. It is sometimes termed Lancashire breed. See *Cattle*.

LONG-JOINTED, a term, applied to a horse, which denotes that his pastern is slender and pliant. Long-jointed horses are said to be subject to wind-galls.

LOOP, a hinge of a door or gate.

LOOSENESS, in *farriery*, a disease distinguished in the horse, by a frequent discharge of feces, accompanied with pain, restlessness, and loss of appetite. After the second day the discharge is chiefly mucous, or mixed with small and large lumps of feces, covered with an oily matter. And according to Mr. Denny, when the disease has been too long neglected, and the discharge becomes involuntary, accompanied with coldness of the legs, a fatal termination generally ensues. He considers the disease as arising from debility, mucus irritating the intestines, violent exercise, drinking large quantities of cold water when the body is heated, and, lastly, from worms. But it sometimes occurs after acute diseases, and in such instances frequently proves salutary; but others, arising from various causes, ought, if possible to be removed. They, vary, so as to require different modes of treatment.

In a *critical diarrhœa*, which is accompanied with debility, the more powerful astringents should be avoided, and such gently stimulating remedies be only employed as have a tonic effect in restoring the healthy functions of the bowels. For this purpose, the above writer advises the following ball to be given:

Take of Calomel, one drachm;
Aloes,
Cinnamon,
Ginger, each two drachms;
Treacle, sufficient to make a ball.

And in the course of twelve hours after, to give the following ball, repeating it morning and night:

Take of coriander seeds,
Caraway seeds, in powder, each half an ounce;
Ginger,
Rhubarb,
Armenian bole, each two drachms;
Treacle, as much as is sufficient to make a ball.

During this period, the diet should consist of oatmeal

mashes, and bran, or malt, not made too moist: and a little bran may be boiled in the water intended for drink, which should be given only in small quantities. When the disease arises from violent exercise, or from drinking large quantities of water, it is advised to have recourse to the following draught, and to repeat it as there may be occasion every six hours.

Take of Cinnamon,
Cloves,
Ginger, in powder, each two drachms;
Brandy, four ounces;
Tincture of opium, two drachms;
Gruel, one pint:
Mix them.

The body of the animal should be well rubbed with flannel, and be kept warmly clothed; giving a warm mash soon afterwards. A good allowance of bedding should be given, and the stable be kept quiet, to induce rest. But where this management cannot be complied with, the following mixture should be given every three hours, until the disease abates.

Take of caraway seeds,
Coriander seeds, each, bruised, one ounce;
Ginger, in powder, two drachms;
Gruel, two quarts;
Boil them for eight minutes; then strain them, and add
Tincture of opium, two drachms;
Mix them, and let the whole be immediately given warm.

The most striking symptoms of this disease in neat cattle are, according to Mr. Downing, great irritation in the bowels attended with slimy bilious or a black discharge, but which is sometimes limpid or fluid, at others frothy, greasy, or mixed with a fattish, clayey substance; being attended with want of appetite, dull countenance, harsh dry skin, and sometimes with fever. It is supposed, that the first stage is a companion of what is termed the *joint yellows*.

Take of mutton suet, one pound;
Oil of turpentine, four ounces;
Boil the suet in three quarts of milk, till it is dissolved, giving the whole at night a little warm.

And in the morning, the following:

Take of pomegranate powder eight ounces;
Logwood, in powder,
New pipes, pounded,
Peruvian bark, in powder, each two ounces;
Roch alum, in powder, six ounces;
Mix them together, and let them be given in two quarts of old ale, and repeated every other day; the animal fasting an hour or two, both before and after taking it.

Another remedy of this sort may in some cases be found more useful:

Take of calcined oyster shells, in powder, four ounces;
Pipe clay, in powder, one ounce;
Oak bark, in powder, two ounces;
Grains of Paradise,
Roch alum, each one ounce;
Mix them together for one dose, which should be given in a mixture of a quart of old beer, and a pint of red port wine, or in the same quantity of tan-pit liquor.

According to the same author, where there is a violent flux attended with inflammatory symptoms, the beast being taken with violent pains, resembling the gripes, the eyes and inside of the mouth appearing much inflamed, often lying down, and arising suddenly, purging very much, the dung appearing of a darkish or coffee colour, with a very offensive smell, more so than in the preceding case, the following may be found beneficial:

Take pomegranate powder, three ounces,
Rhubarb in powder one ounce,
Diascordium, one ounce,
Alum in powder, two ounces,
Grains of Paradise in powder, one ounce,
Aniseed powder, two ounces.

Mix them together for two doses, giving one of them immediately mixed in a pint of red wine, and one pint of good ale, a little warm; repeating it every ten or twelve hours, as there may be occasion. This state is often called the *Plague* in the guts, by farriers.

During this course the beast should be kept warm, giving it two or three quarts of rice milk twice a day; and at different times an ounce of nitre, dissolved in about a gallon of warm water. And mashes made with malt, bran, or scalded oats, as soon as it can take them, will be proper food.

LOP, a term signifying to prune or cut away.

LOPPED *Milk*, such as has stood till it becomes sour and curdled.

LOPPING, the operation of cutting off the lateral or other branches of trees. Most old trees are found hollow within, which frequently proceeds from the fault of those who have the management of them, by suffering the tops to grow too large before they are lopped; and this is common in the ash, elm, hornbeam, &c. It is done in order to have more great wood; but the cutting off great tops often endangers the life of the trees, or wounds them so that they yearly decay more in their bodies than the annual value of the tops; hence it is to the loss of the owner to have them so managed; and though the hornbeam and elm will bear great tops, when the body is little more than a shell, the ash, when it comes to take wet at the head, and decays, rarely bears any more top. When timber trees of this kind decay, they should be cut down as soon as possible.

But the lopping of trees at ten or twelve years old, in general, preserves them much longer, and occasions the shoots to grow more into wood in one year, than they do in old tops in two or three. As great boughs, ill taken off, often spoil trees, they should always be taken off close and smooth, and not parallel to the horizon, which is a common practice.

When trees are at full growth, the signs of their decay are the withering or dying of many of their top branches, and the wet entering at some knots,

or their being otherwise hollow or discoloured; also by their making but poor shoots, and the woodpeckers making holes in them.

The above method of lopping of trees is only, however, proper for pollard-trees; nothing being more injurious to the growth of timber trees than lopping or cutting off great branches from them. Miller observes, that whoever will be at the trouble of trying the experiment upon two trees of equal age and size, growing near each other, by lopping or cutting off the side branches from one of them, and suffering all the branches to grow upon the other, will in a few years find the latter to exceed the former in growth in every way, and not decay nearly so soon.

All sorts of resinous trees, or such as abound with milky juice, should be sparingly lopped, as they are subject to decay when often cut. The best season for lopping trees of this sort is in the autumn, at which time they seldom bleed much, and the wounds are commonly healed over before the cold weather comes on.

It is generally recommended not to prune timber-trees at all; and, where they naturally grow straight and regular, they are much better let alone. But all common faults in shape may be regulated by lopping them while young, without any ill consequences to the timber.

The very large forest trees should not be lopped at all, except in cases of great necessity, and then only the side branches should be removed, which must be done as close to the trunk as possible.

LOTUS, a genus of plants of the bird's-foot trefoil kind, of which there are several species, some of which may be cultivated for the purpose of cattle food.

Lotus *Corniculatus*, which is a plant that has a perennial tapering root which strikes deep: there are several trailing herbaceous stems, slender, bluntly four-cornered, procumbent except where supported, as in meadows or among bushes, from six or seven inches to a foot and a half in length; varying even more in different soils and situations. The leaves are ternate, petioled, one at each joint, the leaflets differing extremely in form, in the several varieties, from bluntly ovate to linear-lanceolate. The stipules resemble the leaves, but they are more pointed, and are rather lanceolate than ovate. The flowers grow in flatted heads resembling umbels, on peduncles from two to three inches and a half in length, but on pedicels hardly a line long. There is a single sessile ternate leaf at the base of each head without any stipules; and sometimes there is only one leaflet or two: the number of flowers varies from three or four to twelve or thirteen.

It is found in meadows, pastures, and heaths, flowering in June. It is said to be cultivated in Hertfordshire as pasturage for sheep; and it makes extremely good hay; growing in moist meadows to a greater height than the trefoils, and seems to be of a quality equal, if not superior to most of them. In common with several other leguminous plants, it give substance to the hay, and perhaps contributes to render it more palatable and wholesome for cattle. Dr. Anderson affirms, that every sort of domestic animal eats it in preference to every other plant: it seldom comes to flower in pasture grounds, unless where they have been saved from cattle for some time. What first recommended it to his notice was, he says, the having observed it to grow and flourish in poor ground; as in the midst of a barren moor, where the soil was so poor that even heath could hardly grow: upon bare obdurate clays: in dry and barren sands. It certainly flourishes not only in these, but also chalky soils: and on moors, heaths, and downs hard stocked with sheep, the surface may be seen to be yellow with the flowers of it; which is contrary to what has been asserted above, namely, that it seldom comes to flower in pastures.

Trials are still wanting to fully ascertain the utility of this plant for field purposes.

LOUSINESS in *farriery*, an affection of the skin, arising, in cattle or other animals, from the irritation of lice or other animalculæ, which may be distinguished by the naked eye. Most animals and even insects are subject to this annoyance. The use of mercurial applications of all kinds destroy them with certainty, and which need not be made strong to effect the purpose.

Quicksilver ointment, joined with an equal quantity of lard, will readily effect it; but a more cleanly remedy is corrosive sublimate dissolved in boiling water, in the proportion of a drachm to two quarts. Lice in cattle, it is said, may be destroyed by anointing them with oil of turpentine, mixed with linseed oil, and the flowers of sulphur. Some even rely upon soap mixed with tar, or tar-water; and some use hellebore for this purpose. Where mercurials are made use of, great caution should be used, and at the same time, the animals be prevented from too much exposure to cold.

LOWER, a term applied to a lever in some districts.

LOWK, a provincial term, signifying to weed corn or other crops.

LUCERN, a plant of the artificial grass kind, chiefly cultivated as a green food for cattle, and which affords a larger produce than most other sorts. It is known among botanists by the name of *medicago sativa*, and is the *alsasa* of the Spaniards, and the *grand trefle* of the French. It has a perennial root, and an annual stalk, which rises full three feet high in good land, and is furnished at each point with trifoliate leaves, the lobes of which are spear-shaped, about an inch and a half long, and half an inch broad, sawed towards the stalks. The flowers grow in spikes, which are from two to near three inches in length, standing upon naked foot-stalks two inches long, rising from the wings of the stalks: they are of the pea-bloom, or butterfly kind, of a fine purple colour, and are succeeded by compressed moon-shaped pods, which contain several kidney-shaped seeds. It flowers in June, and its seed ripens in September. There are several varieties of lucern, as those with violet-coloured flowers, with yellow flowers, with yellow and violet

flowers mixed, and with variegated flowers: but Mr. Miller observes that they are only variations of the same plant, arising accidentally from the seed. However, neither the yellow nor the variegated flowered lucern is ever so strong as that with purple flowers; and cannot of course be so profitable to the cultivator.

Columella estimated lucern as the choicest of all fodder, because it lasted many years, and bore being cut down four, five, or six times a year. It enriches, he says, the land on which it grows, fattens the cattle fed with it, and is often a remedy for sick cattle. About three quarters of an acre of it is, he thinks, abundantly sufficient to feed three horses during the whole year. But though it was so much esteemed by the ancients, and has been long cultivated to advantage in France and Switzerland, it has yet found no great reception in this country, though it will succeed here as well as in either of the above countries; being extremely hardy, and capable of resisting the cold of our climate

It is observed by the author of the Synopsis of Husbandry, that it is not till within these thirty years that this grass has been much in repute with the farmer, though it was known in England long before that time: but the cultivation of it was chiefly confined to gentlemen who raised it on their own demesnes; for the husbandmen, being well convinced of the extraordinary care required to prepare the land for the growth of lucern, were deterred from embarking in a business which seemed to be attended with much expence, and contented themselves with raising green fodder from their tares and clover, leaving the cultivation of this useful grass to their landlords, who could better spare the money for that purpose. But now that its virtues are better known, and the method of raising it more perfectly understood, there are few farmers, he says, who do not choose to sow some acres of it, to supply their horses with a wholesome and lasting feed throughout the summer. The seed is of a paler cast than that of clover, and rather larger in size. It is annually provided from Holland by the seedsmen, and sold at different prices, from one to two shillings or more per pound, according to circumstances.

As to the soils most suitable to the culture of this plant, they are all those of the more deep, rich, and dry kinds, as those of the sound, mellow, loamy, and sandy descriptions; but on such as are retentive of moisture, it should not be attempted, as the roots of the plants are liable to be greatly injured, if not wholly destroyed, by the stagnation of water about them. Weeping gravelly lands, and all such as are not well drained, are of course improper for this sort of culture. According to Mr. Young, "the soils that suit lucern, are all those that are at once dry and rich. If, says he, they possess these two criteria, there is no fear but they will produce large crops of lucern. A friable deep sandy loam on a chalk or white dry marley bottom, is excellent for it. Deep putrid sands, warp on a dry basis, good sandy loam on chalk, dry marl or gravel, all do well: and, in a word, all soils that are good enough for wheat, and dry enough for turnips to be fed on the land, do well for lucern. If deficient in fertility, they may be made up by manuring, but he never yet met with any land too rich for it."

The author of Practical Agriculture remarks, that "in the preparation of the land, the soil should be always brought into as fine a condition of mould as possible. This may be effected by repeated ploughing and harrowing, and the previous growth of such sorts of crops of the green kind as have a tendency to clean and render the land more fine and mellow." In this intention, Mr. Young advises the taking of two crops of turnips, carrots, or cabbages, either in succession, or alternating with each other, the turnips in the heavier loams being eaten off upon the land in the second autumn before it is ploughed up. In either of these cases, from the hoeing and constant culture which is necessary while the crops are upon the land, it will be left in a suitable state of cleanness and friability. "Others recommend fallowing, as a better practice, the root weeds of every kind being carefully picked out in the different ploughings and harrowings. From the great length of time the ground must remain unemployed in this mode of preparation, it is probably only capable of being practised with advantage where the lands are heavy and very full of weeds."

But whatever mode is employed, the land must be rendered perfectly clean before this sort of crop is ventured upon it.

And "before the seed is put in, the mould must be rendered perfectly fine by ploughing it over as frequently as may be necessary, and breaking it well down by occasional harrowing. It will seldom be necessary to make use of manure; but where the land is found to stand in need of it, the application is best made with the first of the green crops. The object to be constantly kept in view in this business, is chiefly that of rendering the land perfectly clean from weeds, and at the same time highly mellow and friable."

And as seedsmen are apt to keep their seeds from year to year, it may be necessary to apprise the farmer, that that which is perfectly fresh, is the most proper for being sown, as most small seeds vegetate in the most perfect manner when new.

In respect to the quantity of seed, Dr. Dickson observes, that the proportion that is necessary, is variable according to the nature of the land, and the manner in which the crop is cultivated. In the broadcast method, from eighteen to twenty pounds may be proper, while in that of the drill, it will be considerably less, according to the distances at which the operation is performed. In two feet equidistant rows, the usual allowance is about six pounds; in those of eighteen inches, about eight pounds; in those of twelve inches, ten or twelve pounds; and in nine inch rows, sixteen or eighteen pounds may be necessary, though Mr. Young only recommends from twelve to fifteen for the acre.

In the system of agriculture mentioned above, it is observed, that "the most proper season for putting this sort of crop into the ground, is as early as can be done in the spring months, as in this way the plants may be fully established before the season becomes too hot. The latter end of March, for the more

southern districts, may be the most proper period; and the beginning of the following month for those of the north. When sown late, there is more danger of the plants being destroyed by the fly, as has been observed by Mr. Tull. If the plants be intended to be transplanted out in the garden method, it will also be the best practice to sow the seed bed as early in the spring as the forests will admit, in order that they may be strong, and fit to set out about the beginning of August."

With regard to the mode of sowing or putting in the crop, the writer just mentioned says, "it should vary with the circumstances of the soil, and the mode of after-management that can be adopted with the most convenience. Where much attention cannot be bestowed on the business of hoeing and keeping the crop clean, the best method is that of sowing the land broad-cast: though in this method the crop may not last so long in the ground. But in cases where the crops are capable of being kept in a sufficient clean condition by repeated hoe-culture, the drill may be more adviseable, particularly in narrow distances. The practice of transplanting can, perhaps, only be done in particular cases, on small pieces of deep land that are in great heart, and require the plants in consequence to stand thin and regular upon the ground, as in these modes they become large and of vigorous growth. In soils that are inclined to moisture at some depth below the surface, it may be a useful method of keeping the roots of the plants from being injured by their penetrating too deeply, as is more the case when the plants rise from seed. The seed may be sown either alone or with grain crops in the same manner as clover; each method has its advocates, and it is probable that they may be useful under different circumstances, as in the deeper and more fertile sorts of land, the first may be the most beneficial method, and in those of the lighter and less deep kinds the latter: as in the deep sorts of land there may be less loss of time in procuring the green produce for the use of horses or other sorts of stock, as well as the greater certainty of the crop succeeding. But in the lighter and more porous soils, by being sown with corn the plants may be better protected in their early growth, as well by the shade as the moisture that will, in that way, be preserved. Some indeed speak of its superior utility on the ground of long experience, in its being better preserved from the fly. Wherever this mode is made use of, the grain should be sown thinner than is usually the case, in proportion as the soils are more rich. Oats are preferable to barley for the purpose, as being less liable to lodge, especially when sown thin. From five or six pecks to three bushels sown as evenly as possible may be the best proportions, the smaller quantity being necessary on the richest soils." Mr. Young remarks, that "the greatest success by far that has been known is, by the broad-cast method, which is nearly universal among the best lucern farmers, even among men who practise and admire the drill husbandry in many other articles. But as they mostly (not all) depend on severe harrowing, for keeping their crops clean, which is a troublesome and expensive operation, he still ventures to recommend drilling, but very different drilling from that which has been almost universally practised, viz. at distances of eighteen inches or two feet. Objections to these wide intervals are numerous. If kept clean hoed, the lucern licks up so much dirt, being beaten to the earth by rain, &c. that it is unwholesome, and the plants spread so into these spaces, that it must be reaped, which is a great and useless expense. For these reasons, as well as for superiority of crop, he recommends drilling at nine inches, which, in point of produce, mowing, and freedom from dirt, is the same as broad-cast; and another advantage is, that it admits scarifying once a year, which is much more powerful and effective than any harrowing. These facts are sufficient to weigh so much with any reasonable man, as to induce him to adopt this mode of drilling, as nearer to broadcast by far than it is to drills at eighteen to twenty-four inches, which open to a quite different system, and a set of very different evils. Nine inch rows might, *practically*, but not literally, be considered as broad-cast, but with the power of scarifying." And in regard to "the material point, of with or without corn, two considerations, he says, present themselves. One is the extreme liability of lucern to be eaten by the fly, which does great mischief to many crops, when very young, and against which the growing corn is some protection. The value of the barley or oats is another object, and not to be forgotten. It is also gained in the first year's growth of the lucern, which is very poorly productive, even if no corn be sown, so that he must own himself clearly an advocate for drilling in among corn, either between the rows of nine inch barley, or across drilled barley, at a foot if perhaps the latter is the best method, as there is less probability of the crop being laid, to the damage of the lucern. The quantity of seed-corn should also be small, proportioned to the richness of the land; from one bushel to a bushel and a half, according to the fertility of the soil; another security against the mischief of *lodging*. If these precautions are taken, it would be presumptuous to say that success must follow, *that* being always, and in all things, in other hands than ours; seed may prove bad, the fly may eat, and draught prevent vegetation, but, barring such circumstances the farmer may rest satisfied that he has done what can be done; and if he does succeed, the advantage will be unquestionable."

In every case, as soon as possible after the grain has been sown and harrowed properly in, the lucern seed should be immediately put in, in the broad-cast mode, by a regular even cast over the fine surface, covering it with a light seed harrow, but it should not be too deeply covered in, two inches is fully sufficient. In the drill method, the same system should be followed, the lucern seed being drilled in immediately after the corn has been put in.

It need hardly be observed, that the plats of ground sown for the purpose of rising plants, to be set out in the garden method of culture, should

always be without grain, or other sorts of crops, in order that they may admit of having the plants properly thinned out and kept clean, and in a vigorous state of growth, for being set out with the most advantage and success.

As to the proper distance of the rows, that in addition to what has been just stated it may be observed where the mode of culture is practised, it should probably depend upon the state and circumstances of the soils. Mr. Kent advises two feet as the best distance in all cases; while others think equal distances of a foot in rich soils, such as are worth from thirty to forty shillings the acre, and nine inches in those that are of inferior fertility, as from fifteen to twenty shillings the acre, the best general distances. On soils of less value it is probable that this culture can seldom be had recourse to with much benefit to the farmer. The last distance approaches much to the broad-cast method, which is contended by some as the most appropriate in almost all cases, and of course it may be preferable, as it admits of being ploughed between by a suitable plough, in the room of the harrow method, and the observations made above are decidedly in favour of it.

This sort of seed, in whatever method it may have been sown, is, when good, quick in its vegetation, beginning to sprout in the course of a week, and soon spreading the plants over the surface of the land. And the sooner it obtains its rough leaf the better, as it is then, like turnip plants, out of danger of being destroyed by the fly. But before these plants arrive at this state of growth, they are liable, especially in dry seasons, to be much injured, if not wholly consumed by the ravages of the same sort of insect as that which is so detrimental to the turnip crops, "Where the greatest part of the plants are injured in this way the author of Practical Agriculture thinks it is probably the best method, when the crop has been put in alone, to plough up the land, and sow it down again with fresh seed, as soon as possible." And this, he says, "is an advantage which the practice of sowing the crop alone has over that of putting it in with those of other kinds."

In the after-management of this grass, as the economy of the plant, is such as to render it incapable of being grown with much advantage, where other sorts of plants, whether of the grass or weed kind, are apt to annoy it; much care and attention should of course be employed in keeping it clean and free from the intrusion of all such vegetable productions. This the author of the work mentioned above says "may be effected in different ways, according to the methods in which the crop has been raised. Where the broadcast plan has been pursued, little is necessary, where the land has been properly prepared, after the grain crop has been removed, except keeping all sorts of heavy stock from coming upon it. In a dry season, if there be occasion, the field may, however, be fed a little, by calves, and other very light stock, but they should never be kept long upon the plants at one time. When the second cutting has been made in the following year, if any grass shows itself, the land should be harrowed over in a moderate manner, by a harrow which is not too heavy or too long in the tines, two or more times, as may be necessary, in different directions, the grassy matter being collected by a small light implement of the same kind, and removed from the land. This business should be executed as soon in the early part of the spring, as the nature and state of the ground will admit, as dry a period as possible being taken for performing the work. In the succeeding years two such harrowings may be frequently required, one in the early part of the spring season, and the other in the close of the summer. But in these cases, especially where there is much grass appearing, a much heavier sort of harrow should be made use of." In the 25th vol. of the Annals of Agriculture, one is advised of such weight, as is sufficient for four horses, and which does not spread more than four or five feet; but in most cases, especially where the business is so frequently performed, one that requires less draught may be adequate to the purpose, as where such large heavy harrows are employed, there is much danger of injuring the crowns of the plants, and thereby causing their destruction; whereas by the use of lighter ones, they are mostly much benefited from the mould being stirred about their roots. After the operations, as in the above case, the weeds should be brought together, and removed from the ground. When the crops are thin and patchy, seed in proportion to the deficiencies should be sown over such places before the harrowings commence each time. In every case the roller should be applied immediately after the operation has been performed, not only for the purpose of compressing the mould about the roots of the plants, but to render the surface perfectly level, and fit for the scythe. In this method of culture, "where the produce is not to some extent, it is probably better to feed the crop by light cattle stock in the autumn, than mow it."

In the drill sown lucern, it is likewise recommended, "where the rows are sufficiently evident, in the autumn season after the grain has been secured, that a small shim should be passed between them, in order to extirpate all the weeds, and grassy materials, as well as to loosen the mould about the roots of the plants, and that they may be rendered more perfectly clean, the hand-hoeing of the plants in the rows: and that in the succeeding year, still more particular attention to the use of the shim and hoe will be requisite. The business should be begun as early as the state of the soils will safely admit of its being executed; being continued occasionally in such a manner during the whole summer, as is sufficient for preserving the crop perfectly clean, and free from all sorts of weeds. But in order to accomplish this in the most complete way, great circumspection is necessary, immediately after the lucern has been cut, to the extirpation of the natural grass plants, and the weeds of other kinds, as at this period they can be discovered and removed with the greatest facility and dispatch.

According to the author of Practical Agriculture, "the crops raised in the transplanted methods as they are put in so late in the summer season, they will demand but little regard in the autumn, one or

at most two slight hoeings may be sufficient for the purpose; but in the following year's culture, the same management will be proper as in the preceding case."

It is advised, "as a good rule in these cases to give good hoeings, either of the horse or hand kinds, as soon as weeds appear every time after the crops are taken off. If the plants are perfectly straight in the rows, which should always be the case, a shim may be had recourse to with the greatest benefit, as it may be drawn so closely to the plants, as in a great measure to save the expence of hand-hoeing, as in such cases it will be only necessary to extirpate the weeds or natural grass plants that may have established themselves among the lucern plants in the rows, which is capable of being effected in a very complete manner by the use of a pronged hand-hoe. It is further recommended by the same cultivator, never by any means to suffer fields of this sort to become weedy, under the supposition that the produce may not cut well, or be free from dust, as where it is of sufficiently vigorous growth, and of a suitable distance in the rows, according to the nature of the land, there can be no reason for such an injurious practice, as it is only where the planting is executed at larger distances than the condition of the soil will permit, that any inconvenience can be experienced in this way."

"Where hand-hoeing is the method chiefly depended on for keeping crops of lucern in a proper state of culture, much of the business may be performed by women or even children, and the expence be thus considerably lessened."

If the soils on which this plant is grown are not of considerable fertility, the occasional application of manure may be of great advantage, in thickening and increasing the quantity of crop; for this use clean well rotted dung is probably by much the best manure, as where earthy composts, ashes, or soot are employed, they are apt to promote the growth of, or bring up grasses too much; the latter are however sometimes sown over the crop in the winter season. The dung is advised, in the 25th vol. of the Annals of Agriculture, to be applied in the quantity of about twenty tons to the acre, every five or six years. Mr. Kent, however, thinks it a better practice to put a slight coat on annually in the spring season. As much expence must be incurred in the culture, establishment, and after management of this sort of crop, in order to insure a favourable produce the farmer should not too hastily attempt it, till he has found how far it will suit his convenience.

The various expences attending it, as stated by different writers before the late rise in the price of labour, are thus given, as well as the profit in soiling horses.

Expences.

	£		
Two spring ploughings extra	0	18	0
Harrowings	0	2	6
Eight pounds of seed	0	8	0
Drilling	0	2	6
Horse-hoeing in autumn	0	2	6
Hand-hoeing ditto	0	5	0
First year	£1	18	6

Annual expences afterwards.

	£		
To rent, tithe, and rates	1	10	0
Four horse-hoeings	0	10	0
Three hand-hoeings	0	12	0
Five mowings	0	12	6
Raking together	0	5	0
Loading and carting home	0	7	6
Manuring, to amount per annum	0	12	0
	£4	9	0
Clear profit	£9	18	6
	£14	7	6

Profit in the practice of soiling horses.

By keeping five horses, from beginning of May to middle of October at 2*s.* 6*d.* per horse per week	14	7	6
	£14	7	6

It is observed in a late practical work, that, "as this is one of the most forward of the artificial grasses, it frequently attains a sufficient growth for the scythe, towards the end of April, or beginning of the following month; and in soils that are favourable for its culture, will be in a state of readiness for a second cutting in the course of a month or six weeks longer, being capable of undergoing the same operation, at nearly similar distances of time during the whole of the summer season. In this last sort of soil, with proper management, in the drill method, it has been found to rise to the height of a foot and a half, in about thirty or forty days, affording five full cuttings in the summer. But in the broad-cast crops, in the opinion of some, there are seldom so many cuttings afforded in this season, three or four being more common, as the growth is supposed to be less rapid, than by either of the other modes:" this is, however, contradicted by other cultivators, who have bestowed much care on the subject, as will be evident below. It is further stated, that "in order to have new successions of this grass constantly becoming ready to be cut, it has been recommended, for the purpose of soiling, to have the broad-cast plantations formed into so many divisions, as that one of them may be cut daily, as about sixty; and those of the drilled, and transplanted kinds, into from thirty to forty, according to the nature of the land, consuming them in the same manner. These cuttings must, however, be varied in proportion to the differences in the growth of the crops, and the consumption. The most economical mode of cutting the produce, is, without doubt, by means of the scythe, though the reaping hook has been made use of by some; after being cut, the food should be conveyed as soon as possible to the animals: this may be done by a light cart, or large barrow, made for the purpose, according to the scale on which the business is conducted. One cutting in the day is only advised by some, but as there is a loss as well as injury done to all sorts of green cut food, by keeping, even for a few hours in hot sea-

sons, it may be a better practice to have two cuttings in the day, especially when the weather is warm, and the lucern at no great distance; besides, the food is eaten better when given quite fresh."

It is added by the same writer, that "the produce of this sort of crop, in converting it to the purposes of soiling cattle, will necessarily be different under different circumstances, but an acre can seldom, when under proper culture and management, support less than from three to five or six horses, or other cattle, during the six summer months, the profit of which cannot be less than from seven to ten or twelve pounds."

"And in letting it remain for hay, which is less advantageous, in the three mowings, an acre, where the crop is good, will seldom, he thinks, afford less than from three to five tons of dry hay. In Mr. Arbuthnot's trials, as stated in Mr. Young's tour, the produce was, he says, four loads, but in those of others, on rich grounds, it was five. It is likewise remarked, that "in making this sort of plant into hay, the same directions should be attended to as for clover; the less the produce is shaken about the better, provided it be sufficiently quickly dried, as the leaves will be more fully preserved in the stems, and the hay of course more valuable. From its greater succulence, it will in common require rather more time than clover, or saintfoin, in making into hay. As this sort of hay is held in less estimation than that of either of the above grasses, it should always be consumed at home by the farm horses, or other stock; and that of other sorts sent for sale."

The principal and most advantageous practice, in the application of lucern, is that of soiling horses, neat cattle and hogs; but as a dry fodder, it may also be capable of affording much assistance in many cases; and as an early food for ewes and lambs, be of great value in particular cases. "As this plant bears repeated cutting, better than most of those of the artificial grass kind, springs in a more quick and expiditious manner, and affords a healthy nutritious food, it must, the above writer thinks, be of vast utility to the farmer, where horses and cattle form a large part of his stock: with horses in this way, it has been found by some, as stated in the fourth volume of Mr. Young's Eastern Tour, "to answer better than any other sort of green food that has been tried. The number of cuttings that it admits of, being on different soils, and under different modes of culture, from about three to five, affording a produce of green herbage adequate to the support of from three to four or five horses, for a period of nearly six months in the summer season, as has been seen above;" "and though much of this vast advantage, in the support of these animals, may with propriety be ascribed to the economy of the consumption of the food, that unavoidably takes place in this excellent practice, the real produce in green food, is, without doubt, larger than in most other grass crops. The broad-cast crops, in the trials of some cultivators, appear, he says, to have been more profitable, in this mode of comsuming the produce, than those of either the drilled or transplanted methods of culture: in the practice of Mr. Hall, the former supported from four to five horses for twenty-six weeks, while the transplanted crop, in rows two feet asunder, only afforded produce sufficient for the keeping of three. And in those of Mr. Clayton, in the broad-cast, without grain, five horses were kept from the middle of May till Michaelmas, while that drilled in equidistant rows, at the distance of eighteen inches, only supported four." There are many other facts, this author remarks, that lead to the same conclusion. "On very rich soils, the drilled lucern will, without doubt, when the plants are kept perfectly clean, and the mould well stirred between the rows, and laid to their roots, afford an abundant produce, perhaps more so than in the broad-cast; but to do this, great attention in the culture must be bestowed." And he adds, that, in "its application, in the soiling of cows, and other sorts of cattle, in the fold yards, and in the feeding and fattening of oxen, its importance is equally great. It is found that in soiling cows, the proportion of this sort of food, consumed in twenty-four hours, is from about sixty or seventy, to upwards of a hundred pounds, in those which are of the middling sized kinds; an acre maintaining in the proportion of about four for twenty weeks. In other trials, larger proportions of stock have been kept by this practice." In feeding cattle with this sort of food, it is observed, that "in its green state, care is necessary however, not to give the animals too much at a time, especially when it is moist, as they may be *hoven* or *blown* with it, in the same way as with clover," and other green food of luxuriant growth.

"The trials, it is added, that have been made in fattening bullocks or other cattle, with this green fodder, are not numerous, but they are sufficiently so to prove its utility in such application. In Mr. Young's trials, cattle have, he says, been found to increase fast in flesh by it, paying at the rate of four shillings and six-pence a-head per week, which is considered as a great proof of the value of the plant in this view. Its superiority to tares he thinks prodigious. It has also been considered of the greatest value in this view, in Ireland, by Mr. Herbert, after much experience of it. The great power which it possesses in fattening is rendered indeed sufficiently evident, by the sudden effects which it produces in this way, in soiling horses; in most instances they get into high condition, in a short time becoming "fat, without oats or hay," in some cases. And "sheep have likewise been fattened on this green food with great success, in Mr. Baldwin's trials." Also, "in soiling hogs in the fold yards, it has been attended with considerable success—and it has been suggested that as these animals do not bite so closely as sheep, they may be admitted upon the crop with safety."

The advantage of this mode of application over that of making the crops into hay, and their expence, produce, and profit, are thus stated by Mr. Young:

Average of five crops.

Soils.	Application.	Expences. £.	s.	d.	Product. £.	s.	d.	Profit. £.	s.	d.
Light Sandy loam	Soiling	1	14	6	13	0	0	11	5	6
Rich black loam	Soiling	5	0	8	11	5	0	6	4	4
Good loam	Soiling	3	15	0	14	7	6	10	12	6
Good loam	Hay	3	3	6	9	0	0	5	16	6
Rich deep sandy loam,	Soiling	3	11	1	7	0	11½	3	13	11½
Averages.		3	8	11	10	18	8	7	10	5

The result of the comparative experiment made by Mr. Anderdon with this crop and those of burnet and saintfoin, as stated by Mr. Young, in his Eastern Tour, shows its superiority over them.

Lucern, at four cuttings green, produced,	159
Burnet,	84
Saintfoin,	82

The disadvantages of making them into hay, are thus stated:

One cutting of each,	lb.		lb.
Lucern in grass,	57½	——in hay,	22
Burnet in ditto.	25½	——in hay,	7
Saintfoin in ditto,	29½	——in hay,	9

Although lucern crops, should not be closely fed down with sheep, it is not improbable, according to the writer of a late practical work, but that "in particular cases they may be applied as an early green feed for ewes and lambs with great utility and convenience, as they may be relied on for this sort of feed much sooner than any of the other kinds of artificial grass crops, especially in soils of the rich, dry, and warm descriptions, being often ready for this purpose soon after the middle of March, affording a good bite through the whole of the following month; the most difficult period for the providing of suitable support for this kind of stock. The benefit in the healthy growth and improvement of the lambs in this mode, will much more than counterbalance any loss sustained in the first cut, for the soiling of horses. The sheep should not, however, remain on longer than while the fresh shoots are eating down." And the same author concludes on the whole, that "though this plant is capable of being thus usefully applied, considering the great expences which are necessary in raising and keeping lucern crops in a state of production, and their affording but little produce, especially when sown without corn, for the two first years, notwithstanding they appear to yield a great advantage in the practice of soiling animals; it is probable that much of the profit depends upon the method of consuming them, and not on that of the particularly advantageous nature of the plant. Its superiority to clover, when the differences in the expences of their culture, and other circumstances, are fairly brought into view, will not perhaps appear so great as many, on a superficial observation, may have supposed. The point in which it most materially excels that almost invaluable plant, is, he says, the duration, or time which it lasts in the ground, after being once introduced, continuing from ten to fifteen and even twenty years, according to the state and nature of the soil and the attention that is bestowed in the after management. This is a circumstance of the first importance, in cases where the cultivator wishes to avoid the trouble and expence of grain crops, as he can keep a suitable extent of land under this crop, for the purpose of soiling his stock without them, while with clover it is utterly impossible. Where the proportion of land is small, and the quantity of cattle and horse stock disproportionately large, it is a plant admirably calculated for the cultivator's purpose, when grown convenient to the farm yards, and kept in due order by proper cultivation. It has also been recommended on dairy farms, as of great utility in supporting the cows, and increasing the quantity of milk. Where the soils are suitable, a few acres under this grass, round the house, must in almost all cases be valuable for the purpose of early green food."

Mr. Young, however, considers the advantages of cultivating lucern so extremely great, that the "agriculturist should, he thinks, determine at all events to have sufficient at the least, for the summer support of all his teams, and other horses; and if in addition to this quantity, he provides also for thus feeding much other stock in his farm-yard, he will find it a most profitable practice."

In regard to proportioning the quantity of land thus occupied to the stock intended to be fed on it, a quarter of an acre per head, he conceives, is sufficient for all sorts of large cattle, taken one with another, if the land is very rich and good; but on more moderate soils, half an acre per head will be a proper allowance. It is much better to have too much rather than too little."

It has been stated in a late work on Practical Agriculture that "on attempting to break up lands that have been long under this sort of crop, it has been sometimes found, from the great strength of the roots of the lucern plants, and the consequent difficulty of destroying them, that they have been restored in such a manner, as to induce the cultivator to leave them again for the production of this grass." And that in situations where such grounds could be conveniently flooded, or covered with water occasionally, they might be very advantageously converted into good meadow or grass lands. A sort of application, that has long since been recommended by De Serres, a French writer of great respectability. When such lands are perfectly broken up, they afford in most

cases admirable crops of the grain kind: oats, as being the least injured by a luxuriant growth, may in general be the most advisable as the first crop."

In cutting lucern crops, the author of the Farmer's Calendar suggests that it should always be performed in a longitudinal direction of the drills, or rows, or of the field, in order that a scarifying may be given to the young growth before it is too far advanced.

And the same writer remarks, that this sort of crop requires much manure, for though on good land it may afford a good produce, without such application; to carry its cultivation to the highest state of perfection, "not only of *product* but also of *clear profit*," it should have plenty.

Though this sort of plant is seldom liable to be injured by frosts, in the southern districts of the kingdom, where it is the most extensively cultivated, a writer in an useful periodical work, the Farmer's Magazine, complains that in an experiment of his, in which the lucern was drilled about a foot distant in the rows, they destroyed every plant. "A few indeed, (says he,) at distant intervals, recovered in the spring, and grew very decently, pushing out long, strong, and carrot roots; but their number was so inconsiderable, and the weeds so abundant and luxuriant, that it became necessary to plough all down." In this case the land does not seem to have been in a proper state of either preparation or heart for the growth of this sort of crop.

It is suggested by a writer in the Agricultural Magazine, that in giving this sort of food to cows, it is necessary to have the precaution of letting it be made use of the day after it is cut, and not the same day, as in this case the animal is liable to swell. In his trials it was found that a large cow consumed about eighty-four pounds of this food in twenty-four hours, and that if more be given, the animal will probably waste it. And it is added, that the butter made from milk produced from this sort of food, is equal to any made from cows fed on the best meadows.

LUG, a long measure of land, the same with pole, or perch, sixteen feet and a half. In Gloucestershire, it, however, signifies a land-measure of six yards or a rod, pole, or perch of six yards. It is a measure by which ditching and other similar operations are performed in that district. This term is likewise applied to the stick by which the work is measured. It is sometimes called *Log*.

LUMBRICI, in farriery, a term applied to round worms. See *Worms*.

LUMPS, a term made use of to signify barn-floor-bricks in some places.

LUNAR CAUSTIC, one of the mildest caustics, now denominated *nitrated silver*. It is useful as an application to ulcers in animals where fungous parts are to be destroyed, or a new action excited, though the less costly escharotics are usually applied, such as corrosive sublimate, blue vitriol, &c.

LUNETTE, in *horsemanship*, a half horse-shoe, or such a one as wants that part of the branch which should run towards the quarter. It also signifies the name of a shade, consisting of two small pieces of felt, made round and hollow, to cover the eyes of a vicious horse which is apt to bite, and strike with his fore feet.

LUPINE, a species of wild pea, cultivated principally for being turned in as a manure.

This plant requires but little trouble or labour, in its cultivation as it will thrive in any soil, except the bad chalky, and such as are very wet. It will even grow well on poor hungry, worn-out land, especially if it be dry and sandy. When sown in February or March, after a single very shallow ploughing, and slightly harrowed in, it will blossom two or three times between May and August, and prove an excellent enricher of the ground when ploughed in, just after its second blooming. The best time for mowing this sort of crop, is after a shower of rain, as, the seeds drop easily out of their pods when they are gathered too dry. They must, however, be laid up very dry, or worms soon breed in them. They are inferior to many other plants for the above use.

LURCHER, a sort of hunting dog, much like a mongrel greyhound, with pricked ears, a shagged coat, and generally of a yellowish white colour. These sort of dogs are very swift runners, so that, if they get between the burrows and the rabbits, they seldom miss taking them, and this is their common practice in hunting: yet they use other subtilties, some of them bringing in their game, and these are the best. It is also found that a lurcher will run down a hare on the stretch.

LYE, any watery fluid much impregnated with saline matter. In husbandry the term is generally applied to such fluids as are employed for the purpose of steeping grain; in which cases, the best criterion of their strength is that of the swimming of an egg. See *Steep*.

LYNCHET, a term applied to the stripes or grassy partitions in arable fields, but mostly to such as are in the state of commonage.

LYNCH-PIN, the small pin, in carts or other carriages, that is put into the ends of the axle-trees, to confine the wheels on them.

M

MACHINE, in husbandry, a term applied to implements of various kinds, as those for drilling, thrashing, and winnowing of grain, &c. It is most commonly employed where the nature of the tool is of the more complex kind. See *Drill and Thrashing Machine.*

Draught MACHINE, a contrivance invented for the purpose of ascertaining the force or power of draught, in drawing ploughs, &c. A machine of this sort invented by Mr. More, late secretary to the Society for the Encouragement of Arts, &c. in London, is thus described by Mr. Young in the first volume of the Annals of Agriculture. It is a spring coiled within a cylindrical case, having a dial-plate marked with numbers like that of a clock, and so contrived that a hand moves with the motion of the spring, and points to the numbers in proportion as the force is exerted: for instance when the draught equals 1 cwt. over a pulley, the hand points to fig. 1; when the draught is equal to 2 cwt. it points to fig. 2; and so on. Till this very useful machine was invented, says Mr. Young, it was exceedingly difficult to compare the draught of different ploughs, as there was no rule to judge by but the exertions of the horses as apparent to the eye; a very undecisive mode of ascertaining their force.

Fan MACHINE. See *Winnowing Machine.*

Land Levelling MACHINE, a machine invented by Mr. David Charles for the purpose of rendering high ridges and other inequalities in such lands as are in a state of aration more level and even in their surfaces. It is probable that no effective implement of this sort has hitherto been introduced. It is said in the Transactions of the Society of Arts, to be useful and necessary, even in the most fertile parts of the country, where the new system of drill-husbandry has been introduced, or even where there is any attention to the waste of time, or to the ease of cattle in the act of ploughing; in order to get rid of crooked or unequal ridges, without either a summer fallow by cross ploughing, or else by frequent repetitions of ploughing in the winter and spring, which the humidity of this climate will not allow in every kind of soil. Fourteen acres of land were reduced with it, by the inventor, to a perfect level, where the crowns of the ridges were about two feet higher than the furrows, and where they were crooked and of unequal breadths. But the chief success has been upon a field of eight acres, which lay in an unprofitable state, and which is a deep clay, that had produced a crop of wheat from an old lay sod the former year without any manure, which was winter ploughed, and lay in that state until the machine was introduced the first dry weather in April. It was preceded by two horse-ploughs, taking perhaps a square of an acre at once: these loosened the soil the depth of a common furrow, and twice the breadth across the ridges. The levelling machine followed, drawn by two oxen and two horses, with a man at each handle, to press it down where the height is to be removed, and to lift up the body by the handles where it is to be discharged. Thus four men, one driver, and eight head of cattle, will more effectually level from half an acre to three roods in one day, according as the earth is light or heavy, than sixty or eighty men would accomplish with barrows and shovels, &c. even with the assistance of a plough. In sandy ground where the depth of one furrow will bring all to a level, as much will of course be done in one day as two ploughs can cover;" but in this case the ground required to be gone over several times. It is further stated, that, "after this field was levelled, the backs of the ridges, as they are termed, which were stripped of their vegetable mould, were ploughed up, the furrows not requiring it. They were also harrowed, and the field copiously manured with lime compost, harrowed in, and broke into nine-feet ridges, perfectly straight, in order to introduce Duckit's drill. It was sown under furrow, broadcast, the last of it not until the 13th of May, and

was cut down a reasonable crop the 4th of September." And "the field now lies in proper form, well manured, with the advantage of a fair crop from heavy tenacious ground, without losing a season, and in a year by no means favourable. The writer is "well aware there are many shallow soils, where it may be hazardous to remove the enriched surface, and trust perhaps one half of the land for a crop that had never before been exposed to the atmosphere; but where the soil is sufficiently deep, or there is a good understratum, with manure at hand to correct what is sour from want of exposure and tillage, it is evident, he thinks, from this experiment, that no risk is run." And in order "to avoid the expence of a fallow, and to lay out ground in straight and even ridges, even where drill husbandry is not practised, should, he thinks, be objects to every rational farmer. But where the new system is intended to be adopted, it becomes, he says, indispensably necessary. In laying down lawns, parks, &c. where furrows are an eyesore, or places inaccessible to wheel carriages from their declivity, and from which earth is to be removed, it will also be found equally useful" and advantageous.

This machine is represented at fig. I. in plate V. in which *a*, *fig.* 2, is a part of the pole to which the oxen or horses which draw the machine are fastened, and which is attached to the machine by a pin at *b*; *c c* the two wheels, shod with iron, which run upon the axle *d*; *e e*, the upper frame work of the machine, extending from the axle to the extremity of the handles *f f*, and secured firmly by the cross pieces *g g*, the curved iron sliders of the machine, which may be raised or depressed a little by means of the pins *h h*, which pass through holes in the wood-work, and also in the iron sliders; these sliders form one piece with the back iron scraper *i*, in the manner more fully explained in *fig.* 3; *k*, the wooden back of the machine, which should be made strong, to resist the weight of the earth when collected therein. The iron scraper should be firmly secured to this by screws and iron work; *l l*, the wooden sides of the machine firmly connected with the back and frame work, in order to assist in collecting the earth to be removed; *m*, a strong cross piece, into which the ribs which support the back are well morticed.

At *k*, *fig.* 3, is shewn the interior part of the back of the machine; *i*, the iron scraper, sharp at the bottom, and firmly screwed to the back of the machine; *g g*, parts of the side irons or sliders, shewing the mode in which they are united with the scraper *i*; *m*, the cross piece described above.

Stone-lifting Machine, an implement of the triangle kind, similar to that used by wood cutters for weighing bark, constructed for the purpose of raising large stones of some tons weight used in the northern parts of Scotland. It saves much expence in powder and boring as well as labour, three men being sufficient to work it. It is thus described in the Agricultural Survey of Perthshire.

"The three legs, *a d*, *b d*, and *c d*, are shown at fig. 4, pl. V. which are beams of any hard wood, four inches thick, six inches broad, and about fourteen feet long. Their thinnest side points inward, which gives them more strength. Their feet form, on the ground, an equilateral triangle *a b c*, and their three tops at *d* are fixed together by an iron rod, which passes through each. The two legs *a d* and *b d* are fixed to one another by the windlass *k*, and by the cross bars *o p q*. There are two pullies, *e* and *f*, with an iron hook of two inches in circumference to each; *g g g* may be (more than one, but rather) one iron chain, which goes round the stone *n* while lying in the ground at *m*, below its greatest diameter, or where it begins to become narrow. This chain consists of rounded links, which are about three inches long, and about the thickness of a man's little finger. It has a hook at one end, that may be put into any link towards the other end, which will make it embrace the stone exactly, and be of the same circumference, where the stone touches the earth; *h g*, *h g*, *h g*, are shorter chains of the same workmanship, whose hooks are fixed into links of the surrounding chain at *g g g*, and so on round the stone, having the corresponding link of each fixed on the hook of the lower pulley at *h*. The whole rope must be of the same thickness with the two great hooks, two inches in circumference.

"All things being thus prepared, two men turn round the handles of the cylinder, and the waggoner assisting them by applying a lever to any side of the stone that seems to be firmest, they force it aloft and hold it at the proper height, until the driver put his carriage backward between *b* and *c*, which carriage ought to have a strong frame upon four low stout wheels; then the stone is let gently down, and carried away.

Water raising Machine, a sort of machine contrived for the purpose of raising water a few feet high by the power of the *wind* for the purpose of draining morasses, or of watering lands on a higher level, and other similar uses. A section of it is given at fig. 5, pl. V. It is described by the author of the Philosophy of Agriculture and Gardening to "consist of a windmill sail placed horizontally like that of a smoke-jack, surrounded by an octagon tower; the diverging rays of this tower, *a b*, *a b*, may consist of two-inch deals only, if on a small scale, or of brick-work if on a larger one. These upright pillars are connected together by oblique horizontal boards at A B, by which boards placed horizontally from pillar to pillar, in respect to their length, but at an angle of about 45 degrees in respect to their breadth, so as to form a complete octagon including the horizontal windmill sail near the top of it; the wind, as it strikes against any of them, from whatever quarter it comes, is bent upwards, and then strikes against the horizontal wind-sail. These horizontal boards, which form the sides of the octagon, may either be fixed in their situations, or be made to turn upon an axis a little below their centres of gravity, so as to close themselves on that side of the octagon tower most distant from the wind. It may be supposed that the wind thus reflected would lose considerably of its power before it strikes on the wind-

sail; on fixing a model of such a machine, however, on the arm of a long whirling lever, with proper machinery to count the revolutions of the wind-sail, when thus included in a tower, and moving horizontally; and then when moved vertically, as it was whirled on the arm of the lever with the same velocity, it was found, on many trials by Mr. Edgeworth, in Ireland, and Doctor Darwin, that the wind, by being thus reverted upwards by a fixed planed board, did not seem to lose any of its power. And as the height of the tower may be made twice as great as the diameter of the sail, there is reason to conclude, the Doctor says, that the power of this horizontal wind-sail may be considerably greater than if the sail was placed nearly vertically opposed to the wind in the usual manner. At the bottom of the shaft of the wind-sail is placed a centrifugal pump with two arms at D. C. which consists simply of an upright bored trunk, or cylinder of lead, with two opposite arms with an adapted valve at the bottom to prevent the return of the water, and a valve at the extremity of each arm to prevent any ingress of air above the current of the water as it flows out. *c c c c* is a circular trough to receive the streams of water from C. and D. to convey them where required.

At fig. 1. pl. VI. is another machine invented by Mr. Sergeant of Whitehaven calculated for raising or forcing water in particular cases, as for domestic or other uses. It is extremely simple and cheap in its construction, the whole exclusive of the pump pipes, &c. not costing more than five pounds. The object for which it was particularly contrived was that of raising water for the supply of a gentleman's house from a stream running at the distance of about 140 yards. In which intention a dam was made a little distance above, so as to cause a fall of about four feet, the water being brought by a wooden trough, into which was inserted a piece of two-inch leaden pipe, a part of which is seen at *a*. the stream of this pipe is so directed as to run into the bucket *b c*, when the bucket is elevated; but as soon as it begins to descend, the stream flows over it, and goes to supply the wooden trough, or well, in which the foot of the forcing pump *c* stands, of three inches bore; *d*, is an iron cylinder attached to the pump rod, which passes through it, which is filled with lead, and is in weight about 240 pounds. This is the power which works the pump, forcing the water through 240 feet of inch pipe from the pump up to the house. At *e* a cord is fixed, which, when the bucket comes to within four or five inches of its lowest projection, becomes stretched, and opens a valve at the bottom of it, through which the water discharges itself.

MACK, a provincial term sometimes applied to a sort or kind of grain, or breed of cattle or live stock.

MADDER, the name of a plant, sometimes cultivated in the field, as an ingredient in the business of dying a scarlet colour.

The species commonly cultivated is the *rubia tinctoria*. It is a plant of the thick fleshy tap rooted kind.

It is stated by the author of Practical Agriculture, that this plant "was formerly much more cultivated in particular districts than it is at present, the importations from Holland having lessened the demands and reduced the price of it, so much as to render its culture incapable of being conducted with profit to the farmer."

The soils the most suited to the cultivation of this plant, according to the same writer, are those of the deep fertile sandy loams that are not retentive of moisture, and which have a considerable portion of vegetable matter in their composition. It may also be grown on the more light descriptions of soil that have sufficient depth, and which are in a proper state of fertility.

In the preparation of the land for the reception of the crop, it will, he says, be necessary to plough it up deeply before the winter into high ridges in order that it may be exposed to the action and influence of the frosts. Early in the spring these ridges should be well harrowed down by a heavy long tined harrow, and then ploughed again in the contrary direction to a good depth. And when after this it is not perfectly clean from weeds or not rendered sufficiently fine and mellow, another ploughing and harrowing may be given. In the last operations the ground should be left in as level a state as possible. It is then ready for the reception of the plants. It is added that the sets or plants may be obtained either by sowing the seed upon a bed of earth which is rich and made perfectly fine by digging and raking in the spring, it being lightly covered in, or from offsets or suckers from the old plants. In the first method, on the plants appearing, they should be made perfectly clean by weeding, and be set out at the distance of three inches in the beds by the hoe. In this way, by keeping the ground quite clean and well stirred about the plants they will be ready to set out in the second autumn, though it will mostly be better to defer the business till the spring, in this climate if the sets can be procured, as the plants seldom ripen their seed perfectly or afford it in a state to vegetate well. It requires about twenty thousand plants for setting an acre of land. The most suitable time of taking the sets is shown by the plants having attained the height of ten or twelve inches from the ground and the suckers having thrown out fibrous roots at their bottoms. This may be seen by drawing up a few of the plants, and is usually about the latter end of May or beginning of June." And "it is necessary that the sets have formed root-fibres at the bottoms before they are removed, as where that is not the case, they never succeed well."

The plants being thus provided and the land prepared in the manner directed above, "a sufficient number of labourers are, he says, to be provided, that the work may be performed as expeditiously as possible. In taking off the sets, much care is necessary not to injure them. Some perform it by means of a dibble with a flat edge, and which is shod with iron; this tool, on being thrust into the ground on the side of the shoots, divides and separates them by depressing the handle without hurting the fine fibrous roots. The number of plants that can be set in a short space of time should only be taken up at

once. They should be prepared by having about a third of their top parts cut off. A sort of thin batter should likewise be made, by mixing good vegetable mould and water well together into which the roots of the sets should be dipped before they are placed into the earth, as by this means the necessity of watering the plants afterwards is prevented. This work is executed by a person before the planting commences. Two others are employed afterwards in distributing the plants so as to be convenient for putting them into the ground."

"There are, he says, different methods employed in setting the plants: in some cases they are put in the furrow by means of the plough, while in others they are set in beds by a dibble. The former is probably the better method, and as being the most expeditious, is best adapted to the culture of the plant on an extensive scale. In this the planter begins by drawing a straight furrow on one side of the plantation to a good depth; a row of plants are then laid in it by a person for the purpose at the distance of five, six, or more inches from each other, according to the circumstances of the land, in such a manner as to lean off from the plough; another furrow is then formed, by the mould of which they are covered. In this manner the work proceeds until the whole is finished.

"In the other method, he observes, the sets, after the land has been formed into beds, five feet in breadth, with two feet between each for intervals, are put in by means of a line and a dibble, beginning at the distance of six inches from the outsides, and setting a row of plants at suitable distances from each other as just mentioned; then removing the line two feet farther on them, and putting in another row; after which it is again removed two feet, and a third row of plants set in, which finishes the bed; the work proceeding in this manner till the whole of the plantation is completed. In this way, each bed contains three rows of plants, at two feet distance each, three feet being left between the rows on the different beds."

But "in Holland, where the culture of this root is extensive, their method is, it is observed, a little different from the above. The plants, after being taken from the older plantations about the month of May, are immediately set in rows at the distance of three or four inches from plant to plant and about fifteen inches from row to row, the beds being ten or twelve feet in width with intervals of only about two feet."

It is added that "as in whatever manner the plants are set, some of them, even in the most favourable seasons, are liable to die soon after the work has been performed, it is necessary in the course of a fortnight or three weeks to look over the ground and put fresh vigorous plants in the places where the others have been destroyed. By this means the plantations may be rendered more perfect and productive."

Whatever method of planting is practised, it is of the greatest importance to the success of the crop, the same writer remarks, "that it be kept perfectly clean from weeds, and that the mould be occasionally stirred about the roots of the plants." The first of these is accomplished, according to the Survey of Kent, by means of hand-weeding and hoeing during the summer season, and the latter either by the use of a hand-hoe, or a light plough: this last is the most easy and expeditious. In this manner, or by digging the intervals of the rows, the mould is also laid up to the plants once each year after the stems have been removed in the autumn season. Where the bed practice is followed, they are sometimes earthed up in the autumn after the stems have been cut down, by paring the intervals somewhat in the manner of those of the asparagus kind. This method is, however, in general too expensive and troublesome where the crops are cultivated on an extensive scale.

The best way, according to Mr. Young, of performing this culture is "to use the shim: not for turning a ridge against the rows, as the plants will yet be too weak for that operation, but merely to loosen the earth of the intervals, thereby to kill the weeds, and prepare the soil for throwing up against the rows by a succeeding operation. Hand-hoeing and weeding should depend on the number of the weeds that arise among the plants. Let, says he, the cultivator of madder, through the whole process of the crop, remember, that he must be to the full as accurate as a gardener: his soil must be rendered but little inferior to a dung-hill: all weeds must be for ever eradicated; not one must injure the plants: his land must always be kept perfectly loose and well pulverized; for a crop that depends merely on the quantity of the roots, can never thrive to profit in land that is bound or in an adhesive state."

Whatever practice is used, it is observed, "the crops are to be managed in this manner until the third autumn after planting, when the plants will be in a state to be taken up: this is known by their stalks beginning to wither, and is generally about October. This business is performed either by trenching the land over with a spade, or by means of the plough. The first is the more certain, though much less expeditious method. In executing it the workmen dig along the rows to the depth of about two feet, breaking and reducing every spit of earth as perfectly as possible, each being attended by two persons, who pick out the roots of the madder. But when the planting has been done in narrow beds, it is sometimes the practice to take the roots up by turning the earth into the intervals by a *spud*, or broad three-tined fork. In this way it is supposed that the roots are taken up more perfectly and with less danger of being injured. But the most ready method is by means of the plough, which after having the earth board and coulter removed, is passed along each side of the rows, so as fully to loosen the mould; persons being employed to pick out the roots, loosening such parts of the earth as may have escaped the action of the plough, by their spades." And that "when the roots have been taken up they should be exposed some time to the air in order that they may be rendered so dry as to be cleared from dirt. They are then to be conveyed to a kiln, such as is employed for the purpose of dry-

ing malt, or hops, when they are to be brought into such a state of dryness as to be perfectly brittle. This is to prevent the danger of their being injured by becoming mouldy, or from running into a state of fermentation; but much caution is necessary in conducting the process. After this they are packed up in bags, in order to be disposed of to the dyer, who reduces them into a powder by a mill before they are made use of as a colouring ingredient." Mr. Young, however, observes, that he is "informed, that at present (1803) the largest quantity of madder used in our manufactures, is used without being powdered as formerly, and that it is saleable with common drying, without stove-work; but that, that common degree is open to much uncertainty, so that the preceding remarks are not done away. The price of £4 per hundred weight, he says, marks a considerable desiccation."

In order to judge of this root, the best is that which, on being broken in two, has a brightish red or purplish appearance, without any yellow cast being exhibited.

It is remarked that, "in order to collect the seed of the madder plant, it is necessary to let the plants remain in the field till the seed is almost wholly ripe, which is generally in the month of September; the heads are then to be separated from the stems, and exposed on a cloth in the sun till the seed can be easily forced out by slightly beating them. It is then to be rendered perfectly clean, and afterwards placed in a sunny situation, until it is become quite dry, for if the least dampness remain, it will grow mouldy and its vegetative power be either greatly impaired or wholly destroyed. When thus properly dried, it should be put in small bags and hung up to the ceiling of a room where a fire is constantly kept."

The produce from the root of this plant is different according to the difference of the soil, but mostly from ten to fifteen or twenty hundred weight where they are suitable to its cultivation.

It seems not improbable, according to the author of Practical Agriculture, "that the cultivation of madder might be rendered a profitable article of field-husbandry in different districts, if the importation of the root from Holland was prohibited; as the event of different trials have shewn that full crops of good madder are capable of being raised." And it is supposed by the intelligent writer of the Survey of Kent, "that if the price was never lower than £3 the hundred weight, it might be grown not only with profit by the farmer, but without injury to the consumer."

It is concluded that, "from the high degree of culture which land under this sort of crop must necessarily undergo; and its not being so much exhausted as in many other cases, it must be an excellent preparation for wheat or any other crop that requires a clean and fine pulverized condition of the mould or soil."

The author of the Farmer's Calendar "advises the young farmer to remember that the culture of these plants, applicable only to the use of manufactures, and which are also largely imported from abroad, is rarely advisable. He was a madder planter once, and lost by every acre he planted. A man may, he says, plant in the moment of a high price, and take up his crop, three years after, at a low one. All such speculations are too hazardous; nor was there even a fair open competition among the purchasers. Those who have cultivated madder with the success boasted by the writers of husbandry, should not hold these observations in contempt. There appears to him almost as much use in mentioning trials that were unsuccessful, as in those that are ever so profitable: for it is certainly of as much consequence to tell one man that his soil *will not do* for madder, as to assure another that his *will do*. Instead of an acre or two, he might possibly have launched (like many others) into 10 or 15 acres, in which case the loss would have been no trifle. And it surely is highly incumbent on every one to make known to the world such of his experience as will probably be of any use to it. Bad success of several persons in a culture, is too apt to prejudice others *in general* against it. However irrational, still it is so, and it ought to be a caution not to recommend any thing in general, under the extravagant notion, that because an article of culture is profitable on one soil, it must be the same on very different ones. But the grand obstacle to the culture of madder is the difficulty of sale: for while a man has not a fair market for his unmanufactured madder, none can with any prudence engage in it, unless on so large a scale as to admit the whole apparatus of reducing it to such a state as to be absolutely a marketable commodity. In answer to this, it may be said, that madder really dry is a *marketable commodity*. But this matters not, if the purchaser has it in his power to be a knave: he has a pretence, a screen always at hand that will cloak the greatest knavery, and to a degree known in no other branch of agriculture. Among the gentlemen of trade who have a mutual understanding and confidence, such objections appear trivial; but to the cultivator, at a distance from the market, it is a different affair. He writes to a madder-merchant to know the price. The answer is, *four pounds an hundred weight*. Up he sends his madder, and instead of 4l. receives but 3l. not from a variation in *price*, but in *weight*. It may be said, that the correspondent in London may be right. Very true; but will the countryman believe it? He thinks himself, right, and has no other proof that he is not so, but the interested assertion of the man who buys it. Is it not evident, that in such a case the cultivator will be disgusted, and throw aside a business in which he knows neither the market weight nor the market price. If encouragement is designed to this culture from any quarter, it should not be exclusive of this circumstance: manufactures should be erected and established, in which the madder could be prepared for any one at so much an hundred weight, and that by persons not the least concerned in purchasing. Then the cultivator would have a commodity in his hands which he could sell in as simple and fair a way as any other. If nothing of this sort can be effected, all encouragement should be for such a number of acres (and no less) as will answer the expence of a

private manufacture, which would prevent persons being unguardedly drawn in, by premiums apparently considerable, to cultivate a root which, when raised, is in its sale absolutely at the mercy of the purchaser."

Kilns are often necessary in the culture of this root; but for small crops a common oven may serve, though it is very tedious, and would require large ovens to supply the place of kilns. However, to save the expence of building such kilns, a place may be made over the roof of the oven, to put the roots in, that they may begin to dry: where much madder is grown, it is notwithstanding absolutely necessary to have a kiln proportioned to the quantity that is to be dried. These may be made of very different forms, being attentive that it may contain a large quantity of roots; that it be worked with ease and the smallest proportion of fuel; and that it may be so contrived as to retain an equal moderate heat.

Those made use of in the Low Countries differ very little from that used here in drying malt: there is a large furnace in which a great fire is made; this furnace is made under an arch; the hot air and smoke pass through a funnel over the furnace, and spread themselves in a space in form of an inverted pyramid, the bottom of which is covered with a perforated floor, on which the madder-roots are spread. See *Kiln*.

And where the manufacture of the article is carried on, a mill for the purpose of pulverising the dried madder is likewise necessary. See *Mill*.

The Expence attending the Culture of an Acre of this sort of Crop on Land worth forty Shillings the Acre, in the digging Method before the late Advance in the Price of Labour.

Expences.	£.	s.	d.
Rent for three years	6	0	0
Digging ditto at two pence per perch	1	6	8
Dividing ditto into beds, two men one day, at one shilling each	0	2	0
Raking ditto, two men one day, at one shilling each	0	2	0
Planting ditto with two thousand plants, one day, at one shilling and six pence each	0	3	0
Six women to take up two thousand ditto, at six pence each, one day	0	3	0
Hoeing the first summer five times	0	15	0
Covering ditto in autumn the first year	0	6	0
Hoeing ditto the second summer three times	0	9	0
Covering ditto in autumn the second year	0	6	0
Hoeing ditto the third summer twice	0	4	6
To be paid in lieu of tithe, at five shillings per acre per annum	0	15	0
Digging ditto out of the ground	5	0	0
Beer	0	6	0
	15	18	2

Produce.	£.	s.	d.
Produce of an acre of madder	52	12	2
Expences	15	18	2
Clear profit	36	14	0

In this estimate, which is much below the present price, nothing is allowed for plants; as, though expensive at first, when once done, a supply from the plantation will constantly be had.

MADE *Streams*, such as are formed by art, as in the case of irrigation, &c.

MADS, a provincial term, applied to earth-worms.

MAGGOT, a well-known animal that is frequently troublesome to sheep. See *Fly*.

MAGNESIA, a substance which has not yet been found in a pure state in nature: it is constantly combined either with acids in the form of earthy salts, or mixed with other earths, as *serpentine*, *steatites*, *talc*, *asbestos*, &c. For most purposes it is commonly prepared by the decomposition of bitter salt, by the fixed mild alkalis, and subsequent separation of the carbonic acid by calcination. This substance, "when pure and perfectly free from acid, has no taste. It imparts a faint green to blue vegetable juices, and is scarcely soluble in water, for no less than 7692 parts of it are required for the complete solution of one part of pure magnesia, nor does it become hot with it. Fire does not change it in the least, and if pure it resists the most intense heat. It is not dissolved by siliceous earth, but with calcareous earth it melts into glass which scintillates with steel. It vitrifies also with borax and microcosmic salt."

The experiments of Mr. Tennant seem to shew that this substance, when in combination with calcareous matters, such as that of lime, is unfriendly to vegetation. It is, however, observed by Lord Dundonald, that it is found "in a variety of earths and stones, and that it combines with acids, forming neutral salts, all of which are very soluble, and the greater part of them promote, in a very considerable degree, the growth of plants. Magnesian earths, he conceives, may be applied with peculiar advantage to soils generally, and not improperly called sour soils, containing green vitriol, arising from the decomposition of pyrites. It will, he says, decompose the metallic salt by superior affinity, and form with the acid Epsom salt, known in a high degree to promote vegetation; while the earth of iron will be separated in the state of an ochre, or iron combined with fixable air," or carbonic acid gas.

A writer in the Farmer's Magazine, likewise, remarks, that he tried the vegetative power of this substance, by sowing oats in a pot containing one tenth part of magnesia, and the rest common earth, in which they grew and throve extremely well; but in another pot containing magnesia alone, they would not vegetate at all, which might, he thinks, be expected. It is likewise supposed to extirpate sorrel, when applied on lands which abound with it, probably by neutralizing the acid, which is the case with lime. This writer has, however, applied it to lands overgrown with sorrel, without its producing such beneficial effects.

MAIZ, a provincial term applied to a large light sort of hay basket, in some districts.

MAIZE, a species of grain much used for food in America, under the name of Indian corn. It is very productive; the size of its ears, where it is cultivated on good warm soils, being, on a medium, nearly a span long, having commonly eight or more rows of grain, each of which usually contains about thirty seeds of various colours, as red, white, yellow, blue, olive, greenish, blackish, speckled, striped, &c. sometimes in the same field and the same ear; but the white and yellow are the most common: nor does this diversity of colours ever reach beyond the outside of the grain, the flour of which is always white, with a little tinge of yellow. The seeds, which are as big as large peas, are round at the outer surface, very smooth, and set extremely close in straight lines. The ear is clothed and armed with several strong thick husks, which defend it not only from unseasonable rains, and the cold of the night (for it does not ripen fully in some places till towards the latter end of September), but also from birds. In the northern districts, the stalk of this plant, which contains a remarkable sweet pith, and is jointed like the cane, does not grow near so high as in the southern parts. It has long leaves almost like the flag at every joint, and at the top a bunch of flowers of various colours. Its culture upon any extensive scale has not hitherto been attempted in this climate.

This kind of crop may be grown on most sorts of soil. On a light poor sandy soil, in Mr. Miller's trials, the method of preparation for it was to have the land ploughed up deep before winter, and laid up in high ridges till the spring, when it was broken fine with the harrow. It was ploughed again in April, laid level, harrowed smooth, and then sowed in drills four feet asunder, into which the seeds were dropped at the distance of about eight or nine inches from each other. When the plants were about three inches high, they were thinned with a hand-hoe, by cutting up some of them where they grew too close, and the intervals between the rows ploughed shallow, to destroy the young weeds: but when the stems were advanced, the ground in the intervals was ploughed deep, and the earth laid up to the plants on both sides; and when the weeds began to grow again, a third ploughing was given, to destroy them. This kept the ground pretty clean from weeds till the corn was ripe, as the season did not prove wet; otherwise a fourth ploughing would have been necessary.

In Ireland, in the experiments of Sir Richard Bulkley, the grains were set a foot asunder in rows about a yard distant from each other. In the former of these cases, there were from each stalk from three to six spikes of grain, and in the latter from three to six stems, and upon each stem three spikes or ears of corn, with two hundred and forty grains in each spike, which was an amazing increase.

In M. Duhamel's attempts to raise this sort of grain, he found it to thrive better in a light and sandy soil, than in stiff and clayey land. It did not answer without dung; and the ground intended for it received two good ploughings in March. A third ploughing given towards the end of April, made the furrows for the seed: and what clods remained after this were broken by hand.

A fine clear day was chosen in May for sowing the seed, which was done by making at the bottom of the furrows, with a stick or other instrument, small holes, into each of which two grains of maize were dropped. The furrows were a foot and a half asunder, and the holes at the same distance, disposed in such a manner as to form a kind of quincunx. When the corn plants appeared, the weakest of the two was plucked up, where both seeds had sprung; and where neither of them had grown, two new grains were planted.

Towards the middle of June, the ground was hand-hoed round each plant; and as they *stud* at the bottom of the furrow, the mould which crumbles down from time to time, laid fresh earth to their roots, and helped to support them. About the end of July, a slight hoeing was again given them, which was the last; and the earth laid towards the roots of the plants.

It is added, that the panicles of the male flowers, which grow at the top of each plant, and are well known not to contain any grain, should be cut off about the middle of August, but care must be taken that the grain be impregnated before this is done, which may be known by the turgid appearance of the outward covering of the ears: and they should not be cut off from all the plants at the same time, as some of the ears are not impregnated till a fortnight after others. These panicles are excellent food for cattle. When they are cut, or shortly after, all the leaves should be stripped off the stalks, together with all the blighted and smutty ears: for it is said that the good ears would not grow so large, nor the grains be so well nourished, if they should be left upon the stalks. All these leaves and ears are given as fodder to oxen.

The time for reaping maize is towards the end of September. The ears are then gathered by hand, and put into baskets, in which they are carried and laid in heaps from space to space in the field, after which they are loaded in carts, carried home, and spread upon an even floor prepared for that purpose. They are then taken out of their sheath or hood, and dried in the sun, before they are laid up in the granary, or else the grain is taken out at that time. Maize which has been well dried in the sun, will keep several years, and not be the less fit for sowing. The granary should be very dry, and the corn laid up in it should be turned at least every three months, to prevent its growing musty, or being attacked by insects. There are two ways of taking out the grain; the first, which is the most expeditious, is by threshing it with a flail, but in this method a great deal of the corn is broken or bruised. The second, and more common, is by rubbing the ears hard against the edge of a flat piece of iron; this easily separates the grains from the spike or cob without hurting them, and this remainder of the ear is very good food for oxen. As soon as the ears are gathered, the

stalks remaining in the ground are plucked up, and laid by for winter fodder for oxen. The field is afterwards ploughed up as soon as possible, it being the general opinion of farmers, that the roots of the maize would otherwise continue to suck up the rich particles of the earth; whether this be true or not, their notion is, that if this ploughing should be deferred, the next year's crop would certainly suffer by it.

When maize is planted only for fodder, particularly for cows and oxen, it is sowed very thick, and harrowed in, or covered with a rake, in a good soil which has been ploughed twice, and well dunged; but it is observed, that in these thick sowings, all the female flowers are barren and produce no grain: and it likewise is so great an impoverisher of land, that though the ground be dunged every time it is planted, wheat never does so well where this corn has grown, as in the neighbouring fields where it never was.

In M. Amien's trials it was found of importance to sow maize rather in the beginning than at the latter end of May, because if it be sown early, the plants will have acquired sufficient strength before the great heats to shoot out then with vigour, and the ears be not liable to that barrenness to which they are subject when sown late; besides, the stalks will be stronger, and their ears larger and fuller of grain; the ears of maize also are greatly hurt by cutting the panicles too late, which ought to be done before the hoods are open. By leaving a plant with its male flowers at every twenty feet distance, all the female ears may be impregnated.

In order to ascertain whether it be best to sow maize thick or thin, he planted three different spots of ground with this corn in April; the seed used for the first, where the grains were placed about a foot and a half asunder, according to the common practice of the country, weighed one ounce and one pennyweight: the second, in which the grains were only a foot asunder, was sowed with two ounces and two pennyweights of seed: and the third, in which they were but six inches apart, was sowed with four ounces and a half. The first of these spots produced eighteen pounds and four ounces of grain: the second fifteen pounds seven ounces: and the third, eleven pounds two ounces. A manifest proof, M. Duhamel observes, that some sorts of grain do not thrive unless they are sown very thin, and that for want of this precaution, a great deal of corn is often lost, and the crops considerably diminished.

This plant, when cut green, affords a good cattle food: the grain is likewise highly useful for feeding poultry and hogs, and when ground into flour, for various purposes.

In America, according to Mr. Parkinson, the common method to prepare land for Indian corn, is in the fall (Autumn) to plough it, or what is termed *flushing* it. The soil is raised in a rough manner by ploughing broad furrows; it being so thin, that it is not turned over, but stands on the edge very much; the ploughs are of a bad construction. In the latter end of April or beginning of May, the plan is to *list* it out, that is, crossing the field five or six feet asunder setting two furrows back to back, then the like the other way, which forms a sort of hill where these furrows cross each other. The practice is then to go with a large hoe, such as that its weight will break the clods, in the same manner as malls (beetles) for that use, and make the mould very fine, something in the manner that gardeners do for cucumbers in the gardens in this country. In these hills are put four or five corns, and this is generally done in the first week of May.

Reckoning four corns to one hill, four thousand only will be required to plant an acre containing a thousand hills. When the corn is come up, the custom is to go with their hoes, and draw a little mould to the plants, destroy any weeds that may appear, and plant fresh corn, if any be wanting, which often happens; that done, to plough from those hills both ways, then to go with the hoes, and work the hills again, and to draw the plants of an inferior kind out, leaving two of the best on each hill, or if the land be good, three and sometimes four, and to transplant those drawn out where any are wanting. However, when more than two plants are left on one hill, there will, he says, be little corn, but much tops and blades. Then to plough all the land towards the plants one way; after this it is necessary to what they term *sucker* them, that is to take off any young sprouts that have tillered, otherwise the corn will not grow in the ear to its proper length or size, but grow short, what they call *cobbings*; this done, just before it goes into silk, they plough the land to the corn the contrary way, which is five times in all. The expence would be about seven pounds per acre, he says, if the work were done by hired labourers, and horses for ploughing.

Expences on one acre of land.

	£.	s.	d.
To ploughing, or what is termed *flushing*,	1	2	6
Listing, and preparing the hills for planting and sowing the seed, - -	1	2	6
Moulding the corn, where the first missed,	0	15	0
Ploughing from the corn, - - -	0	18	0
Hoeing and transplanting, where any plants may be wanted, - -	0	15	0
Ploughing to the corn, - -	0	18	0
Suckering the corn, - -	0	3	9
Ploughing the contrary way to the corn,	0	18	0
Topping and blading, - -	0	3	9
Leading home, - - -	0	1	0
Pulling the corn, - -	0	1	0
Carrying home, - - -	0	0	6
Seed, - - -	0	2	0
Husking fifteen bushels -	0	1	6
Rubbing it off the ear, (fifteen bushels)	0	15	0
	£. 7	17	6

The last time of ploughing is "during the latter end of August, then some of them sow the wheat under furrow, for which the Indian corn crop is a preparation, but which is harrowed in by others in September; the ploughing is done in a skimmering manner, very thin."

It is added, that "the raising of Indian corn is an absolute preparation for wheat, rye, or winter barley, and perhaps better for the land in that hot country, than nothing, and cost little more than the seed wheat. It is a general practice to cut the tops, and pull the blades, before they sow the wheat: the topping and blading is done by cutting the top off with a knife, just above the uppermost ear, as there are or ought to be two ears on each stalk, which are thrown out about four feet above the ground; he has had from five to seven ears put out silk, but they never came to perfection."

But Mr. Parkinson, however, in his own practice, put the corn into the ground in drills, at different distances from three to six feet, harrowing the seed in, and found on actual trials, that a better crop of Indian corn may be raised by planting at six feet apart, and eighteen inches in the drills, than by any other mode which he has attempted, where the land is rich. Upon very poor land he does not, however, doubt but that the hill method may be superior, as by hoeing and ploughing there may be rather more of the best earth added to the roots of the corn. This sort of drilling was found the best and cleanest method, as well as probably the cheapest.

The same author remarks, that "good Indian corn will be from twelve to fourteen feet high, and that the white corn is much higher than the yellow; but the yellow is by far the sweetest, although the tops and blades are not so abundant. There are several kinds or varieties, both of yellow and white corn; the yellow is earlier than the white by one month." And, that, "the tops are set up in bunches, or shocks; the blades are pulled off, tied up in small bundles, about one pound each, and hung on one of the corn stalks by the tie or band, and in two or three days it is ready to carry." It is added, that "the usual method of preserving them for the winter is to make what is termed a fodder house, by setting up long grained posts, and laying a rail upon the tops, then placing other rails upon the ground, leaning against what may be termed the ridge-tree, they then lay the tops on like thatch, the blades are stored within the house; the husks are put into the house after the corn is gathered and husked, and given in the winter to the cattle. The white corn generally hangs on till frosty weather, as it takes a great deal of curing or hardening, having a very thick husk and a large cob. One leaf hangs over another, and the ear hangs downwards, and would not take harm all the winter, were not the ear to drop off the stalk. It is generally gathered in frosty weather, and sometimes when snow is on the ground, One reason, he says, may be, that it does less injury to the wheat, as they are obliged to cart upon the land where the wheat grows. The corn is taken from the cob by hand, as it cannot be thrashed as grain is. They have generally a husking feast, when all the neighbours come and help to husk."

This sort of crop was formerly introduced in rotation with other sorts of grains, so as to greatly injure the ground as well as be less productive; and the practice still prevails in many places; but in the more improved methods of cultivation, and where the better sorts of husbandry prevail, it is now the custom to grow this kind of grain in courses with crops of the green ameliorating sort, such as the following:

Old American maize course.	*Better Maize course.*
1 Maize,	1 Maize,
2 Wheat or Rye,	2 Wheat, (or spring barley),
3 Lay, or mean pasture;	3 Clover,
or,	4 Rye or winter barley,
1 Maize,	5 Clover,
2 Naked fallow,	6 Clover.
3 Wheat,	
4 Lay or mean pasture.	

Improved Maize course.

1 Maize,
2 Beans,
3 Barley,
4 Clover,
5 Wheat,
6 Clover.

This is not, he says, a beneficial crop, and from calculation it cannot; but it must be a useful crop, he thinks, as it is the whole support of America. They begin, says he, to eat it as soon as it is formed in what is termed roasting ears; they boil them, and eat the corn in the same manner as we do green peas, with drawn butter, and to bacon, ham, beef, mutton, or any other kind of meat. The blades and tops feed the horses, cattle, and sheep; the corn feeds both man and beast, and is very excellent food for fowls, hogs, &c. The people eat it in *hominy*, mush and bread, or cakes: the *hominy* is made in like manner to our creed wheat buttered, by knocking the husk off in a wooden mortar; the mush is made of the flour as our hasty pudding, and eaten with milk or treacle. The better sort of people make a very nice cake, with eggs and milk, about the size and thickness of *pyfleets*, or what are called crumpets in London; the lower class of people mix the flour with water, make a sort of paste, and lay it before the fire on a board or shingle to bake, and generally eat it hot, as it is but very indifferent food when cold; it is called *Johnny* cake.

MALANDERS, a disease of the cutaneous kind, in horses, in which cracks are found in the bend of the knees or hocks, that discharge a sharp fœted indigested matter; they are often the occasion of lameness, stiffness, and stumbling. It is usually confined to draught horses, and is produced by an obstruction of the perspirable vessels, from want of proper cleanliness and friction.

This distemper may be cured by washing the parts with a lather of soap warmed, and then applying over the cracks a strong mercurial ointment spread on tow, with which they should be dressed, night and morning, till all the scabs fall off. But a better method of cure is to clip off the hair close to the skin, and wash the parts well with soft soap and water; after which, according to Mr. Denny, the following powder should be rubbed on twice in the day:

Take of vitriolated zinc,
Alum, of each in powder, half an ounce.
Mix them together.

Gentle purging or a diuretic ball may also be necessary in obstinate cases, where there is much inflammation; but Mr. White makes use of an ointment constituted in the following manner, twice a day:

Take of ointment of wax two ounces,
Olive oil one ounce,
Camphor, oil of rosemary, and
Acetated water of letharge, each one ounce
two drachms. Mixed.

MALM, a term sometimes applied to a sort of white marley clay. It is a substance that has been found beneficial on soils of the stiff clayey kind when laid on in pretty large proportions, as about sixty tons per acre. In one instance of this kind of soil, mentioned in the fourth volume of Communications, when applied in this proportion on a very large scale, the produce was full three times as great per acre as in the original state. It is asserted that the quality of this substance may be best proved by common vinegar; in which case a portion should be dried, and put into a wine glass full of vinegar; when it instantly begins to effervesce and attract the acid, it may be depended on to be highly useful as a manure.

MALT, a name applied to barley, after it has undergone the process of malting; by this means it becomes fit for making beer or ale.

It is said, that the soil on which barley grows makes a considerable difference in the grain, and that the barley fittest for malt is that which grows on a rich, light, or gravelly soil, and which has been raised from seed brought from a farm of a different soil and situation. The fullest and largest grained parts of such crops should be chosen for making malt. It should be heavy, and perfectly sound, and such as has not suffered any accident in the field. Its being a very little heated in the mow is by some considered rather an advantage, as the grain will be more equally dried, and will consequently the more equally imbibe water; but when it has been so much hurt in the mow as to look blackish when broken at the thick end, it is unfit to make good malt. It is also found by experience, that barley taken immediately from the field does not malt so kindly as that which has been some time in the house or mow. And particular care should be taken that it be free from the seeds of weeds; for these in the malting are apt to give the grain a bad taste, which cannot afterwards be got rid of.

In the process of germination, all the principles of the grain are put in action. The heat which it undergoes separates and divides its parts; and the viscidity which it before possessed, is removed or converted into a sweet principle, or sugar.

In order to its being malted, the barley is put into a cistern lined with lead or stone, and covered with water about six inches deep above the barley, to give room for its swelling. All the good grains sink in the water, but after stirring it, the imperfect or distempered ones rise to the surface. These should be skimmed off, and given to poultry or hogs, for they will never make good malt. By the water's gaining admittance into the barley, a great quantity of the air is expelled, as appears from the number of bubbles which rise on the surface.

The barley is left in the water two or three days, more or less, in proportion to the heat of the weather and the dryness of the barley. A judgment is formed that grain is fully saturated with water, from its appearing turgid, and easily giving way to an iron rod dropped perpendicularly into it. Or, by taking a corn from the middle of the cistern, and holding it steadily, by the two ends, between the fore finger and thumb; pressing it gently, and if it continues firm when so pressed, and the skin does not break, it must soak longer; but if it crushes together and feels mellow, and the skin crack, it is watered enough. Nicety in this is a material point, and can be learnt only by experience. If the grain should be suffered to remain too long in the water, it would begin to lose part of its sweetness. When it has been steeped sufficiently, the water is drawn off.

The water used for this purpose should be that of a clear running stream, or rain-water; or if such cannot be had, pond-water, provided it be sweet and clean, will do very well; or pump-water, which should be rendered soft, if it be naturally hard. If the water made use of is any way tainted, it communicates to the malt a taste which it never loses.

From the cistern, the barley is laid in a regular heap, where it must remain thirty hours, or till it contracts a heat. It must then be worked in one or more heaps, and turned every four, six, or eight hours, according as the weather is cold or hot. When it begins to spire, it should be turned every three or four hours, according to the temperature of the air; and as it *comes*, as its spiring is commonly termed, the heap must be spread thinner to cool it, lest it be heated too much, and the germination be carried on too fast. The turning of it must be continued in proportion as it is more or less slow in growth, so that it may be brought tolerably dry to the skin. When the spires begin to deaden, the couch must be thickened again, and often turned, that the growth of the sprout may not revive. At this time the spire should be near piercing through the outer skin of the barley: as if it grows quite out, the strength of the malt will be too much consumed. After the malt is made thus far, the common practice is to lay it at once on the kiln: but the best way is to gather it all up in one heap, to let it lie in that state twelve hours, and then to turn it every fourth hour during the space of twenty-four hours. No person should be suffered to tread on the malt with their shoes, while it is on the floor, because many grains are inevitably bruised thereby, and these, vegetating no longer, afford the roots of the other grains a substance into which they extend their fibres, and are by that means entangled in bunches; and besides this, the bruised corn acquires a degree of putrefaction which taints the liquor made from the malt. Equal care should also be taken, that the grain be not bruised by any other means.

According to some the time most proper for malting is, when the temperature of the air is such that the grain naturally begins to germinate. How far the limits may be extended, experience alone can determine. The warmer the weather is, the greater must be the disadvantage under which the malster labours; because the motion of the fluids is then so strong, that the process goes on too quick, and the finer parts are apt to fly off: the consequence of which is, that instead of a sweet, the malt inclines to a bitter taste. This is so universally experienced, that brewers carefully avoid purchasing what is termed latter made malt.

The grain thus prepared for drying is spread on the kiln, where, meeting with a heat greater than is suited to vegetation, its farther growth is stopped. It is spread on the kiln three or four inches thick, and turned every three or four hours. The laying of it thicker is attended with inconveniences, among which is particularly its being unequally dried; and therefore that should be avoided. The strength and duration of the fire is different, according as the malt is intended to be dried pale, amber, or brown. The pale malt requires more leisure, and less fire, than the amber or brown. Pale and amber malt are dried with coke or culm, which not emitting any smoke, give it a brighter colour, and do not communicate that bad flavour which it has when dried with wood, straw, &c. Coke is best as it affords a steady and constant heat, whereby the malt is dried more uniformly. Where wood, or any vegetable fuel is used, it should be extremely well dried, in order that, being as free as possible from moisture, it may yield less smoke.

An ingenious and attentive malster found the degree of heat in the malt whilst on the floor, to be, during the first ten days, between 50 and 60 degrees. During the next three or four days, from 60 to 65 and 77 degrees; and during the last days of its lying there, to 80, 84, and 87: which last was the degree of heat when the malt was put on the kiln. There cannot be any absolute rule as to the difference of heat during the different times in the process of malting, because it must be suited to the heat of the air; at least we have not yet sufficient date whereon to found such a calculation. The heat of the malt on the kiln when fit for pale malt was 120 degrees, and when it was fit for brown, 147.

The observation, that malt is fit for what is called pale malt, when its heat is 120 degrees, suggests a caution which should be carefully attended to, namely, that whatever colour it be intended to give the malt, the heat at first should always be the same: thus, for example, malt which is dried to the degree of high brown, should first be rendered pale malt, then amber, and so on progressively; not by a sudden increase of the fire, but by a longer continuance of it. In this manner the whole body of the grain is equally and gradually dried; whereas a strong and quicker fire would parch, or as it were singe the outside, while the internal parts remained moist; and as that moisture is afterwards evaporated, it must crack the surrounding hardened crust, and damage the grain in another respect.

As soon as the malt is dry, it must be removed from the kiln, and spread thin, that it may cool to the temperature of the air. It cannot be supposed that any of its parts are capable of retaining the heat in such a manner as not to suffer it to escape, though some have conceived that to be the case. In proportion as malts are dried, their particles are more or less separated, and coming in contact with water, they strongly attract from it particles which fill up their interstices. In mashing, this action between the malt and the water generates a small degree of heat but not durable; though from hence arose the opinion, that brown malt is full of fire or heat.

The size of the malt-kiln should be proportioned to the quantity of malt for which it is intended. Some build their kilns square, and others make them round; but this last is undoubtedly the best form as the heat of the fire is more equally diffused therein, and the grain is of course more equally dried. Various substances have been made use of for covering the kiln, such as tiles, plates of tin, and wire: of these, the wire is to be prefered, because it does not contract so great a degree of heat as to parch the grain in contact with it: but, for this very reason, hair-cloth is probably preferable to any other covering; as when any part of the malt is in immediate contact with a substance much more solid than itself, and therefore capable of receiving a proportionably greater degree of heat, the malt in contact with that heated body is parched or burnt, by heat which is not equally diffused through the whole mass: which mass cannot therefore be all equally heated. The hair-cloth is spread upon small wooden rafters, and these are supported by bars of iron laid across the kiln. See *Kiln*.

The grain may, at a medium, be said to lose by malting one fourth part of its weight, including what is separated from it by the spires screened off; but this proportion varies according as it is more or less dried. The condition of the barley, as to its greenness or ripeness, at the time of its being gathered in, is clearly discernible when it is malted. If it was gathered green, it rather loses than gains in quantity; the malt becomes of a smaller body, appears shrivelled, and often is unkindly hard; whilst, on the contrary, that which was cut at full **maturity** increases in malting, appears plump, bright, and clear, if properly carried through the process, and, on being cracked, readily yields that fine mealy substance so much desired by the brewers.

Malt which has not had a sufficient time to shoot, so that its plume, or *acrospire*, as the adepts in malting call it, may have reached the inward skin of the barley, remains charged with too large a quantity of its unattenuated matter. All those parts which have not been put in motion by the act of germination being, when laid on the kiln to dry, so hardened as not to be readily soluble in water, and consequently will be lost to the strength of the liquor. When it is suffered to grow too much, or until the spire has shot through

the skin of the barley; though all that is left be malt, yet, as too large a portion of its essential part will have been expended in vegetation, the malt must be greatly diminished in proportion to what it ought to have been, and what remains cannot be so fit for brewing drink for long keeping. And such as has been duly worked on the floor will, if it has not been sufficiently dried on the kiln, be apt to germinate or sprout afresh, perhaps take on a very great heat; and should it continue long with a moderate degree of heat, the least evil that can be expected is, that it will grow mouldy and have an ill flavour. When it has been well worked, but over-dried, it will be so hardened, that it will not imbibe from the air that moisture which is necessary to mellow it, and render it fit for brewing: for when it has been previously softened by the moisture of the air, it mixes more easily and more intimately with the water, and by that means yields a more copious extract than it would otherwise do. Such malt as has just, or but lately been taken from the kiln, remains warm a considerable time. Until it becomes as cool as the surrounding air, it does not mellow by the addition of a due quantity of moisture from the air; and the wort made of such malt requires a much longer boiling before it breaks, than that which is made of malt some months old.

The practice of sprinkling water on malt newly taken from the kiln, to give it the appearance of having been made a proper time, or to plump it, is highly prejudicial, as tending not only to defraud, as less grain fills the bushel, but if not used speedily, heats, soon grows mouldy, and suffers great damage.

It is obvious that malt dried on a kiln not sufficiently heated must require a proportionably longer time for it to receive the due effect of the fire; for want of which it will be in the same state as that not thoroughly dried. Or if the fire be too quick, or too fierce, instead of gently evaporating the water from the corn, it scorches the outward skin, and separates it from the body of the grain. The malt to which this happens is called brown malt, and is very bulky; and if such a fire be continued, it changes some parts of the grain into so brittle a substance, that the malt is said to be glassy. The particles which are thus hardened will not dissolve, or but in small proportion; so that they frequently occasion an almost total want of extract, which, in the phrase of the art, is termed the setting the *grist*.

The goodness of malt may be known by the following marks: when a grain of it is broken, and it tastes mellow and sweet, breaks soft, and is full of flour from one end to the other, it is good. If it has a round full body, and upon putting some grains into water, they swim on the surface, it is good. Barley sinks in water, and malt that is not well made will do the same: but it is to be observed that this is not an invariable proof, because, if the malt be broken, or in the least cracked, it will take in water, and sink. Malt that is rightly made will not be hard, but of so mellow a nature, that if drawn over an oak board, across the grain, it will leave a white line upon the board, like a mark of chalk. Its smell also may be consulted; for malt, though otherwise good, may have contracted an ill scent from the fuel, or from the water used in the steeping.

In respect to the changing the water in steeping, some malsters think it no ways necessary; others, on the contrary, approve of it, but do it indiscriminately in the same proportion during the whole season. They are probably in both respects wrong; for the times when the water requires to be changed oftenest, are at the beginning and latter end of the season, in autumn and spring, when the weather is warm; for in the middle of the winter the weather is too cold to admit of the water being at all changed to any advantage. Suppose the barley to be left in steep forty-eight hours in the spring; if the weather is inclinable to be warm, the water may be in that space of time changed three times; in other cases twice may be enough: but the best rule is, that as it is well known, that in the autumn and spring, if barley is left too long on the steep in the same water, the water will grow slimy, and sometimes sour: the malster should watch the changes of the water, and when he finds that it is smooth and oily to the touch, and that it is inclinable either to smell or taste sour, let him by all means have it instantly changed; but he must observe, if he regards his interest, a particular method even in doing this. The usual way of changing the water is, first to draw off that in which the barley was steeping, and afterwards by pails full, or by pumping, fill the cistern again. But it is advised, as a better method, to have some water in readiness to pour on immediately after the first is withdrawn, as by that means the danger of heating is prevented. Much mischief often arises from the not changing the water at these seasons.

In converting this substance to the purpose of brewing, it should be freed from the tails and dust before it is ground, which would otherwise heighten the colour of the wort, render the liquor muddy, and give it a bad taste, which cannot afterwards be got rid of. A cylindrical sieve will be useful for this purpose.

In grinding, when too small, its flour will mix too freely with the water, and cause the wort to run thick. Many are of opinion that the best way is only to crack it, so that none of the grains may come out whole; for the intent is, that the water should draw out an extract, but not be mixed with the mealy part, in the manner of a paste or gruel. Some think that malt is better ground by a stone mill than by a steel one, because the former bruises it, and the latter only cuts the grains.

After it is ground it should lie some time to mellow in a cool room where no sun comes. The time for this is different, according to its kind. Brown malt may be ground at from three to four or five days before it is used, in order that the corn, which is rendered uncommonly hard by that degree of drying, may be gradually softened by the moisture in the air; by which means it will become the more soluble in water. The pale malts require only one or two days. After lying thus in the air, less mashing suffices; the strength of the malt is more perfectly extracted, and the beer

will be considerably stronger than it would be with the same quantity of malt taken directly from the kiln; but care must be taken that it get no damage in lying. Further experiments on these points, however, are wanting. See *Brewing*.

In addition to what has been stated above, on the drying of malt, an experienced maltster remarks, that his constant practice has been to give his malt as much drying as he could on the floor: this is, he says, not only a great saving of fuel, but also attended with several other advantages. The malt, by being thus gradually divested of its outward moisture, does not shrink so much when it comes to be laid on the kiln; and of course it measures to more advantage, and is besides, of a better quality, having acquired no foreign taste. It is supposed that where malt is laid very damp on the kiln, a thick smoky vapour immediately arises from the surface of it, which, being repelled and condensed by the cold circumambient air, falls again on the malt, where, by the heat from the furnace, it is a second time rarefied, and ascends in clouds of steam: and that this alternate rarefaction and condensation of the moisture is of great disservice to the malt, by often giving it a disagreeable musty flavour, and making it more unfit for keeping. But by the method of suffering the malt to receive a part of its drying on the floor, this inconvenience is, it is believed, in a great measure avoided; as the gross moisture is evaporated before it is laid on the kiln, and that which remains creates no great degree of steam, provided the fire in the furnace is not at first made to burn too fierce. The above maltster says, that with this precaution he has often made pale malt as fine as he has seen any where, such as was constantly praised. In drying it, he took care that there was, during the whole time it was on the kiln, but a very moderate yet equal fire in the furnace.

It is suggested in the fifth volume of the Farmer's Magazine, that the best *pale malt*, for making beer, is only capable of being produced by drying it with steam; and that such grain as is intended to be malted, should have its dampness corrected, and be rendered fit for keeping only by the heat of steam, as it is known that exposure to a naked fire, however cautiously managed, destroys a great part, if not the whole of the embryo germs of seeds.

In order to have malt highly dried, as some like brown malt better than pale, when the moisture was nearly evaporated, the above mentioned maltster caused the fire to be gradually increased till it roared in the furnace, taking care that the malt should be properly stirred, lest it proved kiln-burnt; and by this method he had a fine, sweet, brown malt, fit for making harvest beer, such as some farmers are very fond of brewing.

It is the opinion of some, that brown malt, used in the same proportion with the pale, will make the strongest beer; but this, he says, is certainly a mistake, as he has often made the experiment with great precision, but could never find any material difference, and what difference there was at any time, seemed to him to be rather in favour of the pale than the brown malt: this, he thinks, may easily be accounted for, as the flour in the pale malt always remained sound and uninjured in the drying; while the brown malt sometimes, notwithstanding all the care of the maltster, is liable to be injured or parched by the fire, and that part must of course, lose much of its virtue. It is, however, noticed that such pale malts as are slack dried, make a raw, unwholesome liquor, which will not keep well, but if pale malt be gradually and slowly dried by an uniform gentle heat, it will certainly answer the character he has given of it, and besides, keep as well as any brown malt whatever, as he has fully experienced.

It is observed, that in the spring and autumn, the making of malt in all its parts, is a very critical business; as it is then particularly necessary that the beds, or couches, should be frequently turned, or the malt will not come kindly: as the first root will be apt to shoot forth vigorously, starving the other roots, and preventing them from accompanying it in its growth: this must be checked, and the remedy is, to turn the couch often, spread it thin, and give it a sufficient quantity of air, at the same time keeping it cool and temperate. This will stop the progress of the first root, give the others time to sprout, and the barley will then malt kindly and more regularly.

A thin skinned fine-coated barley is said to be best for making malt, and it is not worse for not being very full-bodied; yet a lean, half-starved, unripe grain should not by any means be recommended. And such as has grown on lands highly manured is not so good for making malt as that which has been produced by land of a moderate richness without it: in fact, a luxuriant soil, whether naturally so or enriched by art, is not, in general, best for yielding barley for the maltster's use. Some prefer, for malting, a grain which is the produce of a soil that is rather poor than rich, rather light than strong, and more inclined to a gravel than a clay. As this grain is clean coated, taper, and elegant in its form, is full of flour, mostly transparent when watered, and will be sufficiently wetted in forty-eight hours. It also increases in the malting, fills the bushel well, and makes a fine, sweet, wholesome, clean, full-bodied malt, from which the best beer may be brewed, either brown or pale, according as the malt has been dried higher or lower.

Mixed grain, or such as is grown on various soils, and in different situations, should never be purchased when it can be avoided, as it will be apt to disappoint the buyer, from the kernels spiring at different times, and some of them not at all; so that after the couch is dried, some part of it will only be half malted, and a great deal not malted at all.

The following method is recommended to discover malt that has been made of mixed, or in part unripe barley. Take a bowl of water, throw into it a couple of handfuls of the malt, give it a gentle stirring, and the barley which has not been malted will sink to the bottom; the half malted grains will have one end sunk, being in a vertical position; and the true good malt swim. It is, however, remarked, that the same

barley, though ever so good, will not malt alike well at all times: for instance, take it as soon as it is housed, it comes well, but whilst it is in its sweat, by no means so; yet after it has done sweating, it comes well again. And barley which has been got in early in a very dry season, makes but indifferent malt; while the same barley, if it is left abroad till rain falls on it to loosen the husk from the kernel, malts very well, and yields a large increase. Also old barley, mixed with that of the last harvest, does not malt well, as it does not all spear, or put forth its beard, at the same time. These niceties, though little attended to, are of importance in the making of good malt.

Malt-*Dust*, the dust or substance that separates from the malt in the act of drying, or during its preparation. It is sometimes called malt-combs, and has been found useful as a manure, in lessening the cohesion of stiff heavy soils. But it may probably be made use of to the greatest advantage, as a top dressing when sown over crops in the early spring season.

The following experiments are recorded, with respect to the disputed point of its being more adapted to barley than wheat crops. It has often been asserted, by some, that malt-dust is much better suited as a manure to barley than wheat; as from the latter lying a whole year in the ground, and the malt-dust being sown with it, the virtues of the manure are exhausted long before the summer, when the corn principally wants nourishment; being too early advanced in its growth, and rendered winter-proud by it; while others, contradicting this assertion, say it is best for wheat, making it appear, that it often causes very good crops of corn, particularly after a hard winter. In order to make some experiments to ascertain this matter, a field of ten acres was fixed upon, which had borne a good crop of horse-beans; after which it was sown with turnips, which, being fed off, it was summer-fallowed, being intended for wheat. The soil was a stiffish loam, in good heart and tolerably clean. It was divided by deep furrows into ten equal parts, each containing one acre, and numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10. The whole field during the course of the fallowing had four ploughings given it, which reduced it to a fine tilth, or mould. As wheat-seed time came, number 1 was sown broad-cast, with three bushels of wheat, and ploughed in, laying on no manure whatever. Number 2 was sown with the same quantity of wheat, after which ten quarters, or eighty bushels of malt-dust were strewed over it, and that and the seed ploughed in together. Number 3 was also sown with wheat in the same manner, except that the strewing on the malt-dust was deferred till the latter end of January. Number 4 had a dressing of dung in the ordinary way, and was sown with three bushels of wheat like the other parts. Number 5 was dressed by sheep-folding, and was also in like manner sown with wheat. Number 6 was sown with wheat in the same quantity: and in February, after sowing, received a half dressing of very rotten dung, which had been several times turned and mixed. Number 7, after receiving a ploughing in the spring, was sown with ten pecks of barley, which was harrowed in, and no manure at all applied. Number 8 was sown with barley, as above, but had ten quarters of malt-dust laid on it. Number 9 had in the winter a good dressing of dung, and was in the spring sown with the same quantity of barley. Number 10 was sown with barley, like number 8, only it had five instead of ten quarters of malt-dust laid on it.

It is observed that all the pieces of wheat were sown the first week in October, and all the barley the second week in March. In January on examining the wheat, it was found that the acre marked number 2, looked most forward and flourishing; though there was in appearance but little difference between that and number 4. The numbers 1, 3, and 6, neither of them looked so vigorous as those already noticed; and number 5 seemed rather thin on the land; but the wheat plants were in good condition and healthy. And on another examination, in May, of the wheat crops, it was found that number 1 was tolerably clean and promised well; and number 2 gave hopes of a large crop, and was surprisingly clear of weeds. Number 3 was greatly improved since the laying on of the dressing of malt-dust. Number 4 looked very vigorous and strong, but was very foul, having several sorts of weeds not to be met with in other parts of the land. Number 5 was thin of plants, and they did not branch much: however, they still seemed healthy and strong. Number 6 was like number 3, greatly improved; but it was foul, and, what appeared strange, had many weeds of a nature quite different from those with which number 4 was infested, though the dung laid on both these parts was taken from the same heap.

And at this time, on looking at the pieces sown with barley, number 7 was found promising and clean. Number 8 was forwarder, and afforded the prospect of a large crop. Number 9 was forward and fine, but foul with weeds. Number 10 bore much the same appearance as number 1, and promised as well.

At harvest number 2 of the wheat was first fit to reap, after which succeeded number 4; the rest were ready nearly at the same time.

Of the barleys, numbers 8 and 10 were first ready to mow.

It is almost unnecessary to observe that those crops which were clearest of weeds were the soonest fit for carrying.

These crops were all laid separately, as well as all separately thrashed, and dressed as early as possible in the winter.

The produce of the several crops, on being distinctly noted, were the following:

Crops.	*Produce.* Bush.	Pecks.
Number 1, unmanured, wheat -	20	1
Number 2, manured with malt-dust when sown - - -	28	3
Number 3, manured with malt-dust after Christmas by way of top-dressing	40	1

Crops.	Produce. Bush.	Pecks.
Number 4, manured with dung in the ordinary way	32	2
Number 5, folded with sheep	29	3
Number 6, dressed with rotten dung in February	30	0
Number 7, unmanured barley	32	3
Number 8, manured with ten quarters of malt-dust when sown	48	0
Number 9, manured with dung in the winter	40	2
Number 10, manured when sown, with five quarters of malt-dust	44	0

From these trials it is concluded, first, that when malt-dust is used as a manure for wheat, it is the best to lay it on by way of top dressing after the corn is come up, as the crop of numb. 3 yielded above twelve bushels more than that of numb. 2; and it is supposed that the virtue of the malt-dust laid on numb. 2 was exhausted before it could be of any essential service to the crop; whereas, in numb. 3, the manure began to yield forth its virtues just as the wheat plants began to be in want of a fresh supply of nourishment. It was also evident that the grains of wheat which grew on number 2 were thinner and had less substance than those of number 3, the grain of which was fine, plump, and heavy.

It was also clear, from the produce of number 4, that malt-dust is, in many cases, a better manure for wheat than dung, not only as it gives a larger increase, but also because it does not stock the land with destructive and devouring weeds.

The wheat grown on number 5 was as fine as that of number 3, but considerably less in quantity, as appears by the account.

The method pursued in number 6 is not desirable: it is a good alternative, if the farmer happens to have too little dung to dress all his fallow lands with.

It is also supposed that malt-dust is a very good and profitable manure for a barley crop; but the yielding of number 10 being forty-four bushels, and of number 8 only forty-eight bushels, which last is not an increase in proportion to the additional quantity of manure laid on, it may be concluded, that eight quarters, or sixty-four bushels, of malt-dust is the proper quantity to lay on an acre for a barley crop, and that at the time of sowing. In speaking of malt-dust, it is meant the kiln-dust, or that which falls from the malt in drying: as to the tail-dust, that falls through the screen whilst the malt is cleaning before it is put in sacks, that may be applied to a better use, being generally given to pigs, and often to cows, in which last case it makes them give a great deal of milk.

It has been suggested that the virtue of malt-dust, as a manure, lasts only for one crop; but this is a mistake, for when this manure is laid on in January or February, a good crop of the green kind may be had after the wheat.

This manure is supposed to be of a very warm nature: this has induced many farmers to think that it may burn crops; and it may perhaps do so on a hot gravelly soil; but on clay land, or a stiff loam, it seldom or never does any damage: and indeed the only danger is a dry time ensuing after it is spread on the land, for the first shower of rain washes it in, and secures the crop from all hazard of being burnt or injured in that way.

It is supposed by some, that malt-dust is for a stiff soil a better manure than dung; but the difficulty is, whether it is most profitable to lay it on when the wheat is sown, or by way of top dressing in January or February. The above experiments seem to show, that the best time to dress heavy wheat land with it, is in January or the following month.

It is also stated, that nothing surpasses this manure when laid on cold grass grounds, to the amount of about eight quarters or sixty bushels an acre. Its effects in this way are said to be very great.

In an experiment of Mr. Bedford's, in which a piece of land was manured with this substance at the rate of four quarters to the acre, and sown with barley and clover, the barley was very luxuriant, producing near seven quarters per acre, and the clover extremely fine; from which it is concluded that it is a valuable sort of manure, being cheaper than rape dust or any other sort of top dressing, as it only costs about twelve shillings the acre.

About Dunstable this sort of manure costs one shilling a bushel, is sown by hand at the rate of from twenty-four to thirty-two bushels the acre over the barley land, and harrowed in with the seed. It is seldom used to wheat in that district, but would probably answer well to it as a top dressing, in the proportion of about thirty bushels to the acre, sown over the crops in March.

The black malt-dust, or that which falls through the kiln plate, is preferable to the white, from the seeds of weeds being destroyed by the heat in drying.

MANAGEMENT *of Horses on the Road*, the method of treating them when travelling. Previous to travelling, every precaution should be employed to bring horses into as perfect condition as possible, as much trouble and inconvenience is thereby avoided.

The author of the Compendium of Veterinary Medicine remarks, that should the horse "be at all subject to grease or swelling of the legs, a dose of physic is to be recommended, taking care to preserve the heels clean, and to keep up a brisk circulation in the legs by frequent hand-rubbing. Should the feet be tender, it is necessary to inquire into the cause. If it arise from corns, let the directions be followed that are given under that head; if it proceed from flat and thin soles, apply tar to them, and let the horse stand upon a flat surface, without shoes, by which means they will be rendered thicker and more firm; and when he is ridden, let a concave shoe be made use of. When the thrush or disease of the frog is the cause of the tenderness, cut away the diseased parts, apply tar, with a pledget of tow, and upon this place the artificial frog—the natural frog by the use of this will soon become firm and solid. If the thrush be occasioned by a contraction of the heels, which is

frequently the case, it will then be necessary to rasp the quarters moderately; and should they appear to be too strong, wanting a proper degree of elasticity, keep the hoof constantly moist. See *Hoof* and *Frog*.

Horses that travel during the winter are very liable to have their heels inflamed and cracked, as it is termed, unless great attention is paid to them in the stable. In cases where the heels are already thus affected, they should be washed with moderately warm water as soon as the horse gets in, and, afterwards carefully wiped dry with a soft cloth; if much inflamed, an astringent lotion is to be applied; and if there be any ulcers or cracks, a suitable astringent ointment. See *Grease*.

When a horse's wind appears to be imperfect, he should not be allowed to fill himself with hay or water, and must be prevented from eating his litter, which horses of this description are generally inclined to do, particularly when stinted in hay. In this case costiveness sometimes occurs, which always increases the complaint; to remedy this, let a clyster and a few bran mashes be given. See *Clyster*.

Too high feeding is also very prejudicial in such complaints, as any thing which tends to create a plethora, and determine too much blood to the lungs, is sure to aggravate the disease. To a horse that purges or scours in travelling, and appears faint, sweating much with moderate exercise, give a cordial ball, the efficacy of which is sometimes increased by being mixed with a pint of ale or strong beer. See *Ball*.

If the complaint does not give way to this treatment, let an astringent ball be given.

As soon as a horse comes into the stable, let his feet be well cleaned, and all dirt or gravel carefully removed. It is a very common practice with ostlers, even in winter, to tie the horse up in the yard, that he may undergo the ceremony of having his heels washed with cold water; this should never be permitted during the winter, as many bad consequences may arise from it.

During hot weather, when the roads are dry and dusty, allow a horse to drink a small quantity of water now and then, while on the road; this not only refreshes him considerably, but has the useful effect of cooling and moistening his hoofs, as he will generally be made to stand in the water while drinking, nor is there the least danger to be apprehended from it, unless he is ridden very hard immediately before or after. In winter he should never be taken into the water if it can be avoided. Where the horse appears dull and loses his appetite, let him be bled moderately, and take a dose of nitre with a bran mash; this, with a little rest will soon recover him. It is a common practice when this happens, to give cordials, which are very improper, and often do much injury to the animal, by bringing on a fever. Some horses are particularly subject to the flatulent colic, or gripes; this is often the case with *crib-biters*; on such occasions it is advisable to be always provided with a remedy, and the following ball is the most convenient form:

Take of Castile soap three drachms;
Venice turpentine, six drachms;
Carraway seeds, in powder enough to form the ball for one dose.

It operates more speedily when given in a pint of peppermint-water; or if that cannot be had, a pint of warm beer.

When there is a suppression of urine, or great difficulty and pain in staling, which sometimes occur in travelling; a diuretic ball is commonly given, which, though sometimes successful, has often done mischief. The most effectual way of relieving the horse, is by throwing up a clyster, and bleeding moderately: should there be no appearance of inflammation in the kidneys, a dose of nitre may also be given,

The above writer very justly condemns the common practice of loading horses with clothes and keeping them in a close warm stable when they happen to take cold on a journey. It is, he says, certainly improper, since they are liable to be frequently exposed to wet and cold. It is a well-known fact, that animals are not hurt by being kept in any uniform temperature, whether it be hot or cold; but that their diseases more commonly arise from sudden changes, or frequent variation of temperature.

When a horse becomes suddenly lame upon traveling, his feet should be carefully examined. And if it should be occasioned by a wound from a nail or flint, apply a little tincture of myrrh, after having removed all dirt or gravel from it. If the wound has been inflicted with a nail, it should be carefully opened to the bottom with a small drawing-knife, and proper means used to prevent dirt from getting to it afterwards.

MANG, a provincial word applied to signify a mash of bran, malt, or other similar substance.

MANGE, a cutaneous disease, incident to different domestic quadrupeds, being often attended with an eruption and loss of hair.

Mr. White observes that it is known to exist by the horse being constantly rubbing or biting himself, so as to remove the hair, and sometimes produce ulceration; the hair of the main and tail frequently falls off, and small scabs may generally be observed about the roots of that which remains. He believes it a local disease. This disease is seldom met with, except in common stables where scarcely any attention is paid to the horses, and where their food is of the worst quality: it is certainly very contagious, and may in that way attack horses that are in good condition.

The causes of mange, according to Mr. Rider, are sudden changes of temperature, hot stables, bad diet, joined to want of cleanliness. The perspirable matter being never properly removed by friction, and being frequently mixed with dust, &c. completely plugs up the external vessels, whereby they become obstructed, and a diseased action takes place. It may also be caused by infectious matter coming in contact with the skin; as when a sound horse rubs himself against the stall in which a mangy horse has been kept. The principal symptoms are, in his opinion, the horse growing very thin, without any apparent cause, attended with a staring of his coat. This is soon followed by eruptions, which discharge a thick yellowish matter, forming a kind of

scurf, which peels off, and is succeeded by fresh eruptions, and the hair falls off. This, though partial at first, soon spreads all over the body, is attended with an itching, and causing the horse to rub against every thing he comes near.

Great attention to cleanliness is necessary.

Take of prepared hog's lard, one pound;
Sulphur, half a pound;
White hellebore in fine powder, three ounces;
Mix, and add
Olive oil sufficient to make a soft ointment.

Of this ointment a moderate quantity may be rubbed well with the hand all over the affected parts, or where there is the least appearance of any eruption; and this should be repeated after an interval of three days. In removing cutaneous obstructions, improving the appetite, and promoting condition, antimonials may be useful with aromatics.

The following formulæ have been applied with success in Mr. White's trials.

Take sulphur vivum, finely powdered, - 4 oz.
Oil of turpentine, - - - - 3 oz.
Hog's lard, - - - - - 6 oz.
Mix.
Or
Take oil of turpentine, - - - 4 oz.
Strong vitriolic acid, - - - ½ oz.
Mix cautiously, and add
Train oil, - - - - 6 oz.
Sulphur vivum, - - - - 4 oz.
Mix.
Or
Take white helebore, powdered, - - 4 oz.
Boil it in 3 pints of water to 1 quart, then add
Muriate of quicksilver, - - 2 dr.
Previously dissolved in 3 drachms of muriatic acid.

And as an alterative he advises the following:

Take of muriate of quicksilver, - - - ¼ oz.
Tartarised antimony, - - - - - - - 3 oz.
Powdered aniseeds, - - - - - - - 6 oz.
Powdered ginger, - - - - - - - 2 oz.
Syrup enough to form the mass, to be divided into sixteen balls, one of which is to be given every morning.

When they appear to diminish or take off the appetite, or create a purging, they should be discontinued two or three days or longer when necessary.

In this disease, much depends on proper diet, exercise, and good grooming. The food ought to be of the best quality, and given in liberal quantities. The bowels should be kept open with mashes, in which nitre is dissolved. And the affected part should be well washed with a strong solution of soft soap, and afterwards rubbed, morning and evening, with the above ointment.

After the disease is removed, Mr. Denny advises the horse to be turned out to grass, if at a proper season, a salt marsh being preferred.

In some cases, a sublimate wash has been found highly useful in removing the complaint.

When the horse is thoroughly cured of this distemper, it may be necessary to wash the floor and other parts of the stable very well with soap-suds. And the clothes should also be laid in scalding water, &c. being washed very clean with soap, and thoroughly dried, before they are used again; for if these precautions are not used, other horses may be liable to the infection.

MANGEL *Wurzel*, a plant of the tap-rooted kind, which has been introduced into field culture. It is a variety of the common beet. The author of a late work on Husbandry remarks, that it grows to a large size, both in the root and top, the former being of a reddish cast, and the leaves in the latter of an oblong form, extremely thick, fleshy, and succulent. Mr. Young, however, observes, that it is but little in cultivation at present; though in Norfolk, Sir Mordaunt Martin finds the root advantageous for his cow stock. The leaves are asserted to be "equal in quality to Spinach, and from their frequently extending in length more than thirty inches, and in breadth above twenty, to greatly exceed that vegetable in point of produce.

This, like all the other tap-rooted plants that have been employed for the purposes of husbandry, thrives the best in soils of the deep, friable, sandy, or light loamy descriptions.

In preparing the ground for its reception, it is necessary to render it as deep and fine as possible in the mould. This may be best effected in the heavier sorts of land, by means of trench ploughing, in the manner of that for parsnips; and in those of the lighter kind, by repeated common deep ploughings. In both cases, the frequent use of the harrow will likewise be requisite. A proportion of good manure should also be turned in, so as to render the ground sufficiently rich for the perfect growth of the plants. After this, at the time of putting in the seed, the land should be thrown into two-bout ridges, which leaves the tops about two feet in breadth, and the furrows one. In this way a considerable increase in the depth of mould is provided for the roots of the plants. And in soils that are in some measure retentive of moisture, the lands are kept much drier, and in a state more fit for the growth of the plants.

It is advised, that the seed should be carefully selected from such plants as are the most perfect of their kind, and that have been cultivated at a distance from other varieties. It should have arrived at a full state of ripeness, and be made use of while fresh. The most proper season of putting the seed into the ground in the common method of sowing, is in the early part of the spring as soon as the season will admit, as in the beginning or middle of April; but where the transplanting method is intended, it should be sown much earlier and very thinly, as the beginning of March, in order that the plants may be in a state to be set out.

The most common method, where the surface of the land is flat, is to sow the seed thinly over the ground in the manner that is practised for carrots, covering the seed in by means of very light harrowing. In this way, the plants are afterwards set out by the hoe to proper distances. But where the land is raised into ridges in

the manner just described, another mode is practised: the seed is dropped singly by the hand into little holes made by a dibble, to the depth of about half an inch, all along the middle of them, at the distance of eight or nine inches from each other; the plants thus standing at the distance of three feet, from row to row, and eight or nine apart in them. But as it is not necessary that they should stand nearer than sixteen or eighteen inches, every other plant may be removed, and used for filling up vacancies where they occur, or if not wanted in that way, wholly removed by the hoe. In this mode the intervals can be kept perfectly clean by the plough or horse-hoe and the rows by hand-hoeing.

In the practice of transplanting, the plants should be removed, when not more than three or four inches in length, and be planted out in rows upon ridges prepared as above at the distance of eighteen inches each way. In performing the work, the holes should be made sufficiently deep to admit the roots without their being bent. The tops of the plants may be taken off before planting, but the roots should not be touched, nor should they be put in too deep. A rather moist season should be chosen if possible for this business. But though the plants grow well, in this method, the roots seldom become so large, as when they have remained in their original situation.

All the culture that is afterwards necessary in this sort of crop, is to set out the plants to proper distances, where put in, in the first methods, and keep them clear from weeds by one or more hoeings, according to the manner of sowing that may have been practised and other circumstances.

The application of this vegetable, according to the author of Practical Agriculture, "has been chiefly in the feeding of neat cattle and hogs; in which, both the tops and roots have been employed, but without that success which might have been expected from the manner in which it was brought to the notice of cultivators."

It is probable, he says, that upon the whole, the root has neither been found to be equal in quality, as a cattle food, or to afford the quantity of produce that was supposed on its first introduction, but from its being of a hardy nature, and not liable to be injured, either by insects or the effects of drought, as well as from its leaves being capable of being repeatedly cut over, it may be occasionally cultivated in situations where green food is much wanted in the latter end of the year, for milch cows or other sorts of live stock.

In some trials detailed in the Annals of Agriculture, the plants seem, however, to have afforded a large produce in leaves, when gathered every two or three days, from July till late in September; others have not found the whole produce, in leaves and roots, equal to that of the large cabbage, on the same kinds of soil, while the culture was considerably more troublesome and expensive, and the crop not so useful for the purpose of winter consumption.

In the trials of an ingenious cultivator, as stated in the Bath Papers, the tops were found to be eaten with much greediness by cows, calves, and hogs, when cut green, during the latter part of the summer and in autumn, but the roots were almost wholly rejected at these periods, though in winter, after they had been taken up, they were eaten very well.

The great objections to this vegetable as a field plant, are, according to a late writer "the great expence of its culture, its being liable to degenerate, and the fibrous nature of the roots rendering their preparation as cattle food troublesome."

The roots frequently rise, it is said, to the weight of from five to eight or ten pounds, according to the goodness of the land; and they may be preserved in the winter, by being taken up and packed in the manner of carrots or any other method.

MANGER, an internal part of the stable in which the corn or cut provender for the horse is put. It is a sort of box or crib, and the usual method is to have them the whole breadth of the stall; but this is unnecessary, as if eighteen or twenty inches in length and fourteen or sixteen in breadth, they will be sufficient for every useful purpose. In the fixing of them they should be so contrived as to admit of being removed for the purpose of being cleaned. This can, however, never be done in the old method of fixing them: but by a little contrivance, may be easily effected. It is in many cases, a convenient plan to have them in the corners or angles at the heads of the stalls. See *Stable* and *Stall*.

MANOR, an ancient lordship, or royalty, consisting of demesnes, and services, and of a court baron incident thereto. It is a kind of fee granted out partly to tenants for certain services to be performed, and partly reserved to the use of the lord's family, with jurisdiction over his tenants, for the land held of him. Manors are different in different cases; they are freehold, customary, &c. A manor in law, must have freehold tenants, and a customary manor, copyhold tenants.

Manorial *Claims*, the claims which the lords of manors have upon their tenants, and which are different in different cases, according to the nature of the manor. In respect to the appropriation of commonable lands, these claims should, according to Mr. Marshall, be regulated by the particular advantages which the lord of a given manor may enjoy, and which he may continue to enjoy, while they remain open and uninclosed, whether they may arise from mines, quarries, water, timber, alien tenants, fuel, estover, pannage, game, &c. The claims of lords, as guardians of the soil, which is productive of *pasturage* only, is, he says, in most instances, merely honorary; and it is for the legislature to apportion the share of lands, to which they are entitled, as an equivalent for such. But their claims, in right of the soil on which *thriving timber* is standing, are more substantial; as out of these, they have he says, in effect a real yearly income, equal to the annual increasing value of the timber; a sort of advantage, which they of course will continue to enjoy, if the commons remain open and uninclosed, as long as the timber continues to increase in value. Their claims in this respect, consequently depend on the quantity of timber, and its state of growth, conjointly

taken. It is observed that, "young thriving timber, not only affords an annual increase of value at present, but will continue its benefits for many years to come, if it be suffered to remain undisturbed, or the soil which supports it, during the estimated period of its future increase; whereas dotards and stinted trees, which afford no increase of value, do not intitle their owners to any share of the soil they stand upon; the trees themselves, or their intrinsic value, appears, he says, to be all that the lord has a right to claim." It is conceived that the claims of the crown, or of hereditary rangers on forest lands should be satisfied on the same principle.

MANOR *Courts* are such as are held within the manor, for the purpose of adjusting the various rights, claims, &c. It is observed by Mr. Marshall, that the business of holding these, depends on whether they are held of right, or merely by custom. It is added, that "if the *copyhold tenure* is so far worn out, in any manor, that there are not two ancient or feudal tenants remaining within it, the court has lost its legal power. It cannot by right take cognizance of crimes, nor enforce amerciments." It is however, allowed that manorial courts have their uses, in regulating farm roads, drift-ways, and water-courses, and in preventing nuisances of different kinds within a manor, and it is generally right to preserve the custom of holding them for these purposes. Where *copyhold courts* remain in force, and where legal forms are to be observed, they are best held by a law steward.

MANURE, that sort of material, whatever its nature may be, that has the property or tendency when applied on, and incorporated with a soil, to increase its fertility, and thereby promote the growth of plants of the grain, grass, or other kinds.

The substances capable of being made use of in this way, are extremely numerous, and of very different natures and properties. It has been observed by a late writer, that on account of the changes that are continually taking place among bodies in nature, and the new combinations that are formed in consequence of them, a vast variety of matters are unfolded, elaborated, and prepared for the nourishment and support of vegetables; some of which possess a high degree of fluidity and volitility, as water, various gasseous materials, as oxygen, hydrogen, azote, and carbonic acid, in different states of combination, with other more subtile, and elastic fluids, which are principally formed and applied in or upon the soils, on which the plants grow and exist; and in larger or smaller proportions, according to the season of the year, the nature of the climate in respect to heat or cold, and the state or condition of the land in regard to its properties; while others exist in a more gross and heavy state of connection with the different materials, and require to be applied and blended with the soils or spread out upon their surfaces, in order that they may exert their influence in promoting vegetation. It is these last, as being the chief means of supporting various sorts of plants, as crops, that are considered as manures, though it is plain they must undergo different changes to fit them for the purpose. It is likewise remarked, that in the various substances applied in this way, there are great differences; "some are found to yield the matters which are necessary for the support of plants much more readily, and more abundantly than others, as animal, vegetable, and all such substances as are rich in mucilage, saccharine matters, and calcareous earth, and readily afford carbon, phosphorus, and some aerial fluids, such as have been mentioned; while others that are greatly deficient in all or many of these principles, or do not readily part with them, are found to be of much less utility, when employed in the way of manures." This it is supposed, is "a principal reason why some sorts of manures or substances, when put upon grounds, are so greatly superior to others, used at the same time, and in the same manner and proportion." But besides these there are "other ways in which substances, when applied to soils, may render them more fertile and productive, and contribute to the aid of vegetation. Some, besides furnishing such matters as are suitable for the purpose of promoting the growth of plants, are known to add considerably to the quantity of vegetable and other matters contained in the soils on which they are placed, and thereby provide a more suitable and convenient bed for the reception of the roots of plants; others contribute little in this way, but operate chiefly upon such materials as are contained in them, breaking down their organization or texture, and thus setting at liberty different volatile and other ingredients, by which new compounds are formed, and brought to such states as are the most adapted to the support of vegetable life; others again act principally by producing certain changes and alterations in the constitution or texture of soils, such as rendering them more open and porous, or more stiff and compact, and by such means bringing them into the most proper conditions for the bearing of different vegetable productions; and there are still others that contribute in all or several of these ways at the same time."

These substances have indeed been conceived by different writers, to "operate in all the different ways by which vegetation is promoted. By imparting to the soil with which they are mixed, the vegetable food which they contain. By communicating to it a power of attracting this food in greater plenty from the air. By enlarging the vegetable pasture. By dissolving the vegetable food which it is already possessed of, and fitting it for entering the roots of plants. Some afford nourishment only: as rape-dust, soot, malt-dust, pigeons' dung, and in general all top or hand-dressings. Others give nourishment, and also add to the soil; as animal dungs, and all rotten animal and vegetable substances. Others again open the soil, and do not nourish in their own nature: as lime, light marls, sand, &c. And lastly, other manures stiffen the soil, and at the same time nourish a little: as clay, clay marls, and earth." These matters have also been "considered by different authors as simple and compound; as natural and artificial; nutritious and stimulating, or solvents and mucilages; mechanical or chemical; as animal, vegetable, and mineral." All which distinctions may

have their use, but are each attended with difficulties and liable to objections. "Some of them operate in all the ways above-mentioned; and there are probably none that do not operate in more ways than one. It is a fundamental mistake to suppose with Tull, that tillage may be substituted in the place of manure. Manures will indeed be of little avail without it; but although good tillage, by separating the soil may bring a greater number of nutritious particles within the reach of the crop, yet the soil cannot possibly continue to be so completely divided as it is by the fermentation excited by dung and other manures; which are found to enrich the best pulverized soil again and again, after it is exhausted by crops; and therefore promote vegetation by increasing the quantity of vegetable food. Some manures lose part of their strength by being long exposed to the air. Thus after dung is sufficiently fermented, the longer it lies the less is its value. Cow-dung dried on the pasture, gathered and laid upon other land, has scarcely any effect; whereas the same quantity carried from the cow-house, or collected by folding the cattle, enriches the land. Hence this kind of manure contains the vegetable food in itself, and does not receive it from the air. Other manures, on the contrary, operate sooner, and with greater violence, the longer they are exposed to the air, before they are used. Lime and marls are of this kind. They are observed to have a strong power of attracting certain qualities from the atmosphere; and operate by communicating to the soil with which they are mixed, a power of attracting vegetable food from the air." And further "some manures exhaust land of its vegetable food, and do not restore it again when immediately applied. This is thought by some to be the case with lime. Land thoroughly limed, after having carried many very good crops, seems to be exhausted, and reduced to a worse situation than before. When in this case lime has been applied a second time, its effects have been found to be far inferior to what they were when first applied. This manure therefore seems to operate by dissolving the vegetable food which it meets with in the soil, and fitting it for entering the roots of plants. It may however be remarked, that the exhaustion of land by lime, is owing to bad management and unmerciful forcing of it with continued white crops. It is not certain that land will not bear a second liming. But it is certain that the effect of the lime may be long kept up by the proper application of dung and other oily manures: and there have been instances of the effect of lime continuing forty, fifty, or even a hundred years." It is certain that almost "all kinds of manures contribute to open the soil. Any person may be convinced of this, who will take the trouble to compare a piece of land on which dung or any other manure has been laid, with a piece contiguous that has not been manured: he will find the former much softer, much more free and open than the latter. It must be allowed therefore, that all manures operate by enlarging the vegetable pasture of plants."

On account of the great differences that are thus met with in the properties and principles, as well as in the agency of the matters that are made use of as manures, it is difficult to bring them into any sort of practical arrangement. "That which tends to show the nature of the materials from which they are derived, seems to be the most advantageous in the cultivation and improvement of land; in which view they may be distinguished into *Animal*, *Vegetable*, *Fossil*, *Saline*, and *Compound Manures*, which is the method principally adopted by the latest and best practical writers.

Animal manures. The materials that constitute this sort of manure, are of very different kinds, but they may be conveniently distinguished into such as are of a *soft* and *hard* quality; the former comprehending all sorts of animal dungs, and various other animalized materials of a soft nature; the latter including all sorts of hard animal matters, such as bones, horns, hoofs, and different other substances of a similar kind.

It has been remarked by a late practical writer that all substances of the animal kind, when reduced by the process of putrefaction or other means into a soft, pulpy, or mucilaginous condition, have been shown by the experience of the most correct and able cultivators, to afford those matters which are suited to the nutrition and support of plants, with greater readiness, and in a more copious manner than most other bodies. And chemical analysis has demonstrated that the chief component materials of such substances, so far as agriculture is concerned, are principally water, jelly or mucilage, and saccharine oleaginous matters, with small portions of saline and calcareous earthy substances. Hence animal matters, though they agree, in some circumstances, with vegetable productions, each having in common, water, saccharine and calcareous matters, are far more compounded; and in animal substances some of these materials are in large proportions, while in vegetables they only exist in a very small degree; and the jelly, which in some measure, resembles the gum and mucilage of plants, differs likewise from them, in its having much less tendency to become dry, as well as in its property of attracting humidity from the atmosphere, and of running with great rapidity into the state of putrefaction and decay." And "all these principles of animal substances are, it is added, resolved by their ultimate decomposition into other matters, such as the different gasseous fluids that have been mentioned above, carbon, phosphorus, lime, &c." It is likewise supposed that, "in animal substances of different sorts, there may be differences in regard to the proportions of these several ingredients or principles; some kinds affording one or more of them, in greater abundance than others; while others again are deficient in these, but abound in some of the others. On this supposition, the different effects of substances of the same class, when applied to soils of the same kind, may, it is conceived, be easily accounted for."

All substances of this kind, "on being deprived of their vital principle, have, it is observed, a quick tendency to take on or run into the state of putrefaction, a process which is considerably affected and influenced by the circumstances under which it is produced. But

in the horny and more compact animal matters, this tendency to putrefaction and decomposition, is, under similar circumstances, much less rapid, than in such as are of a less firm and dense texture. The process of putrefaction is, however, greatly expedited by the conditions under which it takes place being favourable; such as the substance, of whatever kind it may be, possessing sufficient moisture, being exposed to the free action of atmospheric air, and a moderate degree of heat. On various accounts it would likewise appear, that the decomposition of such substances may be promoted by moistening them with water, slightly impregnated with common salt, and perhaps, some other saline substances, such as the muriats of magnesia and soda, or sea-salt, as ingeniously suggested by the Earl of Dundonald."

It is suggested as probable also, "that the decomposition of some of the more hard and solid substances of this description, such as horns, bones, hoofs, and rotten rags, &c. might be greatly promoted, and rendered more immediately useful, by being reduced into much smaller particles than has been usually the practice, as well as by the application of higher degrees of heat than that of the atmosphere, when it can be done with convenience, and in a sufficiently cheap manner."

And it is further stated, that "as the dissolution of animal as well as vegetable matters is known to be much impeded by their being excluded from the air, or exposed to such degrees of heat as are capable of drying up and taking away their moisture, and by the mixing of such earthy substances with them as are capable, from their open and porous textures, or vitriolic and other qualities, of depriving them of the fluid matters which they contain; it is evident, why under certain circumstances of their being mixed and applied as manures, they may prove less beneficial than in other instances."

Other circumstances besides those have a tendency to render the decomposition of all such matters more quick and expeditious, as those of their being lightly deposited together, and not in too large heaps, or with too much earth mixed with, or deposited upon them, by which the air is prevented from acting upon them so extensively as might otherwise be the case. The practice of sprinkling common water over them frequently, especially in hot and dry seasons, and where they are of the more hard and compact kinds, in many instances might probably be useful in promoting their dissolution, and rendering it more quick and complete, consequently to supply the food of plants more readily and in greater abundance.

The principal substance, and that which is the most commonly applied as a manure, is the excrement produced by various kinds of animals, which is found in very different conditions, or states of preparation and richness, in some measure according to the kind of food on which the animal has been fed, and the materials with which it is incorporated, or intermixed. It is stated by the writer of the Middlesex Report, that "the dung of fat animals is unquestionably more rich, and consequently possesses greater powers of fertilization, than the dung of lean ones; and that the quality of the dung of every sort of animal will, in a great measure, be proportioned to the goodness or poverty of its food. Thus when the animal is fed on oily seeds, such as lint, rape, and others of a similar nature, it will be the most rich; when kept on oil-cake, or those seeds which have been deprived of part of their oily matter, the next so; on turnips, carrots, and such like vegetable roots, the next; on the best hay, next; on ordinary hay, next; and on straw, perhaps the poorest of all. The dung of lean hard-working cattle, feeding on straw, must, he conceives, be poor indeed."

The soil of privies is sometimes met with in a state fit to be applied to the ground, when not much mixed with fluid matters, such as urine, and forms a most excellent manure. It most frequently happens, however, that it is in such a liquid state, as to require other more solid substances to be blended with it, before it can be conveniently applied to the soil. In doing this, a late writer remarks that, "too little regard seems to have in common been paid to the choice of the most proper materials: but it is obvious, that such as can be the most fully acted upon, and the most readily converted into the state suitable for affording the nutrition of vegetables, by the principles of the matters thus employed as manures, must be the most adapted for the purpose, as well as the most beneficial. When, therefore, the manure made use of in this way, is either wholly or principally constituted of such animalized matters as, from their fluidity, are in an improper state or condition to be set on land without having other substances previously mixed with them, such peaty, boggy, or black vegetable earths should be chosen, as contain large proportions of matter, which the ammonia, or volatile alkali so abundantly provided by the decomposition of such substances may exert itself upon, and reduce into that state of solubility which is suitable for promoting the growth of plants. By duly attending to this practice, which has been so scientifically handled by the Earl of Dundonald, much advantage may, he says, be gained, not only in the quantity, but likewise in the quality of the manure. The results of experiments attentively made in this way, indeed, he says, clearly demonstrate, that an inconceivable loss is incurred by the inconsiderate practice of exsiccating human excrement, as well as the negligent custom of permitting the liquor or fluid parts of dung heaps to run away. The trials which he has been enabled to make, also lead him to suspect that it is a much more wasteful practice to apply these liquors to the ground in their uncombined state, than in conjunction with such earthy materials as have been mentioned above. Besides, much of them must be imperceptibly carried off by the process of evaporation, even when they are carried out in the most favourable seasons of the year; and they cannot, in this way, always be made use of on those soils that contain a sufficient quantity of those earthy materials, or principles, with which they can readily form combinations, and exert their most beneficial and fullest effects."

It is observed in the same work, that "most of the later practical writers on agriculture, are decid-

edly of opinion, that the soil of privies is a manure of the most enriching kind, but that its effects are not so lasting as those of many other substances. In the trials which have been lately made, with it, by Mr. Middleton, and here detailed, "it is said to have produced such astonishing fertility, as to induce him to conclude that it exceeds all other sorts of manure that can be put in competition with it, for the first year after its application. The second year he thinks it of some service, but in the third its effects nearly, if not quite disappear." The circumstances which render this sort of manure so immediately active in promoting vegetation, and so quickly deprived of its beneficial influence, would seem to be, says a late author, from the great quantity of elastic principles which it contains, in a loose state of combination, and the small quantity of earthy matter which it is capable of supplying to the soil, by the last stages of decomposition or decay. This also further shews the advantage of mixing and incorporating with it such kinds of earthy substances as it may be capable of acting upon, and uniting with. From the causes just noticed, its most active and nutritious properties are almost immediately set at liberty, and either directly contribute to the growth of plants, or form such new combinations as readily become useful for the purpose, while but very little of the earthy material is left behind for further decomposition, and the durable aid of vegetable increase. Mr. Middleton also further remarks, that this matter is not only prepared in the most suitable manner for the purpose of perfect vegetation, but that the herbage produced by it is capable of fattening the *largest* cattle in *less* time than any other. And the first of these writers knows from repeated experiments, that the finest garden vegetables may be produced by it, when properly employed, without the least injury to their taste, even in the most delicate of them, such as cauliflowers, white brocoli, &c. Instead of a bad taste being communicated to herbage by the use of this manure, it would seem probably, that it considerably improves its flavour, as it has been observed, in the Annals of Agriculture, that the patches of such pastures as had been manured with this substance, were constantly eaten *quite close* by horses, cows, and young cattle, while in other places there was much *longer grass*."

It is concluded from these facts, that "the importance of this substance, as a manure, is such, that every possible means should be contrived to prevent its loss, which is shamefully permitted, at present, to take place in many large towns, to the astonishing extent of more than two thirds of the whole, and some method made use of to render its conveyance and application more general and convenient." See *Night Soil*.

But it is not only this, but the dungs of all those animals which feed on such sorts of food as constitute either wholly, or in a great part, the food of man, as has been noticed above, that are, from the experience of practical farmers, found to be more effectual in promoting vegetation, when applied as manures to the ground, than those of such animals as are sustained by such kinds of matters as are seldom or ever made use of in that way; "hence it is obvious that the dungs of carnivorous birds, dogs, swine, horses highly fed, poultry, pigeons, and such like animals, must be more powerful in their effects as manures, than those of horses when fed only with hay or grass, neat cattle, sheep, and other animals that live in the same manner. On the same principle too, it is suggested as not improbable, but that the excrements of insects may be less efficacious as manures than their bodies, as it is well known that by their destruction and decomposition the fertility of land is considerably increased in particular instances. It is probable likewise, that the dungs of some animals may, from the state of their stomachs, and other causes, as well as the nature of their food, be more completely reduced and animalized in its passage through their bodies; that this is the case, at least, in granivorous birds, in which the food is subjected to considerable trituration in the course of its digestion, there can be little doubt, and thereby they perhaps become, in some measure, in a condition more suitable to form new combinations, or afford the support of vegetation."

It is suggested, that "this view of the nature of the manures afforded by different animals, should lead the practical agriculturist to be more attentive to the subject, in order that he may render them more abundant, and be capable of employing them under the most favourable circumstances, which cannot be the case while they are, as at present, indiscriminately mixed and blended together in the common dung-heap. That they should not be used in this way, is, it is conceived, clear, from the contradictory accounts of them that have been presented to us by various writers and experimenters, which would seem to have been caused by employing them in states of mixture with other substances. By some it is asserted that one load of *swines' dung* is nearly equal to two of most other sorts, and that it is the richest of all animal manures; in this, however, they would seem to be mistaken, as from trials made by others, it has been shewn that *night-soil* is certainly to be ranked much before it. In some of the ingenious experimental attempts of Mr. Young, it is also shewn, that the dungs of rabbits and poultry are superior to that of pigeons, and greatly more durable. But poultry dung, in the comparative experiments of Mr. Arbuthnot, was found to be more effectual than that of rabbits, and that of the latter greatly superior to wood ashes. *Pigeons' dung* has, notwithstanding, been proved by much experience to be a powerful and efficacious manure, and probably, from its abounding with volatile alkaline principles, been concluded to be of a hot or stimulating quality." But it is "from the larger animals that the farmer derives the principal part of the dung that is made use of as manure, in the cultivation and improvement of land; the dung of such horses as are highly fed being found, as has been already seen, to be much more valuable, for the general purposes of agriculture, and some uses in horticulture, than that which is made by horses when fed with hay or grass only. Where the animals are kept in the latter way, it is probably not so good as that of well-fed cows and neat cattle in

general, as in these it may, perhaps, become more animalized from the circumstance of their food being more intimately blended with the *saliva*, or other juices, during the ruminant state of feeding in such animals. The dung of horses is, however, in common, much more disposed to take on the process of putrefaction, and cause more heat, than that of cows and other neat cattle, and indeed these are the chief distinguishing circumstances between them as manures. The dung of neat cattle may also, on account of its less disposition to run into the state of putrefaction, contribute more of the earthy material to the land on which it is applied. Hence, probably, its superior utility on the leaner and poorer, or thinner sorts of soil. The dung and urine of animals when newly voided, are not, except when the animals are morbid, in a putrescent condition, the length of time in which they remain in their bodies being too short for its fully taking place; but some degree of, or tendency to putridity is constantly necessary to their discharge; and the means which are further suited to promote it in these substances have been fully described and explained above, when speaking of the nature of animal substances in general."

The experiments that have been made with the dung of sheep show "that it is equally valuable with that of many other animals that feed in the same way, but agriculturists have not yet turned their attention sufficiently to the means of collecting and preserving it, so that it may be used alone as a manure. The method by which it is at present applied to land, is by folding the animals upon it, under which method of management, on many soils, a great part of the advantage must be derived from the operation or action of the ammonia of their urine upon the vegetable matters contained in them, as well as from the consolidation produced by their treading upon it." See *Dung*.

There are many other *soft animal substances* that may be of use for the purpose of improving land as manures, some of which have yet been but little attended to by the farmer. Of this sort are *graves*, or the residuum which is left after the making of candles, and the *scum* which is collected in the boiling or refining of sugar. The author of a late practical work observes, that "different trials upon a small scale, with the former, have fully convinced him, that it is a substance that possesses great powers, when employed as a manure. And although it is a substance which is generally procured at a high price, from its going a great way, and being a lasting manure, it may, probably, be more frequently had recourse to, than has hitherto been the case. It is mostly procured in the state of hard compressed square cakes, though sometimes in a soft condition, without having undergone any pressure. When in the former state, the cakes must be broken down, and reduced into as great a state of division as possible, which may be rather a troublesome and expensive process, except a mill or some proper machine for the purpose be employed. But when it has been even reduced to the finest state possible, it will still be improper for application as a manure, until it has been mixed and incorporated with a pretty large proportion of some rich earthy substance with which it may combine. In the attempts which he has had an opportunity of making with this animal substance, after being much reduced it has always been blended in the proportion of three or four parts of good vegetable mould, according to the condition of the land, to one of the graves, and then sown as a top dressing on grass land, where it has never failed to produce a full crop of hay, considerably greater than that by the usual dressings of dung, and a rich sweet after-grass, or such as cattle were remarkably fond of feeding upon."

And Dr. Wilkinson, of Enfield, has found that the animal kingdom furnishes the strongest manures, among which graves, in his experience, is the most powerful and durable in its effects. "From one ton to a ton and a half, he considers as sufficient for an acre according to the state of the land. The cakes in his practice were, he says, minutely divided, which, on account of their hardness, is an expensive and laborious operation; and that even in this state of minute division, unless mixed with mould, they frequently prove too strong for corn, as he found by experience, on applying them to barley, the grain of which being injured by the rankness of the straw. They are, he conceives, peculiarly adapted to promote the growth of grass, turnips, and the leguminous plants." It is stated by the author of Practical Agriculture, that "eight acres of pebbly loam were manured, by the same cultivator, with dung, at the rate of ten loads of the common Middlesex carts per acre, except one acre of the poorest and most gravelly, which was dressed with a ton and a half of graves. The turnips where the graves were spread, and the succeeding barley (which were the crops on the whole piece,) were thicker and more vigorous than where common dung had been laid. He has observed grass rendered so rank by the use of graves as a manure that cattle would not touch it till mellowed by the winter's frost; and even in the succeeding year he was able to trace, by the superior verdure of the grass, to what extent this manure had been spread. He has also used with success, salted fish provisions, particularly herrings, which had been spoiled on shipboard, and has found them equal to the graves. In the same manner he has used salt meat, that has become putrid in a long voyage. His general mode of application has been to mix them with mould raised from the headlands of the field where they were intended to be spread. By letting them lie for some time, the earth imbibes the strong smell and virtues of the animal manure. Over these he has spread, with advantage, the liquor drawn from the graves, and the washings of the casks of salted meat, which had been spoiled. When sprinkled immediately over grass in the spring, he has also observed this liquor attended with considerable efficacy in producing a plentiful crop of hay." See *Graves*.

"Last year, (1800,) he used with success a combination of lime and graves, mixed with mould from the headlands, in the proportion of about fifty bush-

els of lime to a ton of graves. This composition, he observes, resembles *sugar scum*, which consists of lime and bullocks' blood." On the whole, "from the large experience he has had of the benefits arising from sugar scum, he thinks this combination of lime and animal matter deserves further investigation." On this the above author has observed, that "there can be little doubt but that by combining lime with animal substances, they may be rendered highly active as manures, especially when applied on soils that have a sufficiency of those earthy substances on which they can exert their full influence. In this way they seem frequently to be rendered more active than when employed in a simple uncombined state; but experiments are perhaps wanting to fully ascertain the utility and best means of employing such matters." It is further added that "lime might thus be combined with bones or woollen rags, or with a compost of earth and night soil; and would certainly greatly facilitate their conversion into manure, as well as render them more active in producing their effects in the support of vegetable crops. And by some of their properties being absorbed by the lime, during the time of their decomposition, and afterwards parted with more slowly in the soil, they may also by such means be, probably, rendered more durable and lasting as manures." See *Sugar Scum*.

Doctor Wilkinson observes, that "the Arabians, who take great pains to improve their lands, are accustomed to make large pits, they then put in animal substances, and cover them with calcareous or clayey earths, and afterwards these earths, which of themselves are sterile, acquire the properties of the richest manure. He adds that he once ordered a heifer which died in a field at a distance from his house to be buried in a compost of lime and earth; he does not assert that this was its most profitable application; he had however no reason to complain of his compost." And "Mr. Wight, in his Survey of the Husbandry of Scotland, he observes, mentions a compost of two parts lime, and one part pigeon's dung, to remain mixed until a considerable fermentation takes place, which is known by the effluvia. Six bolls of this compost, it is said, is sufficient for an acre, and will mark itself for many years after it has been applied."

Various other combinations of this nature may be successfully made use of for the purposes of agriculture, when properly made and applied.

Besides these there are many other materials of the same class, that may be employed as manures on land, such as the *refuse of glue-makers*, the *cuttings of felt-mongers*, the *clippings of furriers*, the *scrapings of oiled-leather*, and the *chips or waste of shoemakers*, where they can be collected in sufficient quantities. These, from their abounding in mucilage and oil, their great attraction for moisture, and their being readily soluble in water, contribute quickly, it is observed, to the support of vegetation, but are not probably so durable in their effects upon land as many other substances. Hence they should only be made use of with a view to the immediate crop, which it is believed, is pretty much the case in those places where they are capable of being obtained in such quantities as to be employed for the purposes of the farmer. See *these different Heads*.

Of the fish kind there are many substances that may be applied in this way, as the *blubber*, remaining after the preparation of oil from the whale, and other large fishes, and different sorts of small fish, both of the shell, and other kinds; likewise the offals of such animals, where they can be procured in large quantities, as in large towns, sea districts, and where they are cured or prepared in great numbers for the market, and be found beneficial. See *Blubber*.

It is observed, that, "these substances may be readily reduced to that state which is proper for manure, by mixing with them a small portion of the carbonat of lime, and afterwards, according to circumstances, a quantity, two or three times more than the whole, of good vegetable mould. Shell-fish, such as muscles, are commonly applied without being mixed with earthy matters; but this is certainly a wasteful practice, as much of their valuable principles is dissipated and lost, as is evident from the highly disagreeable stench that assails the neighbourhood of the ground on which they have been applied." By mixing good vegetable mould, scrapings of ditches or peat earth with them, the quantity of the manure would not only be greatly increased, but the offensiveness attending the use of such manures, in a great measure, corrected, and the effects of them in promoting the growth of vegetables probably rendered more extensively advantageous to the farmer.

The waste and refuse of slaughter-houses and butchers' shops are likewise capable of being prepared and made use of in a similar manner to that of fish; but as the manures formed from these animal materials are capable of affording much elastic volatile matters during their decomposition, they of course require to be well mixed and blended with such earthy substances as they can combine with, and render soluble, and in proportions suited to their powers, in order to produce the most beneficial effects on vegetation, and afford the greatest advantages to the cultivator.

Woollen rags, hair, feathers, and such like substances, though frequently made use of as manures to land, from their having a less portion of oily or mucilaginous matter in their composition, are probably in their effects inferior. These substances must be cut or chopped into small pieces before they can be advantageously applied to the ground as manures.

The author of Practical Agriculture concludes, "from the experiments that have been made with such animal substances as manures, that it may be inferred, that their effects continue longer than those of many substances of other kinds," and that they are highly useful materials in many cases. See *Woollen Rags*, *Hair*, and *Feathers*.

Among the harder sorts of animal substances that are employed as manures, there are considerable differences in respect to their texture and firmness, some being quite firm and solid, such as bones, horns, hoofs, shavings of horn, and some other similar substances, while others are more soft and pliable. The

bones of all animals are capable of affording much nutritious matter to plants, but those which are procured from cattle that have been killed when fat, are said to be the best for the purposes of manure. Those which have been boiled are far inferior, in this view, to those which have not undergone that process, as by such means they are principally robbed of their oily and mucilaginous properties, and consequently must yield much less nourishment to the immediate crop, whether it be grain or grass. All these sorts of substances require to be ground down in mills constructed for the purpose, or otherwise reduced into small pieces, before they are laid on and mixed with the soil, or formed into composts. It is remarked that "the usual method, is to reduce them to about the size of large filberts, but that there can be little doubt but that they would sooner run into the state of putrefaction, if they were reduced into still smaller particles, and thus be made to afford their nutritive properties much more expeditiously, as well as more abundantly; by which means much less quantities would probably produce equally full effects with the large ones at present made use of, as where the pieces into which they are broken are left large, they remain a great length of time in the soil, and are only gradually decomposed, without yielding that full supply of nourishment which is necessary for the supporting of crops. And when they have been even prepared in this way, too much earthy materials should not be mixed with or applied upon them, as where this is done, by preventing the free operation of the air their decomposition is greatly retarded. Nor should they, upon the same principles, when intended to be incorporated with the soil, be ploughed in too deeply, as by such a practice the crop will be deprived of much of the advantages which it might otherwise have obtained from such manure."

It is stated that "these substances are constituted of a considerable proportion of mucilaginous or gelatinous matter, a slight portion of fat, and an earthy salt composed of the phosphoric acid, and calcareous earth. If great heat be applied, they afford a large quantity of hydrogen gas, carbonic acid gas, and a volatile alkaline liquor. From the nature of these different principles, it is evident that some sorts of substances may be blended and united with the reduced particles of bony matters so as to promote their effects, as manures, in a considerable degree, such as lime, chalk, peat earth, and good vegetable mould, in suitable proportions, as by such means new combinations may be formed highly favourable to the process of vegetation." And it is added, that "the consuming of bony or horny substances, by means of fire, for the purpose of obtaining their ashes, is a wasteful dissipating practice that ought never to be attempted by farmers, as by it the mucilaginous and oily materials are driven off and lost, and nothing remains but a phosphat of lime, which can be of but little use in promoting the growth of vegetable crops."

Dr. Hunter found, from the application of reduced bones to a poor calcareous soil, with a grain crop in the proportion of sixty bushels to the acre, that the crop was much superior, where this was used, to that which had not been dressed in the same way, and the grass crops afterwards for some length of time, on the same place, displayed a superiority, and appeared more early. He also found the same superiority in turnip crops in different fields, when dressed in the same way. Mr. Young likewise found the effects of bone manures to be very great; but they did not correspond to the quantities employed, as with twenty-five cart loads, the crop was better than with fifty. This curious fact is, however, explained in the opinion of the first of the above writers, by his observing that the soil was an extremely poor one, as in such a case there could only be a small proportion of earthy matter for the ammonia and other substances, afforded by the decomposition of the bones to act upon, and reduce to that state of solubility the most adapted to the support of vegetation. Hence the immediate benefit that was derived from the manure probably depended solely on the oily and mucilaginous materials that were afforded.

Where bony substances are not broken down into very small particles, it is suspected, from some few trials that the first of the above authors has been enabled to make, that the effects of such substances will be equally, if not more, apparent the second than the first year, whether they be used on grass land, or that which is under the plough. The trials which Dr. Hunter made with ground and unground bones, seem likewise, he thinks, to support this opinion, as he found that for the immediate crop, the unground bones were of little or no service, but the ground ones of much benefit. What effect the unground ones had the second year, is not exactly known; however, from his concluding that these substances are in general, upon grass land, more effectual the second than the first year, it may be easily supposed to have been the case. See *Bones*.

Vegetable Manures. Different sorts of vegetable matters, when deprived of their living property, by undergoing the processes of decomposition, soon become proper for the nutrition and support of new plants, and fit for being applied as manure. Their reduction into this state is greatly promoted by their being exposed to the full influence of the air, moisture, and a suitable degree of heat. Under these circumstances different substances are evolved, and new combinations formed that become useful in the support of vegetation. These processes of decomposition have been commonly supposed to succeed one another with regularity, from that which is productive of sweetness, to that which is the ultimate result of putrefaction. But Dr. Darwin has suggested, "that it is more probable that different sorts and parts of organized matters, when dead, may undergo many different sorts of chemical changes, and that these may be different according to the differences in the degrees of heat, the quantity of water, and of air to which they are exposed. He was led to this supposition from the saccharine process, preceding the vinous fermentation, which takes place in certain states of animal stomachs; and from what happens in the germination or sprouting of grain, by which

the mealy matter is converted into sugar. And from observing that the acerb juices of some kinds of fruit are rendered sweet by baking, he conceives, that the saccharine process may take place in a degree of heat which is about that of boiling water, and that by it the process of fermentation may be altogether prevented from occurring. By destroying or injuring the life of fruits, it is also supposed, that the saccharine process of their juices may be promoted, as is found in many instances; such as the ripening of fruits after being plucked from the trees; their being sooner ripened after being injured by insects, or other means; and after partially cutting, or otherwise injuring the branches of the trees on which they grow: and this, which is termed the saccharine process, it is conjectured, may take place either beneath or upon the earth, in the incipient state of vegetable decomposition, before the vinous fermentation, and thus afford a very nourishing matter to plants." And further, that in the vinous, or process which commences after the saccharine, carbon becomes united with pure air in a large proportion; and that probably at the moment of their combination, while they are in the form of a liquid, and before they assume the gasseous state, they may be taken up by the roots of vegetables. And, that as in the process of putrefaction, carbon is not only changed into carbonic acid, but water decomposed, as is evinced by the smell of hydrogen, it is suspected that that inflammable substance may combine with carbon, as in the case of hydrocarbonate gas, and by this means render them both soluble in water, and thereby capable of being taken up as food by the roots of plants, without their passing into the acid or gasseous states. The union of azote with pure air, towards the close of the putrefactive process, by which nitrous acid is produced, it is likewise conceived, may possibly tend to promote vegetation. This, however, may be promoted from the circumstance of the pure air or oxygen adhering more loosely to its base, the azote, in the formation of this than other acids, and on that account yielding it more readily to the absorbent roots of vegetables. But, besides these means of supplying the nutrition of plants, as in the decomposition of vegetable substances by the process of putrefaction, the constituent principles of the water which they contain are, as has been just observed, in some measure set at liberty, and the hydrogen, one of them, uniting with the azote which is afforded by the dissolution of vegetable matters, though not in such large proportions as by animal substances, forms ammonia, which, from its ready union with fat and oily matters, and thus rendering them capable of being taken up by the absorbent roots of vegetables, may contribute to the support of vegetation. And, in some instances, where saline, insoluble, earthy matters, or metallic salts are contained in the soils to which manures of this kind are applied, or in which ammonia may be formed, it may decompose them, and by that means contribute to the formation of other new and less noxious compounds, or such as may be more capable of contributing to the growth of vegetables." It is added that, there is another substance which generally prevails in vegetables, and which is supposed to be a simple material, obtained in great abundance from the recrements not only of putrifying vegetable, but animal substances, and calcareous earth, the latter of which he supposes to have been of animal origin in the early periods of the world. This matter, it is thought, when met with in the state of solution, may be taken up entire by the absorbent roots of vegetables, as well as occasionally formed and elaborated by them. It is therefore probable, "that different matters fitted to the nutrition and support of plants, as crops, are formed and evolved during the different processes and stages of decomposition of vegetable as well as animal substances. But that in vegetable productions the changes are less rapid than in those of the animal kind, and probably much more varied, according to the various states and textures of the particular substances; as it is obvious from numerous facts and circumstances, that the more luxuriant and juicy vegetables are much more readily decomposed than such as are dry, and have a ligneous structure. Hence it is, that fresh vegetable matters are much more quickly converted to that state of decay which is suitable for the supplying of vegetable nourishment, than such as straw, hay, wood, and other dry materials of the same nature. It is not improbable, but that some vegetable matters may yield some of the substances that are taken up by the absorbent roots of vegetables in much larger proportions than others; as it has been found that different sorts of grain vary considerably in the proportions of mucilaginous, and what is termed vegeto-animal matter, which they contain; and that grain, potatoes, carrots, and many other roots of the same kind, on being consumed in the open air, afford much larger quantities of alkaline salts than hay, straw, or wood: it is undoubtedly from these and similar causes, that some sorts of vegetable matters, when reduced by means of putrefaction, are found to be so much more effectual as manures than others, when applied under the same circumstances, and to soils in every respect of a similar nature and quality. There is likewise a further circumstance to be attended to in substances of this nature, which is, that in general, when resolved by the ultimate process of putrefaction, they yield larger proportions of earthy materials to the soils on which they are deposited, than most matters of the animal kind, and consequently add more effectually to the substance of the land. And as this vegetable mould, or earth, from various causes, is constantly becoming more extensively and more intimately blended with the other materials of the soils, and, of course, forming new combinations, by which some of those matters which serve for the nutrition of plants are set at liberty, and brought into the state most proper for being absorbed by the roots of vegetables; it is evident why those manures, which are principally composed of vegetable substances, are more durable in their effects than such as are prepared from many sorts of animal materials.

The substances of this kind that are capable of being beneficially converted to manure, are extremely numerous. It is observed that "all kinds of green vege-

table productions may be employed in this way; such as the luxuriant weeds of rivers, lakes, ponds, and ditches; fern, and the refuse of different kinds of garden vegetables. Where green materials of this nature are made use of, they should always be cut down while in their juicy state, just before their flowers begin to appear, in order that they may be in the most suitable condition for becoming quickly putrid, and to prevent the injury that might otherwise be sustained from the vegetation of their seeds. They are afterwards to be collected into heaps of a moderate size, and their putrefaction promoted by their being thrown together as lightly as possible, and the occasional sprinkling them with water, if the season be hot and dry: and as lime is found, when applied to vegetables in their green moist state, to disengage from them both hydrogen and azote, by the combination of which volatile alkali is produced, it may be advantageous to blend a portion of lime at first with the heaps, and afterwards add a suitable quantity of peat earth, or good vegetable mould, for the alkali thus formed to act upon. By this method, the quantity of manure from such substances may be greatly augmented, and rendered more valuable. But when dry materials, such as hay, straw of different kinds, fern, and rushes, are made use of, such additions cannot be had recourse to with equal success, unless where much of the dung and urine of animals have been incorporated with them;" their resolution and decay may, however, be greatly promoted by their being kept in a moderate state of moisture, and not permitted to be trodden down too much by cattle, or other means in the farm yards, or other places where they are provided. And another means of supplying vegetable manure, not sufficiently practised, is that of providing full succulent crops of green vegetables, as clover, buck-wheat, tares, vetches, spurry, pease, beans, turnips, and many other similar plants, to be turned down by the plough, in order that they may undergo the putrefactive process under the ground, and by that means be converted into manure, and supply the food of plants. "In this practice it is suggested as probable by a late writer, that great advantages might be obtained, on the principles which we have just stated, by the spreading of a small portion of lime and peat, or rich vegetable earth, over such crops, and then rolling them down, that they may be completely turned in and buried by the plough; an operation which should be performed as quickly as possible, afterwards, and where the crops will admit of it, in the summer or early part of autumn, while the sun has the power of promoting the decay of such vegetable matters. By this means, it seems probable that the putrefaction of such crops would not only be much expedited, but the principles thereby set at liberty be capable of exerting their influence much more extensively than where the plants themselves are only employed, and little additional expence be incurred by the farmer."

When crops of this nature can be turned down, in sufficiently hot weather, to ensure their running speedily into a putrid state, it is considered as a better and more advantageous practice, especially where manures of other kinds are scarce, than that of obtaining it by consuming them by the feeding or soiling of cattle, which, under other circumstances, is certainly an excellent mode. See *Green Crops.*

There is another plant of the vegetable kind which is capable of being employed as a manure with great advantage, and which should never be overlooked where it is within the reach of the farmer. This is sea weed, *(quireus marna.)* In the management of this substance there is considerable diversity: "in some districts it is the practice to spread it upon the land as soon as possible after being cut from the borders of the rocks on the different sea coasts, or collected after being left by the tides, and to plough it in: where this method is adopted, it is advised that as little time as possible should be suffered to elapse after the cutting, or collecting of the weed, before it is ploughed down; for as the plant in its green or succulent state readily decays and becomes putrid, if there be any considerable delay in the performance of the business, especially when the weather is hot, much of its valuable properties as a manure is dissipated, and carried away by means of evaporation, as is sufficiently shown by the pungent and disagreeable smell that issues from it, on its being thrown upon the land while undergoing the process of putrefaction: and, besides, when t is suffered to become dry and hard before it is turned into the ground, the parts that remain are considerably longer before they become decomposed, and reduced into the state suitable for affording the nourishment and support of vegetable crops." It is believed to be, on these accounts, as well as that of the weed affording but little earthy matter in proportion to its bulk, on its decomposition, that it is found in general, to be less permanent in its effects, as a manure, than some other vegetable matters. Something may likewise depend on the goodness and luxuriance of the weed itself, and the state which it is in when gathered from the shores, or cut from the sides of the rocks. As in most other plants, this will undoubtedly be in the most proper condition for the purposes of being converted into manure, when cut or collected in the most succulent state of its growth, before it has become too old. Another method of practice with this weed, is that of collecting it into large heaps, and letting it remain exposed in that state to the influence of the weather until it be completely rotten, and in a condition to be put upon the land; but as the plant contains in its composition a large proportion of saline matters, which during the state of its decomposition, or decay, are brought into activity, it is plain that by such a method of proceeding much loss must be sustained, not only from the dissipation of the volatile and more fluid active parts, by the action of the sun and wind, but by the rains dissolving and carrying down the saline materials that may have been formed. When it is not to be immediately applied as a manure, it would therefore seem to be the most economical and advantageous mode, espe-

cially where the weed is fresh, to first blend a portion of quick lime with the heaps, and then have a sufficient quantity of fresh good earth, mould, or other similar material, placed beneath them, as well as mixed with and covered over them, in order that the substances afforded by the dissolution of the weed may have something to mix with and act upon, and be prevented from being washed away by rains. In this way the quantity of manure may be much increased, and at the same time its effects rendered considerably more lasting in the land. It is the custom in the islands of Jersey and Guernsey, where this weed is extensively employed as a manure, to cut it in the early part of the spring and about the month of July; the first cutting, in most cases, being immediately made use of as a manure for barley and pasture lands, and the latter principally converted to the purpose of fuel, the ashes only being employed as manure. In the practice of consuming the plant in its dry state, however necessary it may be there from the great scarcity of fuel, the loss in manure is extremely great, as the quantity of ashes thus produced are very small in proportion to the weed which is consumed. Such weed as is collected after having been thrown upon the shore by the tides, is found to be much inferior as a manure to that which is cut from the rocks and made use of in its green juicy state. See *Sea Weed.*

There is another material of the vegetable kind, that may be had recourse to as a manure, which is that of such bark as has been made use of for the purpose of tanning leather. This substance, when made use of in this way, should be collected into moderate sized heaps, before it has become dry by too much exposure to the heat of the sun and wind; and then have a quantity of lime mingled with it, and be kept slightly moistened with water, as by this means its putrefaction and decay may be greatly promoted. When intended to be applied to grass lands, it should be considerably more reduced towards the state of vegetable mould, than when laid on land for the purpose of supporting crops of the grain kind. There is another point that ought to be regarded in this material, which is, that as during its decomposition much heat is produced, and many elastic matters set at liberty, it would seem as a manure to be more adapted to the stiff, cold, and heavy soils, than those of the lighter kinds; a fact which the experience of most agriculturists has shown to be well founded. See *Tanner's Bark.*

Mud taken from the bottom of rivers, ponds, and other places where water has stagnated for some time, fresh or maiden earth from the borders of fields or other places, and the scourings of old ditches, are other substances that may be occasionally employed with advantage as manures, as being principally composed of the recrements of decayed vegetable matters. They should not, however, be put upon grounds, especially those in the state of grass, until they have been reduced into a considerable degree of fineness, by means of frequent turning over, and the mixing of portions of lime, rotten dung, or other materials of the same kind, with them, in order to promote and render the decay of the more solid parts complete. In the application of manures prepared from substances of this sort, as top dressings to land, in the state of grass, they should not be spread on too thickly, or in too large proportions at one time, as where that is the case great injury is often done to the succeeding crop, the grass not being able to spread itself completely over the surface of the ground. See *Mud.*

We have another material in the dust which is separated from malt in drying, mixed with the tails, usually denominated *coombs*, which, where they can be procured in large quantity, as in the malting districts, may be made use of for the purpose of manure. In a paper by Mr. Farey in the Annals of Agriculture, it is remarked that the black malt dust, such as falls through the kiln-plate in the operation of drying, is greatly preferable to the white, on account of the seeds of charlock, with which it abounds, being destroyed by the heat, and rendered fit for manure. The heat thus applied, by destroying the vegetative principle of such seeds where they exist, probably renders them and the dust more readily disposed to take on the process of decay and become putrid, and thereby afford the nutrition of vegetables more quickly as well as more abundantly than in other circumstances. It is well observed by a late writer that "this, as well as saw-dust, where they can be had at a cheap rate, may be considerably improved as manures by incorporating them, in pretty large quantities, with the dung and urine of animals, as by strewing them in the bottoms of poultry and pigeon houses, dung heaps, and necessaries; and also in the bottoms of reservoirs into which the urine of cattle, and the soap-suds after washing are emptied; from the action of these matters upon them, they are found to become more quickly in a state to be used with advantage as manures." It is added that "manure of this sort has been found very beneficial when applied in the proportion of four quarters to the acre, sown with the crop for which it is employed." See *Malt Dust.*

In the husks, or cakes, which are left after different oily seeds, such as those of rape, cole, &c. have been subjected to pressure in mills in order to obtain their oil, are other materials that may be converted to the purpose of manure. These substances are generally prepared for application by being reduced into the state of a coarse powder, by mills or other suitable means, and then sown by the hand, and harrowed in with the seed of the crop for which they are used. Some agricultors likewise advise their being mixed, when thus reduced, thinly, with the materials of such dung-hills as are deficient in richness, as where they have been made by lean stock with a large proportion of litter. On turning over heaps of this kind, about a ton of cake is recommended to be well and evenly incorporated with every twenty or thirty tons of the dunghill compost; by this practice a rich and good manure is said to be formed. It is asserted that, "the success of these substances, when made use of alone as manures,

has been found to depend, in a great measure, upon the falling of rain soon after they have been put upon the land, as in dry seasons little benefit has been derived from their application." The reason of this seems to be, according to a late author, "that as the cake when used is mostly in an extremely hard and dry state, it does not undergo that decomposition which is necessary, until it has been moistened by the rain, by which it is rendered capable of running quickly into the state of putrefaction, and consequently of affording such matters as are suitable for the support of plants." It is added that, "when applied without being incorporated with other substances, it is mostly laid on to the amount of four or five quarters to the acre, according to the condition of the land." See *Oil Cake.*

There is still another vegetable matter found in the refuse or pulp of pears and apples, which have been ground, and the liquor squeezed from them, that may likewise be converted to the purpose of a manure, in the districts where cyder is prepared in large quantities. But it is advised that some heavy substance, such as good earth with a little dung, should be mixed with it before it is put upon the soil, as by being blended with such materials it may be more conveniently and more extensively applied to the land.

Fossil Manures. There are a great many different sorts of materials of this nature that may be brought into use for the purpose of improving the condition of lands. The chief of the substances of this description are of the calcareous kind, which are observed to "produce effects more or less powerful in promoting the growth of vegetable crops, in some measure, according to the state and quantity in which they are applied, the nature of the soils on which they are employed, and the properties of the matters with which they are combined. For though calcareous materials have been made use of as manures for a very great length of time, and been applied in various ways, difficulties still remain concerning the manner of their operation, in many cases, which seem principally, however, to proceed from the want of proper discrimination in respect to the state of the different calcareous substances at the time of their application, and their being made use of to different soils without a sufficient distinction of the properties of the materials of which they are constituted or composed." The inquiries of a late experimental writer "have likewise shown it necessary to attend to another circumstance, which is, the substances the calcareous material is combined with; as he has found that where magnesia is in union with the calcareous matter, it is not by any means so beneficial for the purposes of manure and promoting vegetation, as where no such mixture or combination is present, especially when used in the same proportions." This is, however, a point that requires further examination. It has also been observed, "that from sand entering largely into the composition of lime-stone or other calcareous matter, in some cases, as it is a substance of much greater specific gravity than pure caustic lime, considerable differences in its effects as a manure may be produced." On these accounts it is concluded, that, though lime may be produced from chalk, marble, different lime-stones, coral and shells, by subjecting them to such degrees of heat as are necessary to expel or disengage the carbonic acid or fixed air that they contain, which is apparently of the same quality, it may vary in its effects when employed for the purposes of agriculture. See *Lime.*

It may be observed that lime, when newly burned, or before it becomes loaded or saturated with the moisture and carbonic acid, or fixed air, contained in the atmosphere, which, from their strong tendencies to combine or unite with it, generally soon takes place, is, in its greatest state of activity, and from the power which it possesses of breaking down and destroying the texture and organization of such animal and vegetable substances as come in contact with it, termed *caustic* or *quick* lime. When, under these circumstances it is applied to grounds, which abound either with fresh vegetable matters, or such as have undergone some degree of change, by being buried in the soil, as in moory and heathy mountain land, peaty or boggy earth, and all such soils as have long remained in their original uncultivated state, covered with a variety of coarse plants, it is said to be "found to produce beneficial effects; in the first case probably by its ready action on the different materials of the green plants, by which it disengages from them hydrogen and azote, from the subsequent combination of which, ammonia or volatile alkali is produced, a substance which has great power in promoting vegetation, as is seen in cases where substances that contain this matter in large quantities are used as manures; and in the second place, by its combination with the carbonaceous matter of such soils, or with that of the various animal and vegetable matters which are contained in them, in some of the stages of their putrefaction or decay, and by this means rendering it soluble in water, and thereby capable of being taken up as food by the absorbent roots of vegetables." And, it is added, "that though lime in its pure or caustic state retards, in some degree, the process of putrefaction, especially when used in any large quantity, it is probable, that by its power of corroding and dissolving the hard and fibrous parts of vegetable and other matters, as is shown by its quickly reducing the ligneous particles of bark, which has been employed in the process of tanning, to the state of mould, it may bring the abundant vegetable and other materials contained in such sorts of land quickly into that earthy condition, in which they afford the nourishment and support of crops, which by the processes of putrefaction, and insect digestion, could only have been performed in a very slow and gradual manner." And from its well-known property of destroying different kinds of insects, such as worms, snails, slugs, grubs, &c. which are mostly abundant in rich fresh soils, it may furnish much nutritious matter for the purpose of promoting the growth of plants as crops. There is likewise another way in which it may contribute to the same end, which is, from its having a greater tendency to combine with mucilaginous oily matters, than with fixed alkalies, as a kind of calcareous soap

may in some cases be formed that may contribute, in its liquid state, to the nourishment of plants, as has been observed by Mr. Nicholson, in his Philosophical Journal.

It has likewise the power when mixed with clayey soils which do not possess too great a degree of humidity, of rendering them less stiff and tenacious, consequently more suitable for admitting the small fibrous roots of vegetables, which is effected, not only by the heat and other elastic matters, that are evolved during the period of its becoming saturated with the moisture and fixed air, or carbonic acid, which they contain, but also by being thereby more intimately and minutely incorporated with them, from the fine impalpable powdery state to which it is necessarily reduced. And when in such soils, the sulphuric acid is predominant, it may also produce good effects, by forming with it a kind of gypseous compound, and in cases where other acids are present that are prejudicial to vegetation, by the power which it possesses of neutralising them, and thus preventing their hurtful effects.

It is also further probable, that when burnt from the magnesian lime-stone, it may prove serviceable when applied to clayey or other soils, that contain the sulphuric acid, usually denominated sour lands by farmers, by forming a sort of Epsom salt in the ground, a substance which the experiments of Dr. Home have long ago shown to be favourable to vegetation, when laid on ground in small quantities or proportions,.

This substance, on exposure to the atmosphere for some time, undergoes a considerable change, being rendered mild by the absorption of carbonic acid or fixed air, that surrounds it. In this state of combination, it has been termed, by modern chemists, *carbonate of lime*, or *effete* lime: in which condition its power of acting upon, destroying and breaking down, the texture of organised matters, is greatly diminished. It has still, however, the effect of promoting their dissolution by forwarding the natural process of putrefaction, as is proved by the compost dung-heaps with which it has been blended, becoming more quickly in a proper state to be applied to land, than in the contrary cases. By this means it consequently contributes much to the support of vegetation: and it has been lately suggested, that when incorporated with such composts of soil and manure, as are in a state of generating nitrous acid, it may arrest the acid as it forms, by which means a calcareous nitre is produced, and thus the exhalation and ready escape of a nutritious material be guarded against. It is further conceived, also, that the combination of lime with carbonic acid, by rendering it soluble in water in its fluid state, without being expanded into gas or vapour, may supply much carbonaceous matter for the support of vegetation. And by the property it possesses of super-saturating or overloading itself with moisture, by attracting or drawing it away from the air, in contact with the surface of the ground and the earth underneath, and after depriving them of it, and the carbonic acid which they contained, permitting them to escape again, as is evident in the case of new plastered walls, it may be of considerable utility when applied to the dry and sandy sorts of soil, by affording moisture and such aerial matters to the roots of the vegetable crops; which it is capable of supplying in a very equal and extensive manner, from the extreme state of pulverisation to which it is reduced when slaked by the dampness of the atmosphere, or by a very gentle fall of moisture.

But in addition to these modes of promoting the growth of vegetable crops, it has been supposed by Dr. Darwin, that calcareous earth, by containing phosphorus, may be useful, as by its union with it, a kind of hepar may be produced, and the phosphorus thereby rendered soluble in water, without becoming an acid by means of its combination with oxygen or vital air. It is conceived that phosphorus is probably as necessary an ingredient in vegetable as in animal bodies, as is evident, it is supposed, from the phosphoric light seen on rotten wood, in some of the stages of putrefaction; in which, it is believed, the phosphorus is set at liberty from the calcareous earth, or from the fixed alkali, or the carbon of the decomposing wood, and acquires oxygen from the atmosphere, both warmth and light being emitted during their union. And it may, perhaps, more frequently exist in the form of phosphoric acid in vegetables, and be thus readily combined with their calcareous earth, or be separated from its acid by the carbon of the vegetable, during the time of calcination, as well as in the process of putrefaction. It is therefore plain, from this account of the nature and properties of lime, that it may be made use of in one or other of its states more generally to soils, than has been commonly supposed. But it should never be applied without duly attending to the nature and quality of the soil on which it is to be laid, as upon this circumstance, its success in a great measure depends.

The trials that have been made by farmers with this manure, sufficiently show, that the more minutely lime is blended and incorporated with the mould of the land on which it is applied, the more full and complete are the effects which it affords in supporting the growth of different sorts of crops. In support of this it has been remarked by Dr. Anderson, that "if a heap of lime of a considerable thickness shall have been ever so long on one spot, and be afterwards carried clean away from it, so that none of the particles of the lime remain to be mixed with the soil, that spot will not be richer, or carry more luxuriant crops, than the places around it; which, every one knows, is not the case with regard to dung." And further, that "if lime be spread upon the surface of the soil, and allowed to remain there without being ploughed in, its effects will scarcely be perceived for several years, till it has had time gradually to sink through the sward, and mix with the soil; after which its effects begin to be perceived, although much less sensibly than if the same quantity of lime had been intimately mixed with the soil by means of the plough and harrow." The same writer adds, that he is not a stranger to

the improvements that have been made in Derbyshire by means of lime, without the plough; but this, he thinks, is no exception to what he has said. The effects are slow, though certain. "Those," continues he, "who inhabit countries that do not admit of the plough, are often advised to lay lime upon the grass, and are made to believe that their pasture will be instantly mended by it, nearly in the same perceptible manner as if it had been dunged. This he has tried, and has seen it tried by others; but always found that the grass for the first year, was rather hurt than benefited by it; nor was it so much improved in succeeding years, as if the same quantity of lime had been applied and intimately mixed with the soil. In this mode of applying lime, it is long, he conceives, before it yields a proper return; and is not to be recommended to a poor man, unless where necessity obliges him to practise it." On this supposition, it is conceived, that lime may be employed much more advantageously when made use of, even in small proportions, than such calcareous substances as have been reduced into the state of powder without calcination; but much must depend on the mode in which lime is laid on. "If," says he, "it is spread as soon as it is slaked, while yet in a powdery state, a very small quantity may be made to cover the whole surface of the ground, and to touch an exceedingly great number of particles of earth; but if it is suffered to lie for some time after slaking, and to get so much moisture as to make it run into clods, or cake into large lumps, it can never be again divided into such small parts; and therefore a much greater quantity is necessary to produce the same effect, than if it had been applied in its powdery state. But if the soil is afterwards to be continued long in tillage, (as these clods are annually broken smaller by the action of the plough and harrows,) the lime must continue to exert its influence anew upon the soil for a great course of years; it will produce an effect nearly similar to that which would be experienced, by annually strewing a small quantity of powdered lime over the whole surface of the soil: but as the price of the lime must, in the first case, be paid by the farmer altogether at the beginning, which only comes to be successively demanded in the other case, this deserves to be attended to, as it may become a consideration of some importance where lime is dear, and money not very plentiful."

In regard to the use of lime, there is another point to be considered, which is, the quantity that may be necessary. The opinions of practical farmers are much at variance in respect to this point, some contending that a small quantity can only be applied with safety and advantage, while others maintain that scarcely too great a proportion can be made use of. It is plain, says a late writer, "from the differences that take place in soils, that no particular proportion can be suitable in every case, but that it must be varied very considerably according to the circumstances, as well as from the situation or condition of the land on which it is laid, and the proportion of real calcareous matter that may be contained in the lime that is to be applied. As it has been shown that lime, when in its most active state, soon becomes reduced so as to be perfectly mild by its property of absorbing moisture, and the carbonic acid from the air, there can be little danger of injury from its caustic quality, though it may, on its first application, have a tendency to unite with and destroy such green or other vegetable productions as may be present." It is, however, the remark of an able cultivator, that "most kinds of *stone-lime* should be applied with a sparing hand, and with a considerable degree of caution, as the *caustic* quality is many times greater in *this* than in lime made from chalk." He has had many opportunities, he asserts, of seeing total barrenness induced by *a too liberal use of it;* very generally at the several places where the carts were stopped for the men to spread it, at the bottoms of every heap, and once an entire close.

Lime has been made use of as a manure in different proportions from one hundred to six or seven hundred bushels on the acre, on different sorts of soil, by some under similar circumstances, with benefits in proportion to the quantities applied. And accidental experiments in Dr. Anderson's practice, have demonstrated that it may be used in still larger proportions with advantageous effects. In short, he concludes, that "on soils which do not naturally abound with chalk, or other calcareous matter, there is less danger in giving too much, than too little, except in those cases where an over-luxuriance is dreaded in the land."

It has been maintained by some, that this sort of manure never contributes to increase the fertility of the lands, but that it has deteriorated them greatly, by promoting their over-exhaustion. It is, however, difficult to explain this supposition on the nature of its properties, and it is more likely that such an effect may have proceeded from injudicious cropping, and improper cultivation, than the operation of the manure, especially as it has been applied in different well-cultivated districts extensively, and for great lengths of time, without any such prejudicial effects having been experienced by the farmers.

The continuance of the effects of this material in promoting the growth of vegetable crops, must be different, according to the difference of circumstances in the land to which it is applied; the proportion of it that is made use of, the kind of crop that is cultivated, and other causes of the same sort. But from the facts that have been recorded by practical writers, in respect to its lasting powers of disposing lands on which it has been laid to the growth of particular sorts of crops in preference to others; of rendering the operation of other kinds of manure, and other methods of culture, more effectual than where it had never been used; that it affords useful changes in the soils to which it is applied. Of this we have an additional proof in the well-known circumstance of the quality of the grain from such lands as have been limed being much improved, having a thinner skin, and yielding much more flour, than that from ground where it has never been employed; which is supposed, by a late writer, to proceed from its containing more starch and less mucilage, on account of the tendency of the lime to

promote the conversion of the latter substance into the former by expediting the ripening of the grain. This is a circumstance which also shows the utility of this manure in those kinds of land that are late in bringing their grain crops to perfection, whether from the nature of their soils, or their situations.

This substance has been objected to as a manure for tillage lands, by some, on account of its supposed tendency to sink down in the soil below the reach of the plough, and thereby becoming of no utility. It is probable that this can only be the case where it has not been sufficiently burnt, or afterwards on its application properly reduced into the powdery state, and spread out equally over the land: as where these circumstances have been well attended to, from its having considerably less specific gravity than most soils, no such consequence can take place; the fine particles of the lime, from their being so very minutely intermixed with the earthy materials, not having any disposition to sink down through the superficial stratum of mould: but when applied in a coarser state, from its dry quality, and its not intimately combining with the particles of the mould, in the way of animal or vegetable manures, it may occasionally sink down, after being collected on the surface, during the time of reiterated ploughing, and rest upon the more stiff and firm subsoil below the track of the plough. For this reason, in the application of lime, great attention is necessary not only to the preparation, but likewise the reduction of it into the most perfect powdery state, as well as the spreading it out over the land, with the greatest equality, when dry and free from lumpiness. And it has been suggested, as advantageous where it has been laid on the surface of land, especially the grass kind, to plough the first time afterwards with but a light furrow, as by this means the portion that may thus fall down, will not merely be prevented from getting to such a depth as may render it useless, but be more intimately incorporated with the soil by the ploughings afterwards. The differences in applying this substance to stiff adhesive soils, may, it is observed, have caused the great diversity in its effects which have been so often noticed by writers on the subject.

The great differences in respect to the purity or goodness of lime-stone, or other calcareous matters, from which it is prepared, must also produce much variety in regard to it. Where it has been obtained from the purer kinds, when brought into the state of powder by being saturated with water, it is perfectly soft, smooth, and impalpable; while in other cases it feels coarse and gritty, according to the different degrees of impurity, but in general, so far as the purposes of agriculture are concerned, that which has the greatest levity, is the most soft and smooth to the touch, and has the whitest colour, is the best and most useful. See *Lime*.

This substance, with proper care, may be useful on many different sorts of land, but in its active state it is laid on to the most advantage on those of the moory, peaty, heathy and other kinds that abound in coarse vegetable matter. On which account it is perhaps, that it has been found by experience to be equally, if not more beneficial, on poor than on rich soils; and its requiring to be mixed and incorporated with but a small portion of earth or mould, to render it highly productive, is in favour of the same thing. From these facts it may be concluded, that this substance, besides being useful when blended with soils, in rendering the matters they contain proper for the reception of plants, is beneficial in supplying such materials as contribute to their growth.

There are other materials, such as lime-stone, and other hard calcareous bodies, which, without being subjected to the process of calcination by heat, may, in some cases, as where fuel cannot be procured to burn them into lime, be beneficially applied for the amelioration of land, as has been shown by the experiments of Mons. Du Hamel, and others. When thus used they should be well pulverised, by such mechanical means as can be cheaply performed; much of the advantage to be derived from them, probably depending upon their being reduced into a considerable state of fineness, by which they may be more minutely blended with the mould of the soils on which they are applied, and of course act upon and afford nutritious principles more extensively for the support of crops; and at the same time render the heavy and more cohesive soils lighter, by being more uniformly incorporated with their clayey and earthy materials. But as such substances can never be reduced, by any sort of machinery, to the fine powdery state to which they are capable of being carried by means of calcination, it is probable that, when employed upon land, they will be less beneficial in many cases, than when used in the state of lime. The same principle likewise holds good, probably, in respect to the scrapings of roads, made with calcareous and other substances, which are found beneficial in different instances, as a large portion of them is in the state of an extremely fine powder, from the attrition caused in different ways. It has been suggested, by the experiments of an able philosophical inquirer, "that even where magnesian lime-stone is made use of in this state of reduction, without being converted into lime, it may not be so friendly to vegetation as that which is perfectly calcareous, especially when employed in the same proportions; a circumstance which may, in some degree, account for the difference which has been observed in the utility of such substances as manures." It is obvious that such lime-stones as contain the largest proportions of argillaceous earth in their compositions, when employed in this reduced state, must be the most proper for the thin light soils: as by that means the depth and texture of them may be increased to the great advantage of the crops. In the application of this sort of material to land, the farmer should be attentive to the state or condition to which it is reduced, as well as the nature of the soil, and adapt the proportions to them. See *Lime-stone*.

Another substance of this nature, which has been successfully employed in Ireland, is lime-stone gravel; it is

a kind of stony marl, which might probably be equally or more beneficial, in much less quantities, by having the stony lumps which it contains first more perfectly reduced; as it has been found that where the pieces are large, a much greater proportion is required, and the effects are slower than when made use of in a more reduced state. See *Lime-stone Gravel.*

In chalk we have another material of the same sort, capable of producing beneficial effects on land, when applied in a proper manner in its uncalcined state. From the portion of argillaceous or clayey matter united with it in some cases, it partakes of the nature of marl. It has been observed, that, "where it is made use of to the more stiff, clayey, loamy, and heavy sorts of soil, it should, in most cases, be as much pulverised and reduced as possible before it is laid on, in order that it may be spread with greater exactness, and be more regularly mixed and blended with the stiff and compact materials of such lands; from which they may be rendered more capable of admitting the fibrous roots of vegetable crops to spread themselves in them, and thereby take in more perfectly the nutritious matters which are presented to them." That this is an useful practice, is evident from the circumstance of farmers, in most of the districts where chalk is employed as a manure, finding it more beneficial when made use of in the spring, after having been dug up in the autumn, and exposed to the frost and moisture through the following winter, as by that means it is much pulverised and broken down. The advantage of breaking down the large lumps, is also in favour of the same opinion. It has been stated by the author of Practical Agriculture, that "it would probably, however, be a still more advantageous practice to break it down, and apply it as quickly as possible, after digging it out of the pit; as by leaving it exposed to the atmosphere for some length of time, it not only becomes hard, but likewise less soluble, and therefore less proper for the purposes of manure. Hence it probably is, that farmers, where the chalk husbandry is practised, find the dressings more efficacious when the chalk is dug from a considerable depth, than where it lies near the surface of the ground. In the dry and light soils too it may, probably, be more serviceable in this reduced and powdery state, from the circumstance of its possessing more moisture, on account of a more extended surface being exposed to the air, and the particles of the soil, from which it may absorb and attract it, and afterwards part with or afford it in a more regular and uniform manner, to the absorbent roots of the growing vegetable crops. The observations of practical farmers, however, invariably shew, that on such soils it is much more beneficial when made use of in the form of compost, either with rich peat or vegetable earth and mould, or with good dung; as by this means a great defect in such kinds of land, the want of well reduced vegetable matter, is remedied, and a greater proporton of nutritious materials afforded for the support of crops."

In using it upon wet and poachy kinds of ground, there is not, probably, the same necessity for its being reduced to a great degree of fineness, as it may be apt, under such circumstances, to dissolve, and sink down too much by being so greatly diluted with water, while in the rounder state it may be retained near the surface, and thereby be capable of absorbing and taking away the superabundant surface moisture more effectually. In such soils, where the principal intention is the destruction of moss, rushes, and other coarse plants, the growth of which depends upon a great degree of superficial wetness, it may, however, be employed to most advantage in a state of considerable reduction, as from its greater readiness to sink down, it may the more quickly take away from their roots the excessive moisture that supports them. When acids exist under certain combinations in such soils, it may probably also neutralise them more readily when applied in its pulverised state, than in the lumpy one in which it is mostly laid on.

The quantity or proportion in which it may be applied, must depend, in a great measure, upon the state of the soil, the nature of the crop, and the intention with which it is employed. In the southern districts it is laid on the stiff clayey soils in large quantities, as from twelve to fourteen or fifteen waggon loads, of from fifteen to twenty hundred weight each, to the acre; and on the sandy soils in some parts of Kent, at the rate of one hundred and sixty bushels to the acre. On deep and strong kinds of soil, the practice is mostly either to lay it on the clover leys while feeding off, or upon the summer fallows. And it is frequently used in the form of compost on light soils, to the wheat fallows, as well as grass grounds.

As it cannot be reduced to the state of powdery fineness of lime, and cannot of course be so equally spread out, or so minutely blended with the soil, much larger proportions must be employed to produce the same effects upon the soil; three or four times the quantity is in most cases requisite.

It has been suggested, that where it must be carried from a great distance in its wet, heavy state, it may be the most economical practice to have it first converted into the state of lime. See *Chalk.*

We have another substance of this nature, in some sorts of marl which may be made use of as manure to different sorts of soils with great benefit, according to the difference of its nature. See *Marl.*

It has been remarked, that where substances of this kind are laid upon land, for the purpose of supporting immediate crops of either corn or grass, the most crumbly, or those the most readily reducible into a powdery state, are the most proper; but where they are laid on with the intention only of assisting future crops, or of producing more lasting effects, those that are more hard, and less disposed to fall into pieces, may be more advantageously employed, the first of which is shown to be the case, by the observation of practical husbandmen in marling districts, that it does not exert its full effects on the soil until it has been well mixed and incorporated with it by frequent aration, and by the practice of letting it remain some time on the surface of the ground, before it is turned down, from which it be-

comes much reduced into a powdery state: and the latter, by the circumstance of the harder sorts remaining a great length of time upon, or within the ground, before they are fully decomposed, or broken and carried down into the soil.

Substances of this kind produce beneficial effects on most sorts of soil in their different forms: the shell, stone, and those kinds of marl which abound most with calcareous earth, or which have sand in their composition, are the most adapted to the strong, stiff, clayey soils, as by the insinuation of such matters they are not only rendered more light and friable, but a great part of the injurious moisture which they contain is removed. While those in which clay considerably predominates are found more advantageous in the light, dry, sandy, gravelly, and loamy soils, as by such substances the defects of lightness are remedied, and the necessary moisture in some measure preserved. In the Middlesex Report it is stated that "on the stronger sorts of loamy soil, clayey marl will mostly be improper, as it has much tendency to render such sorts of land more wet and adhesive, by which they may be greatly injured. These have been found to be the effects resulting from the application of it even upon a temperate loam, in some parts of Sussex. And besides, it is sometimes apt to bring up coltsfoot, a weed which is difficult to be eradicated."

The quantity or proportion of these substances which is applied, differs considerably in different districts, which in some degree depends upon the nature of the soils; the heavy, clayey, or loamy, demanding in general a much larger proportion than the light sandy or gravelly sorts. The average quantity employed may be estimated at from about one to four or more cubic roods of sixty-four yards to the statute acre, according to the state of the marl, and particular nature and condition of the ground on which it is laid. According to the Survey of Lancashire, "it may in many cases, be the most advisable practice not to apply too thick a covering at one time, but to have recourse to light dressings more frequently, as by such a method the fertility of the land may be better preserved and kept up, and the crops be rendered more full and abundant." See *Marl*.

Manure of this sort is employed, it is remarked in a practical work, on lands in a course of tillage, as well as in grass. On the former it is often made use of as a preparation for barley, turnips, and other similar crops, or applied upon clover or other new leys, previous to their being ploughed up for wheat; in which modes of making use of it, the common practice is to leave it spread out upon the surface for some length of time before it is turned in, in order that it may be well reduced into a powdery form; for the more perfectly the marl is broken down and spread out, the more effectual it is found in promoting the growth of the crops. It has been remarked, that in its application in the latter case, "it is frequently laid on in too large quantities, or left too long in its lumpy state; from both which circumstances disadvantages are produced to the growth of the grass, when either to be cut for hay or fed off by cattle; as by the former, where the marl contains much of the argillaceous material, a kind of crust is formed that prevents its springing, as happens where the stiff mud of ponds, and such like manures, are too thickly laid on lands; and from the latter, the grass is not only injured by the small clods, as is experienced where imperfectly reduced clayey earth is applied, but the effects of the manure are prevented from being fully exerted on account of its not being well broken, and carried down to the absorbent roots of the grasses, by the frequent rains that may take place after its application." And that, "when employed in large proportions, whether upon the heavier or lighter sorts of land, a considerable space of time appears, from experience, to be required to elapse, before it can with advantage be had recourse to again; for if this circumstance be not properly attended to, or too many white crops be successively taken, a very great degree of exhaustion is soon produced, as has been experienced in many of the marling counties of England, and in Forfarshire in Scotland. These injurious consequences are, however, found to be easily prevented, by adopting the alternating system of corn and grass, or other green crops." And it is further suggested, as probable, "that by taking corn and grass crops in succession, or, after having one or two grain crops, letting the land be laid down for two or three years with artificial grasses, the application of marl in small quantities might be more frequently renewed, to the great advantage of the farmer, and the improvement of the land. In some of the places where this kind of manure is made use of, as in Lancashire, something of this practice is adopted with much benefit. And when mixed with dung and other substances, in the form of compost, it is generally found capable of being repeated, at short intervals, with the most beneficial effects." From these facts, the writer therefore concludes, "that such injuries are rather to be ascribed to the mode of cropping, than to the nature of the manure. Something may also, he supposes, depend on the manner in which it is applied, as it has been found to be more efficacious when well mixed and incorporated with the soil, than where this has not been the case; and that, as it has been found highly advantageous in promoting and bettering the condition of the grass lands in some districts, while in others it has been objected to as injuring them, it is still farther probable, he conceives, that much depends on the state and manner of its being put in or upon lands, and that it is only where it is laid on in a moderate suitable proportion, and after if has been well broken down and reduced into a fine powdery form, so as that it may be very minutely and intimately blended with the soil, that its best effects can be exerted upon the land. It is added, that the circumstance stated by Mr. Holt, in his Survey of the Agriculture of Lancashire, "of this substance having been used with great success in small proportions, as eight or ten bushels to the statute acre, after being burned in proper kilns, ovens, or other places, and well reduced into a fine powdery state, so as to be sown with

the hand over the crops, as a top dressing," seems also to favour the same opinion.

The general method of digging it up in the summer season, and spreading it over the ground in its lumpy state, in order that it may be acted upon and reduced by the heat of the sun and the frosts during the succeeding winter, is likewise another proof of the same conclusion. See *Marl.*

There is another useful material as manure in the shelly sand, found in beds in the hollows, and other parts of the sea coast, in different districts, as containing not only calcareous matter, in a state of considerable fineness, but a portion of animal and vegetable substances, with a small quantity of muriate of soda or sea salt; the last of which, from its well known property of promoting the process of putrefaction in animal and vegetable matters, when in such proportions, and that of destroying different kinds of living insects, may contribute greatly to the good effects experienced from it. This is rendered highly probable, from the circumstance of that which is taken from underneath the water, or from such banks and places as are daily covered by the tides, being the most efficacious when applied to the soil.

The proportion of calcareous matter contained in substances of this sort, vary much according to the particular circumstances of them. It has been observed that "where the quantity of calcareous matter is large, and in a very reduced or attenuated state, it is by much the most valuable; as when there is much sand amongst it a much larger quantity will be required, and the expence of application be of course much increased." It is conceived that this substance is "more proper for the clayey or loamy soils than those of the lighter kinds, especially where the proportion of the calcareous ingredient is large. When equally spread, and well incorporated with such lands, it is generally found to produce good effects for a great length of time." And it has been observed by Doctor Anderson that "a considerable less quantity of calcareous matter, when in this fine state, will have a more sensible effect, than when it is in that of any kind of earthy marl, as it admits of being spread over the ground with greater equality, and of being more minutely and intimately blended with the soil."

In regard to the quantity employed, it must obviously be different according to the nature and circumstances of the soil, as well as the sand; but twenty tons to the acre is, for the most part, considered as a proper dressing. It is said to be frequently applied on the summer fallows for wheat, and sometimes as a preparation for barley; and may likewise be laid on clover or other leys, before they are ploughed down for grain crops, but in such cases so large a quantity is not requisite. When put upon grass land, in not too large a proportion, it commonly produces great and sudden effects, the crops quickly becoming very luxuriant." And it is also observed, that such lands as have been treated in this way, when again brought into tillage, mostly produce abundant crops of the grain kind.

It has been stated by Dr. Anderson, that, "the effects of this sort of manure on the west coasts of the northern parts of the island, have been very extraordinary, especially upon the heathy or mossy soils; and it is supposed that such kinds of sand are more common on the east coasts than has been generally supposed from the little attention that has been bestowed by the farmer in such situations to procure it. See *Sand.*

There is a shelly kind of sand, which, in digging up, appears with blue veins, that has lately been used in some parts of Lancashire as a substitute for marl with considerable success, according to the report of the survey of that district.

The author of Practical Agriculture observes that, "it seems not improbable but that oyster as well as other kinds of shells, when sufficiently reduced by suitable machinery, might be of great use as a calcareous manure for the heavier sorts of land. And that where met with in large masses, or extensive beds, it might probably in some cases, be economical to calcine them, and apply them as lime, either in the simple state or that of combination with earthy materials." See *Oyster-shells.*

Although common sand cannot be properly considered as a manure, it is often found useful in the stiff, clayey, and loamy soils, in lessening their tenacity, and rendering them more light and mellow. This substance has been laid upon rough pasture and meadow land, with the effect of rendering the surface more equal, and bringing up a close thick crop of grass with much white clover. In these cases the quantity should be proportioned to the stiffness of the soils; but the best practice is, not to apply too large a dressing at a time, as injuries may be done where a very large proportion is put on at once.

Saline Manures. Various substances of this sort, when in combination with earthy and other ingredients, are found beneficial as manures in many instances, when properly employed. The materials that are principally made use of in this way are the refuse of different manufactures, such as those of bleaching and soap-boiling, where in sufficient quantities, as in the neighbourhood of large towns, and where such businesses are conducted on an extensive scale. The ashes which remain after the combustion of various green vegetable matters, wood, pit-coal, peat, &c. and some other substances, such as soot, and sea-salt, are of the same nature. *See these different heads.*

It is suggested in a late practical work, that "it is probably to the different alkaline principles contained in these substances, from the great facility and power which they possess of acting upon and dissolving the parts of animal and vegetable matters, especially such of the latter kind as have been rendered insoluble by the absorption of the oxygen, or pure air of the atmosphere, from long or frequent exposure to it, and even fossil coal under similar circumstances, and by this means forming new saline compounds which are soluble, that their beneficial effects as manures are chiefly to be ascribed." And "that as such inert or insoluble vegetable or peaty matters, when decomposed or reduced into a state of solubility by alkaline substances, assume a brownish-

red colour, and become insipid; the alkalies, in such cases, must enter into combination, and be neutralised by the acid or acids contained in them, which will be found to be the phosphoric and the oxalic, or acid of sorrel; from which will be formed, according to the nature of the alkali, contained in the substance made use of, phosphates and oxalits of pot-ash, soda, or ammoniac, which are matters capable of promoting the growth of plants." But, beside their forming in the soils, or the earthy materials with which they are mixed, such compounds as are beneficial in promoting the growth of vegetables, they may be useful in many cases, when properly applied, and used in sufficient quantity, in correcting acidity, in altering the state or condition of the lands, as by taking away moisture from the surface where it prevails in an over proportion in meadows and pastures, and thereby supports crops of coarse vegetables, and by rendering the texture of such grounds as are under the plough more open and mellow, consequently more suitable for the reception of the roots of grain, and other crops.

Some of these materials, such as the bleachers' refuse, contains vegetable and mineral alkali, in such proportions as render it incapable of being made use of without being previously mixed with other materials. For which purpose it is suggested that "fresh mould or peat earth should be procured; and after having been well mixed and blended with it in the quantity of about eight or ten parts of the earth to one of the refuse, a proportion of rotten dung suitable to the purpose for which the manure is intended may be added, by which means a good manure will be formed." And the waste of soapers is another substance that may be made use of in the same way; but in this it is observed there is a considerable portion of lime, mixed with the alkaline matter. The lees, or liquors, which are drawn off after making soap, as containing much alkaline saline matter, may likewise, where they can be procured in sufficient quantities, and at a reasonable rate, be made use of in the same manner as the above.

These different substances, when combined with good rich vegetable mould, turf or peaty matters, and made use of as manure, are constantly found to be the most beneficial upon the stiff, clayey, and loamy soils; as in such sorts of land it is supposed that they probably not only contribute to the increase of the crops by furnishing such soluble matters as can be readily taken up by their absorbent roots, but, by lessening their stiffness and tenacity, render them more proper for their reception."

With respect to the proportion or quantity of these manures which may be necessary, it must, as in other cases, vary according to the particular circumstances of the ground or soil upon which they are applied, and the views of the farmer in their application.

It is usual to apply them upon lands in a state of tillage, as well as under grass; in the first they are generally either put on in the state of compost, at the rate of about ten loads to the acre, just before the seed furrow is given or sown over the surface, and harrowed in with the grain: in whichever mode they may be applied, it is requisite to have them spread as equally as possible, in order that they may produce their effects in the most extensive and perfect manner." In the latter it is observed that "though they may in some instances be used alone, it is probably a much better practice to have them mixed with such earthy substances as have been just mentioned before they are laid on the swards, as by such a practice their effects as a manure may be rendered more complete and permanent. Upon grass lands they are often used to the amount of from one hundred to one hundred and fifty bushels. And most grass lands are improved by the application of such manures, but especially such as are wet and disposed to the production of coarse sour vegetables, such as rushes, wild sorrel, and various other plants of the same coarse kind.

Ashes, or earthy saline matters, arising from the combustion of different fresh vegetable products, though beneficial as manures, are too wasteful and uneconomical in their production to be made use of, except in particular instances, as where wood and other vegetable productions are very abundant, and used commonly as fuel, or where they cannot be readily cleared away by other more advantageous methods, as ten or fifteen parts, and in some cases considerably more, of such materials are dissipated and lost during the process. Where they are in sufficient quantities for this purpose, it is suggested that they may probably be employed to the greatest advantage by being mixed with a good portion of rich vegetable mould, or peat earth, and a quantity of well-fermented dung; as, in such a compound state, they are capable of being applied more extensively, and at the same time in the most favourable condition for the support of vegetation. When made use of on the heavy soils, the quantity of ashes in the compost should be much greater than on those of the lighter kinds; they are, in general, the most effectual when applied as a top dressing to grass lands, especially such as are commonly termed sour, or have much tendency to the production of moss." See *Ashes*.

Peat-earth is another substance met with in different districts, which, after being cut and dried by the heat of the summer, is made use of as fuel. By the consumption of this sort of earth in this way, a considerable loss in respect to manure is sustained; as it has been found, that "in many cases, nineteen parts out of twenty of the material are dissipated and carried away in the process of combustion, which, as it has been shewn, that the inert vegetable or peaty matter, produced by the action of oxygen, or the pure air of the atmosphere, for a great length of time, is capable of being rendered soluble, by mixing lime in certain conditions with it, and still more effectually by alkaline saline substances, might have been preserved and rendered useful." However, in Berkshire, it is the common practice to dig up peat-earth, merely for the purpose of burning it into ashes, in order that it may be used as a manure upon land.

As it is only from fresh or green vegetable productions that alkaline saline substances can be obtained when burned, none being afforded by the combustion of dead or decayed vegetable matters, it would seem

that the ashes of peat-earth seldom contain much saline matter. It has, however, been observed by some, that all peat-earths afford alkaline saline matters in a greater or less proportion when burned, and that in some it is from a twenty-second to a thirty-second part of their weight. It is remarked, that "the ashes produced from the burning of peat about Reading in Berkshire, which long experience has shewn to possess great fertilizing powers, are asserted to contain no alkaline salts, nor, from the hasty analysis of them which was made by Lord Dundonald, was any saline matter, except a small proportion of sulphate of magnesia or Epsom salt found. But it is added, that "if the analysis had been more carefully made, and when the ashes were newly burnt, they would most probably have been found to contain a hepar of lime, which is a saline substance soluble in water, while gypsum, the substance to which it returns on being exposed to the air, is insoluble." The fertilizing effects of these ashes may, therefore, it is supposed, probably materially depend upon this hepar, a circumstance which is rendered still more probable from the observation of Mr. Middleton in his Survey of Middlesex, that "the hills on each side of the meadows which produce the Newbury *peat-ashes*, consist of chalk, easily dissolvable by heavy rain, which washes it off the ridges down the furrows, ditches, and streamlets, to the low grounds, where mixing with the floods, it is floated over the meadows, and deposited in the peat. Consequently that the peat of this district differs from that of most others, by the quantity of chalk which it contains; and, when dug, dried and burnt, the fire reduces the chalk to lime, and the rest to ashes. Hence Newbury ashes are a mixture of lime and vegetable ashes; and it is very probable that any common peat-ashes, or the ashes of rough grass land, of turf, heath, furze, ling, wood, &c. produced by the operation of paring and burning, being mixed with chalk lime in due proportion, would be as equally fertilizing as these noted ashes." But it has been suggested, that there is another circumstance that may produce a difference in the saline and other substances contained in the ashes of different peaty earths, which is that of the presence of mineral springs. When, by this means, an overlarge portion of sulphate of iron, or green vitriol, happens to be present in the peat, the ashes produced from its combustion must, in consequence, become injurious, or at least much less beneficial to the growth of vegetables, than in cases were such a substance is not present. Its prejudicial effects, according to Lord Dundonald, may be corrected by the use of either lime, magnesia, alkaline salts, or dung; but that preference is to be given to magnesia and alkaline saline substances, as they not only decompose the vitriolic salt, but form other saline substances, which are found favourable to vegetation.

Where dung is made use of in these cases, the vitriolated iron is brought into its metallic condition, and the sulphuric acid, thus set at liberty, enters into combination with the ammonia or volatile alkali formed from the dung, and produces sulphate of ammonia; or, by uniting with the calcareous matter, and the additional assistance of the inflammable or prutrescent matter of the dung, it may be converted into a hepar that may be beneficial to the growth of plants.

These sorts of ashes may be used as a manure, either by being harrowed in with the grain crops, or sown over them as a top dressing after they have come up. In the former case it is observed, that they should be employed in a somewhat larger proportion than in the latter; in which "the best practice is to sow them over the crops before they are grown too high; and if the weather be rather inclined to wetness, it will be the more favourable: the quantities commonly employed in this way are from fifteen to twenty bushels the acre, according to the state or condition of the land. Where laid on grass lands, whether those of the artificial or natural pasture kinds, they often produce great improvements, rendering the grasses thicker, finer, and more close and abundant." See *Ashes*.

Peaty substances, in the reduced state of dust, are sometimes made use of with great benefit; and it is suggested by Lord Dundonald, that this sort of earth may generally be employed to most advantage by being well mixed and incorporated with such substances as contain alkaline salts, or with alkaline hepars, or by a mixture of sulphate of soda, or Glauber salts, with lime in its active state." It is likewise supposed, that the powdery or dusty matter of pit-coal might, probably, be applied with the same advantage if prepared in a similar manner, as it is capable of being rendered soluble in the same way. And it is further asserted by the same writer, "as the result of experimental trials, that the effects of peat-earth, mixed and incorporated with alkaline saline substances, are equal, if not superior, to those from dung, the weight of each being the same;" which, if it be well founded, shows the superiority of employing peat-earth in this way, instead of converting it into ashes, to be much more than has been already stated. See *Peat-dust*.

The ashes obtained from pit-coal, when applied as manures, are found to be useful in many respects; but it is supposed, that as they can contain saline matter only in proportion to the quantity of fresh vegetable products that may have been consumed along with them, little of the effect which is produced can depend upon it; much more, probably, arises from the portion of calcareous earth which they contain. It is also added that "something, in many cases, probably depends on the animal substances that may have been occasionally burnt, or afterwards mixed with them, before they are made use of as a manure." And that "they may also be serviceable on the stiffer sorts of soil, by rendering them more open and disposed to admit the roots of growing vegetables." This "seems to be shewn by their utility in the stiff clayey grounds from which brick-earth has been dug, and on what are generally termed sour lands. On the more tenacious loamy soils they may operate by giving friability, and at the same time the calcareous principle, in a small degree, where it is deficient, which is further supported by their having been found from experience to be much less useful in the poorer sorts of land, than those that are of a good quality."

The application of these ashes to stiff soils from

which brick-earth has been taken, renders it sufficiently friable to afford good crops of beans, a sort of plant which, though it grows well on heavy soils, could not be produced on lands so very stiff as the bottoms of brick grounds without these ashes. However, except in such cases as the above, this manure is probably best adapted to grass lands as a top dressing, but it may be occasionally used in this way to young grain crops.

The quantity or proportion in which it may be laid on, is different according to the views of the farmer, the nature of the crop, and the state of the ground.

There is another saline substance in soot that experience has shewn to be of much utility, when applied to land as a manure. It is probable, that the beneficial effects resulting from the use of this substance depend, in a great degree, on the quantity of alkaline saline matter which it contains; which, by its action on the rich vegetable mould of the soil or earth with which it is blended, may render it more capable of supplying the nutrition of vegetables; and it may bring the gross oleaginous matter of the soot into such a state as to be capable of solution or diffusion in water, and in that way render it fit to be taken up by the absorbent roots of vegetables. It is supposed, that "the earthy matter of this substance, as well as that of different kinds of ashes, may probably be rendered more suitable for the purpose of promoting vegetation, by their having been exposed to the action of fire, as is well known to be the case with clay." The great state of fineness in which soot is found may, likewise, it is supposed, be serviceable, as by that means it becomes capable of being more regularly and more extensively mixed with the soils on which it is applied." And it is believed, that "the good effects of most substances employed as top dressings depend, in some measure, upon this circumstance." It is thought probable, that this substance, as containing alkaline salt in a considerable proportion, may probably be used with greater advantage by being well mixed or blended with rich mould, or peat-earth, and by such a method the quantity of manure would be greatly increased. This should not, however, be attempted where the destruction of insects forms any part of the design of the farmer in its application. See *Soot*.

It is a substance chiefly made use of as a top dressing to grain crops and grass lands. "On the former it has been found extremely useful in destroying the wire-worm and other destructive insects. This is probably effected by the bitter oleaginous liquid formed from the union of the alkali and the oil of the soot, impregnating these parts of the plants on which they feed, and thereby causing them to be rejected by such insects." It may also produce some advantage in this respect by promoting a rapid vegetation, and thereby rendering the texture of the plants, very quickly, too firm to be preyed upon by them, as has been observed by Lord Dundonald. That it is very powerful in promoting the vigorous growth of vegetable crops, is shown, "by the change which takes place after sowing it over such young wheat crops as have a yellowish sickly appearance, as they frequently put on, in a very short time afterwards, the healthy green aspect. On meadow and pasture lands experience has likewise shewn it to be highly useful, not only by encouraging the growth of a finer sort of grass, but by destroying or correcting the frequent disposition of such grounds to produce moss, and some other coarse sorts of vegetable productions." In respect to the quantity or proportion that may be applied, this must vary according to the circumstances of the case; the most common quantity is generally from about forty to fifty bushels on the acre.

Where any of these or other materials that contain saline matters, are to be employed as manures, it is observed that "they should always be preserved in sheds, or other convenient places, from rains, or the accidental application of water to them, as where this practice is neglected the saline substances are soon dissolved and carried away in a liquid form. It is chiefly from this cause that substances of this kind which have been long exposed without being covered, are often found so inferior in their effects to those which are fresh or newly made. On this account also, if such substances are laid on land at too early a period of the season, they will be liable to have much of their valuable properties carried away by the rains that may take place."

There is still another substance in the muriate of soda, or sea-salt, the utility of which, it has been remarked, "for the purposes of manure, seems not yet well ascertained, as by some it is considered as possessing considerable powers of promoting vegetation; while others have experienced little or no advantage from its application. But though it may prevent putrefaction when employed in large proportions by its antiseptic property, as has been shown by different trials, when used in small quantities it has a tendency to promote the process. On this account it may therefore, it is supposed, be serviceable when incorporated with farm-yard dung, and other animal or vegetable matters, in small portions."

It is also thought probable by the author of Phytologia, "that from calcined clay, as it is met with in the more loose and soft kinds of bricks, having a power of decomposing sea-salt—as is suspected from the circumstance of his having remarked in a cellar where salted meat had been kept for a great length of time in a salting-tub, which was attached to one side of the wall, that on the other there was a great efflorescence, which he conceived to be natron or fossil alkali—it may, when more tardily combined with oxygen, by exposure to the air, from the different processes of cultivation, possess the same property; and that the great diversity and contradiction that has been observed in the effects of sea salt may have depended in some measure on this circumstance, as it might thus be highly useful on clayey soils, though it was of little or no advantage on those of other kinds. It is likewise observed, "that as common salt is a stimulus which affords little or no support in the way of nourishment, but which may excite the absorbent vessels of vegetables to exert themselves more powerfully, it may, in a certain proportion, augment their growth

by inducing them to take up a greater quantity of nutrient matter in a limited time, and to perform their circulation and secretions more vigorously. But that in a large quantity its stimulant powers may be so great, as to destroy them by exhausting the irritability of their vessels, as has been found by Mr. Van Uslar, in watering plants with oxygenated muriatic acid." And that "these circumstances probably further explain the reason why sea-salt, when made use of in large proportions, is frequently injurious to land, and the growth of crops; while employed in small quantities it produces highly beneficial effects." It "may likewise be useful in other ways, as from its known power of destroying various kinds of insects, such as worms, slugs, grubs, snails, &c. a power which Lord Dundonald supposes to depend on the exciting of greater evacuations from their bodies than they are capable of withstanding, much nutrient matter may, in different cases, be provided for the support of vegetable crops. The Rev. Mr. Cartwright has lately made some interesting experiments on this substance as manure which will be noticed hereafter. See *Sea-Salt*.

It has been suggested by the author of Practical Agriculture, that "as every-where in the vicinity of the sea a ready means of obtaining this saline material in unlimited quantities offers itself, it may deserve more particularly the notice of the agriculturist; and more especially as many other substances that are known to contain or be impregnated with it, such as the weed thrown up by the tides, and the sand over which they flow, can be easily procured."

Still another substance of this nature "exists in the bittern, waste, or refuse, of salt-works, which generally contains muriate of magnesia in large proportions. It has been found to possess very great septic qualities, and may therefore be highly beneficial when mixed with dung, or earthy matters. Experiment has shown it to be capable of promoting vegetation in a great degree.

It is well remarked by the above writer, that, "in whatever manner substances of the saline kind may produce their effects in promoting vegetation, when employed as manures, it is evident, from their containing in themselves little or nothing of such matters as are capable of affording nourishment to plants, that they may, in most cases, be made use of to the greatest advantage by being mixed and incorporated with such substances as they are capable of acting upon and reducing to a state proper for the support of vegetable crops; such as rich earthy materials, imperfectly reduced dung, and other matters of a similar kind. Where substances that contain th emuriate of soda, or sea-salt, are employed, if the opinions which have been stated above be correct, they might probably be applied to much advantage by being mixed with imperfectly burnt clay, when reduced to the state of powder. And if, upon trial, they should be found effectual in this form, they might be very conveniently made use of in the way of top dressings to grass or grain crops in the spring."

Compound or *Compost Manures*. From what has been stated and explained in respect to the nature of the different substances that are capable of being used as manures, it is sufficiently plain that many of them may frequently be mixed and blended with each other, or with materials of other kinds, so as to be not only considerably increased in quantity, but often rendered more effectual and proper for application than in their simple states. At the same time, it is clear that some of them may be thus mixed and incorporated with each other with much more benefit than others: for although the constant experience of farmers has decidedly shewn the great importance and advantage of employing composts, till lately they have paid little regard to the mixing together of such matters as are, from the principles which they originally contain, or which are formed from them in the changes which they undergo in the different stages of their decomposition, adapted to act in the most suitable manner for producing such combinations or alterations in the materials, as are capable of being beneficial in the greatest degree in promoting vegetation when applied to the land.

The manure raised in the farm-yard is the most common application of any, and which, from its being formed by the gradual decay of various kinds of vegetable matters, as hay, straw, fern, and various other materials of a similar nature, with which the dung and urine of animals is incorporated and combined, is to be considered as a compound manure. And from the largeness of the proportion in which such vegetable productions enter into its composition, and the quantity of earthy materials that is in most cases added, especially where the management is judicious, by the laying of suitable foundations or bottoms, it is less frequently requisite to blend it with other substances than most other manures. But as most of the vegetable materials that constitute the chief part of it, are made use of in a dry and hard state, and do not so quickly ferment or run into the state of decay, notwithstanding the quantity of animalized matters that may be blended with them; it becomes useful to turn them over once or oftener, in order that their complete putrefaction may be promoted and at the same time the different materials minutely blended together.

It has been suggested that "in the forming of this manure, care should also be constantly taken that the heaps be so situated as that they may not become too dry, or too much soaked in water, as in either case they must be greatly injured." And that "whenever it may be requisite to incorporate any earthy material with this sort of manure, the agricultor should carefully attend to the state or richness in which it may exist in the yard, and proportion such additions accordingly." It cannot, however, ever demand a proportion nearly so large as that of such manures as are almost wholly composed of animal substances.

An ingenious writer in a periodical work, after observing that straw or litter is the basis of farm yard manure, or what is often termed dung, suggests that for light and heavy soils the dung should be prepared in different ways, be used at different seasons, and applied to different crops. For light soils, be

thinks manure requires to be much higher prepared than is necessary for clayey soils; and every step of the previous preparation, to be perfect, ought, he says, to be executed in a quite different manner. "For soils of the first description, where turnips are taken as a first crop, dung can hardly, he thinks, be too well prepared; because the nature of the crop to which it is applied, renders a complete incorporation with the ground absolutely necessary, without which the young plants might be starved at their very entrance into life. In the best farmed English counties, which have come under his observation, dung is often kept over year, in order that it may be perfectly rotted: and the late Mr. Bakewell was in habits of not applying it till it was reduced to a state something like black snuff." He does not, however, approve of such protraction; for, when the preparatory steps are conducted with judgment, there is rarely any necessity for keeping dung over year upon turnip farms; besides, such a delay causes a waste of the article, and most likely dissipates its strength; at all events, a year's interest of the value of the increased produce must be lost. In general cases there is not much difficulty in preparing dung upon turnip farms; because, in the driest season, from the nature of the food used, such a quantity of liquid passes from the animals, as to prevent burning, provincially *fire-fanging*, the greatest obstacle to the rotting of dung that can be experienced. If turnip dung is regularly removed; if it is properly mixed with the horse litter, and other excrementitious matter accumulated upon the farm, it will be found an easy task to prepare all that is made by the middle of April, at which time the fold-yard should be cleared. What is produced after that time should be stored up separately; receive waterings, if the weather is dry, and be reserved for clover stubbles, or other fields that are to be dunged in autumn." But though the middle of April is mentioned "as a good time for clearing the fold-yard, this does not prevent the work from going partially forward through the winter, when suitable opportunities occur. When drove out of the fold-yard, the dung should be laid up in a regular heap or pile, not exceeding six quarters, or four feet and one half in height; and care should be taken not to put either horse or cart upon it, which is easily avoided by backing the cart to the pile, and laying the dung compactly together, with a grape or fork. It is also useful to face up the extremities with earth, which keeps in the moisture, and prevents the sun and wind from doing injury. Perhaps a small quantity of earth strewed upon the top, might also, he thinks, prove useful. Dung, when managed in this manner, generally ferments very rapidly: but if it is discovered to be in a backward state, a complete turn over, about the first of May, when the weather becomes warm, will quicken the process; and the better it is shaken asunder, the sooner will the end in view be gained." And a secluded spot of ground, not much exposed to wind, and perfectly secure from being floated with water, ought always to be chosen for the site of such piles or heaps. If the field, to which it is to be applied, is at hand, a litte after-trouble may be saved, by depositing it there, in the first instance; but he has always found it most convenient, to reserve a piece of ground adjacent to the homestead, for such a purpose. There it is always under the farmer's eye, and a greater quantity can be moved in a shorter time than when the situation is more distant. Besides, in wet weather, and this is generally the time chosen for such an operation, not only are roads cut up, by driving to a distance, but the field, on which the heap is made, may be poached and injured considerably." This he conceives to be "the most approved method of procuring dung upon turnip or light land farms."

But "upon clay soils, where wheat forms a principal part of the crop; where great quantities of beans are cultivated, and few turnips sown, unless for the use of milch cows, the rotting of dung is not, he says, only a trouble one, but an expensive affair. Independent of what is consumed by the ordinary farm-stock, the overplus of the straw must somehow or another be rotted, by lean cattle kept in the fold-yard, who either receive the straw in racks, or it is thrown across the yard, to be eaten, and trod down by them. According to this mode of consumption, it is evident, he thinks, that a still greater necessity arises for a frequent removal of this *unmade* dung, otherwise, from the trampling of the beasts, and the usual want of moisture, it would, he says, compress so much as to prevent putrefaction altogether. To prepare dung sufficiently upon farms of this description, is at all times an arduous task, but scarcely practicable in dry seasons: for if it once gets burnt *(fire-fanged)*, it is almost physically impossible to bring it into a suitable state of preparation afterwards; and, at all events, its virtues are thereby considerably diminished. The straw flung out in considerable portions to the fold-yard, after being compressed by the trampling of cattle, becomes, he says, rather like a well packed stack, than a mass of dung in a preparatory state. The small quantity of water and dung made by the animals, is barely sufficient to cause a slight fermentation; and this fermentation, when the heaps get into a compressed state, is sure to bring on the injury of *fire-fanging*. To prevent such an injury, no measure can, he conceives, be so succesfully used, as a frequent removal of this unmade dung, especially if the weather is wet at the time. If people can stand out to work, you cannot have too much wetness when executing this operation; for there is always such a quantity of the straw that has not passed through the entrails of the cattle, as renders it almost impossible to do injury, in the first instance, by an excess of moisture. What he would therefore recommend, upon every clay-land farm, especially those of considerable size, is a frequent clearing of the fold-yard; and that the greatest care should be taken to mix the stable or horse dung in a regular way with what is gathered in the fold-yard, or made by other animals, in order that a regular heat or fermentation may be speedily produced. Where the materials consist of a small quantity of dung, or excrementitious matter, and a large store of unrotten straw, only partially moist-

ened, he is clear that no damage can ensue from putting horses and carts upon the heap; nay, he rather thinks that a positive benefit will be gained from this slight compression. He is, however, at the same time, well aware that the sentiments of many able and judicious farmers are different from his on this point; they being of opinion, that the natural pressure of the materials is quite sufficient, and that any more is accompanied with injurious consequences. He is, however, satisfied, that such ideas are unfounded; having tried both methods upon an extensive scale, and, from the results, feels himself justified in recommending the management. Perhaps, says he, this difference of sentiment may arise from not attending to the very different qualities of dung on different farms; for he has already fully recognized the propriety of abstaining from putting horses and carts upon such heaps or piles containing materials which can be called dung, even though it may be in an unripe state. He contends, however, that no injury is sustained in slightly compressing a mass of rough materials, nay, that such is attended with beneficial effects; for, if the materials were laid up with a fork, or a grape, as is recommended in the case of turnip or half rotten dung, the small portion of moisture therein contained, would speedily be wasted or evaporated, a circumstance which he has repeatedly witnessed, especially when dry weather succeeded the period when the heap was made up. Besides, driving a one-horse cart over a surface of materials only one stage removed from the condition of dry straw, will never prevent fermentation. If left in the fold-yard, he grants that the constant treading of the cattle therein confined, and the daily increased weight of the heap, would undoubtedly produce that evil; but such is effectually prevented, by frequent removals, especially if rainy weather prevails at the time. The heap or pile, as in the former case, should be formed in a secluded spot, if such can be got at hand; because the less it is exposed to the influence of the sun and wind, so much faster will fermentation proceed. It should be constructed on a broad basis, which lessens the bounds of the extremities; and several separate heaps are necessary, so as too much may not be deposited at once, which, to a certain extent, would bring on the very evil he has all along been endeavouring to avert. By shifting the scene frequently, and allowing each covering or coat to settle and ferment, before laying on any more, the most happy effects will follow, and these heaps (all such as are completed before the first May) may reasonably be expected to be in a fit condition for applying to the summer fallow fields, in the end of July or first August. If the external parts get dry at any time during the process, it is proper to water them thoroughly, and in many cases to turn over the heap completely. He may add, that he has repeatedly experienced great advantage from laying a thick coating of snow upon such heaps, as, by the gradual melting thereof, the whole moisture is absorbed, and a strong fermentation immediately follows. He would continue the same method of management during the summer months, so far as circumstances permitted, though it rarely happens that dung collected at this advanced period is fit for use in the same season, unless it be such as is made by keeping horses or cattle in the house, upon green food. Perhaps, as a general principle, it is proper to thrash out all grain before summer arrives, (a small quantity for litter and other purposes excepted) in order that the full value of the raw materials, when converted into manure, may be gained. Straw thrashed in the summer months, always wants a good deal of its original strength; it is broken and hashed by the mills, therefore a large portion must at once be thrown to the fold-yard, where its strength is still more exhausted and dissipated. Even when stacked carefully, it will be found, next winter, to produce much less bulk of dung, than if it had been used at the proper time: and interest of the amount for one year is lost; all which things added together will, he says, be found equal to one half of the original worth."

He also thinks that "upon large farms, where the management of manure is sufficiently understood and practised, it is an important matter to have dunghills of all ages, and ready for use whenever the situation of a field calls for a restorative. No method of application to clay soils, however, is so beneficial as during the year of summer fallow, though, in such situations, a greater stock of manure is often gathered than is required for the fields under this process." After all, "it must be acknowledged, he says, that, under every exertion, it seldom happens that dung on clay farms, where turnips are not grown, can be so well prepared as upon those employed in the culture of that beneficial root." The practice of soiling with such sorts of green food as can be raised upon them, may, however, in a great measure obviate the inconvenience.

In cases where animal matters are thrown together in any quantity, a great increase of good manure may be made by combining with them, as already mentioned, rich surface-mould, peat-earth, or the scrapings of old ditches and roads; as in this way the ammonia formed during the decomposition of the animal materials is prevented from escaping, as would otherwise be the case, and which, by combining with and acting upon the earthy materials, quickly renders them proper for the purposes of manure. And as substances of the animal kind have been found to run very rapidly into the state of putrefaction, it has been remarked that "they may frequently be incorporated with such vegetable materials as are little disposed, or with difficulty made, to rot or become putrid, and by such means good composts be more expeditiously formed. In making use of such earthy materials, it may be of much advantage to have them exposed to the influence of the atmosphere for a considerable length of time, frequently turning them over, before they are mixed with the manures, as by such means they become in a more pulverized state, and are capable of being more intimately blended with such materials, and afterwards spread over the land with much greater equality, a circumstance upon which their

effects very much depend. And that when, in performing this business, the earthy substances are formed into a sort of ridge, about five or six feet in height, and nearly the same breadth in the bottom, they will be in the most proper situation for being united with dung, or other matters that may be intended to be blended with them.

The experiments of Mr. Parkinson seem to show that such earthy materials as mentioned above may be made use of to a very considerable extent, especially where the manure to be mixed with them is of an animal nature.

A late writer remarks, that "lime is a substance that has often been too indiscriminately made use of in the formation of composts, but which, by attending to the following circumstances, may admit of being employed extensively and with more beneficial effects. Where the destruction or decay of green or fresh vegetable matters, especially those of the more coarse and hard kinds, is intended, it should be used in its caustic state in small quantities; as in this condition, thus sparingly employed, it reduces more expeditiously the ligneous and more hard parts of such matters to an earthy state; and as, during its action in this way on these substances, such elastic matters are set at liberty, as by their subsequent combination afford ammonia or volatile alkali, it may frequently be a beneficial practice to blend such earthy substances as have been just mentioned with them, and thereby prevent the elastic matters from being dissipated and lost. If a portion of rich farm-yard dung be afterwards incorporated with these materials, a valuable compost will be formed." And it is added that, "quick lime is likewise found useful sometimes in bringing the hard parts of dead vegetable matters, as tanners' bark, fern, straw, cabbage-stalks, leaves, &c. quickly into the state of earth or mould; but whenever it is made use of in this way, it should be had recourse to only in a very scanty proportion to those of the matters with which it is mixed, as when it is employed in large proportions it is liable, from the heat that is extricated or disengaged by its combining with the moisture of such substance, being so augmented during its slaking, as to convert them into a coaly substance that is insoluble, and at the same time to force off, in the form of gas, their elastic principles, except such a quantity of carbonic acid as may combine with the lime during the process."

It is further stated, that, "by the common practice of blending quick or caustic lime with farm-yard dung, much loss is frequently sustained; as by its violent operation upon such substances, some of the elastic matters are not only set at liberty and quickly conveyed into the atmosphere, but, with what remains, insoluble saline compounds are formed which cannot assist vegetation." It is conceived that the complete putrefaction of such manures, when necessary, is best promoted by the use of lime in its mild state.

In cases where this substance is "to be blended with peat or earth, the most advantageous method is to use such lime as has been newly made and well slaked, in the proportion of about one part of the lime to five or six parts of the peat or mould, which should not be too much exsiccated, or dried, before it be made use of. By this means the heat which is generated will not be sufficient to produce any injurious consequences, either by forming a coaly matter, or forcing off the elastic principles in the state of gas. And the volatile alkali which is composed in such cases, by being allowed to enter into combination, as it is formed, with that part of the peat or mould which has not been acted upon by the lime, in consequence of its being employed in so small a proportion, and in its effete state, will form a soluble saline substance, capable of promoting vegetation."

It has been observed by Lord Dundonald, that there "are other substances that may be still more beneficially employed in forming composts with peat earths, when they can be procured in such quantities and at such cheap rates as render them capable of being made use of in this way," such as "alkaline saline matters, or such substances as contain them in any quantity; as by mixing these with the peaty materials as above, they are made perfectly soluble, while by the use of lime only such a proportion of them is rendered soluble as can be acted upon by the quantity of ammonia or volatile alkali formed during the time it is mixed with them." And still farther, that insoluble compounds, such as have been noticed, are formed in the latter circumstance.

The practice common, in different districts, of making composts with lime and mould on the head-lands, or other parts of the fields on which they are to be applied, which cannot be done to advantage, except where the surface mould is rich in vegetable matter, is not to be much recommended, but wherever such composts are to be formed, the land should always be ploughed or dug up to a great depth, and be reduced into as perfect a powdery state as possible; fresh lime may then be deposited in small heaps, along the middle or ridge of the head-land, and the earth in this fine state be thrown over them, in the proportion of about four parts of earth to one of lime, being kept close by being beaten down with the back of the spade. It is observed that, from the gradual slaking of the lime, in this situation, by the moisture of the earth, elastic matters are set at liberty, which combining with the mould or earth, render it still further reduced, and by being afterwards very intimately blended by means of the spade with the very fine particles of the lime caused by the slaking, a valuable compost is made for the stiffer sorts of soil, especially if a small quantity of good rotten dung be well incorporated with them afterwards.

Though farm-yard manure is seldom in a state to admit much addition of earthy matter, yet where there is much liquid oozing from such composts, or stagnating about the bottoms of them, some of the earthy materials which have been mentioned may be laid around them in order to absorb or take it up, and prevent the great waste that must otherwise take place, as may often be observed in the situations where dung composts are made. And it is advised

that, "this should be more particularly attended to where such composts are laid in situations that have not been properly formed as dung-steads." In such cases, it may often be an useful practice to place a considerable thickness of such materials in the bottoms, before the farm-yard compost is carted out, and laid upon them, as by that means the manure heap may be greatly increased, and at the same time a proper substance for the volatile alkali contained in such liquors to act upon supplied. This method is fully confirmed by the practice being in use wherever any attention is directed to economy in the forming of manures of this kind.

The nature of the soil, the state or condition of the land, and the goodness of the manures, are circumstances which render a difference in the quantity of such manures necessary. The heavy sorts of soil, such as those of a clayey or deep loamy nature, require composts constituted of the lighter sorts of earthy materials; while the thinner and more light sorts stand in need of those which are formed of clayey, loamy, or the more tenacious earthy matters. It is observed that, "in general, the allowance of such manures should be from sixteen to twenty loads to the statute acre, each containing seventeen or eighteen hundred weight. On many occasions, however, a much larger proportion may be required, and in others a less may answer the intentions of the farmer." And it is added, that, "the mixture of dung, litter, and other materials, which is gradually collected and formed into heaps in the farm-yard, is, in general, when employed without having any other substances incorporated with it, laid on such lands as are under preparation for wheat, turnip, or barley crops. It is likewise in some places laid on for a pea crop, where wheat is intended to be the succeeding crop."

Such composts, or manures, as are collected from the streets of large towns, are formed of a great variety of substances, as the recrements of decayed vegetables, putrid animal matters, and ashes; but from their abounding, for the most part, with substances of the latter kinds, they may, on the principles just stated, be in many instances greatly increased by having rich surface mould, or peat earth, blended with them; and by such a practice, where the manure heaps are in a condition to admit of it, the risk of waste, by the escape or dissipation of their more fluid contents in the aërial or gasseous state, be effectually prevented. But such additions can only be advantageously made where the proportion of animalized materials in the manure is large; in other cases it is better to employ them in the state in which they are met with.

Compost manures are capable of being used with great benefit on different soils, and in preparation for different sorts of grain crops, as well as those of the grass kind. It has been remarked, that, "when applied in the proportion of fifteen or twenty tons to the acre, they generally produce great fertility: they should, however, be applied according to the particular circumstances of the soils, and the nature of the crops for which they are made use of."

The result of practical trials fully proves that the most beneficial composts are all those which are formed by the combination of earthy materials with animal matters. In this way ground bones and whale-blubber have been found highly useful; but by the author of the Experienced Farmer, the effects of the former are asserted to be the most powerful when applied on the moister sorts of ground. See *Compost*.

Methods of increasing and preserving manures. Having thus explained the nature and agency of the different substances commonly made use of to increase the fertility of soils, the best means of augmenting, preserving, and managing them may be considered, as upon this in a great measure depends the general fertility of farms, and the goodness of the crops that are raised upon them. It is of course a matter of great interest and importance to the farmer to see that nothing is destroyed, wasted, or thrown away that can in any way be converted to this purpose. It is remarked by a late writer, "that there are many substances that may be rendered useful in this way, which have hitherto been little regarded by the cultivators of land, there can be little doubt, when the daily waste of animal, vegetable, and other matters, that takes place in every country, from their being carried away by rivers, or consumed by fires, is fully considered." By greater attention to the cutting of grain so as to preserve as much straw as possible, as well as care in getting together the stubble, in many instances vast advantage may be gained in this view. And that "another great cause of loss in the production of manures is from the want of adopting or putting in practice such modes of management, in respect to different substances, as are capable of rendering them fit for the purpose of application, in the most quick and expeditious manner; for it is obvious, that if by properly attending to such means the same quantity of manure can be prepared in a short space of time, which under other circumstances must have required a long one, much increase of manure may be effected, and consequently great advantages be gained by the cultivators of the ground." It is stated that, what is necessary to be done in order to facilitate and hasten the decomposition and reduction of different materials into the proper states for being applied to the soil are, as has been seen "in some measure, the free admission of atmospheric air, a quantity of moisture suited to the condition of the matters made use of, and a due degree of heat. And also the proper blending of animal with vegetable substances, in the incipient stages, and the addition of lime, according to circumstances, and in proportions suited to the state and nature of the ingredients."

In this intention it is observed by the same author, "as the principal resource, on most farms, is the farm-yard, it should be constructed in such a manner as that every thing may with ease and facility be converted to the purpose. In general one dung-stead may be sufficient; but where the size of the farm is large, two or more may be necessary, as the putrefaction of such heaps proceeds with greater regu-

larity and expedition, from the access of air and moisture being more free, when they are not made too large; and, besides, they can be more conveniently turned over or removed. The parts of the yard on which they are situated should, while they are convenient for depositing the dung, and other matters from the sheds and other offices, upon, be neither too much elevated, so as to cause the dung to become dry, or so greatly depressed as to favour the stagnation of water upon it, and thereby deprive it of the properties most essential to the promotion of vegetation. Before each of the dung-steads a reservoir, or basin, ought to be made, into which not only the drainings from all the different sheds and places where animals are fed or kept, may empty themselves, but likewise the urine from the necessaries, the suds from the washhouses, and the washings of the various utensils employed in the family. Without these advantages in the construction of farm-yards, much loss of manure must daily occur from the liquid matters of such places continually running away, and being otherways wasted, as well as from their not being made use of to forward the conversion of other substances into the condition of manures." But that, where these and other suitable accommodations have been provided, the farmer will have little more to do than "be careful in saving or providing such matters as are suitable for the purpose, and causing them to be properly placed and removed, in order to have them speedily reduced into the state of manure, and the quantity of his dung heaps thereby greatly increased and extended. With the same design, various vegetable matters, such as hay, straw, fern, leaves, rushes, coarse grasses, flags, and many other aquatic plants, should be collected and preserved in as large quantities as possible; by allowing nothing of the kind to be sold or carried from farms, except in some particular instances, as where they are situated near large cities, or towns, where such articles can be advantageously disposed of for the purpose of feeding and littering horses, or other animals, and at the same time an equivalent in good manure be brought back to the farm; by mowing and raking together the wheat or other stubbles, the fern from the commons, and leaves where they can be obtained, as in the vicinity of parks and other woodlands, and by cutting the coarse grasses and aquatic vegetables at such periods as they are in the most juicy and succulent states. The whole, after being sufficiently dried, should be carried to the farm yards, and stacked up in convenient situations, either in or near them, for the purpose of being made use of as litter, and by that means being converted into manure. And in addition to these means, every leisure opportunity should be taken, before the commencement of the foddering season, to bring into the farm-yards such quantities of peat or boggy earth, rich surface mould, marl, dry mud from ponds or ditches, scrapings of roads, loam, and other substances of the same kind, as can be conveniently obtained for the purpose of being applied as bottoms for the absorption of the liquid matters."

When such materials as are necessary have been thus procured, it is observed that "the best mode of proceeding seems to be that of covering the whole of the yards, where the cattle stand and tread, and even the pig-sties, in some cases, with layers of these earthy matters, eight, ten, or more inches thick, according to the number of cattle, and other circumstances; and also to deposit in the reservoirs before the dung steads, proper quantities of the same substances, for the liquid matters which come into them to act upon. Upon these earthy bottoms, at the time the cattle are confined, pretty thick litterings of one or more of the materials that have been collected and stacked up, may be placed, and the stables, cow and ox stalls, pig-sties, &c. cleaned out upon them. Where it is the practice to tie up and confine the cattle in the night-time, the straw or other substances, after having been broken down and reduced by littering them, may be used for covering the bottoms of the yards. by which means their decay may probably be rendered more quick and convenient. It appears also probable, that where stubble, fern, rushes, leaves, or other vegetable matters, the textures of which are hard and ligneous, are employed, their decay or reduction into the state of manure may be greatly expedited by means of a slight portion of lime, in its active state, being spread over the earthy bottoms before they are applied, as has been found to be the case with tanners' bark." And that "where the matters made use of in the way of manures are liable to be rendered too dry by the weather, their putrefaction and decay may be much promoted, by having them sprinkled over occasionally with water, which may be conveniently and readily performed by having a pump, with troughs, fixed properly for the purpose; or, where these are wanting, from a pond in the yard." And in order "to render the plan the most effectual it is capable of, the whole of the cattle should be strictly confined to the fold or foddering yards, during the winter, and not turned out, as is frequently the case, into the pastures, by which the making of much manure is prevented, great injury, in many situations, done to the grass lands, and the stock, from being much exposed to cold and other causes, benefited in a far less degree than is commonly imagined. By pursuing this method, from the great consumption of straw and the coarser sorts of food by the young lean cattle, and of hay and luxuriant vegetable roots or plants by the others, such quantities of animalized matters are voided, as by mixing with the bottoms of the yards hastens their putrefaction, and affords not only an immense increase of manure, but of such as is of a very valuable kind. If there be not a sufficient proportion of animal dung and urine incorporated with the other matters, which can seldom be the case where the cattle are not regularly confined to the fold-yards, the manure, though it may be nearly as large in quantity, is found by experience to be very inferior in its effects when applied to land." It is likewise further stated that "where the number of cattle confined in the fold-yards is great, it may be necessary, occasionally, to remove the bottoms, and the matters littered upon them, to the

dung-steads, after they have become in some degree manures, by being well saturated and blended with the urine and other animalized matters. These must be immediately replaced by others in the way just noticed. And "the earthy substances from the reservoirs must also be occasionally emptied out upon the dung heaps, and replaced by quantities of fresh materials of the same kinds, and the stems of different gross vegetable products from gardens or other places," where it can be effected with facility.

It is also advised, that "at the close of the season, when the cattle are turned out of the yards, the heaps of manure which have been thus collected and thrown together, be turned over, in order that the animalized matters may thereby not only be still more intimately incorporated with the earthy substances, but, likewise, that more of the pure air of the atmosphere may be retained among the clods, from their being rendered much smaller by such means, and the putrefactive process be thereby more perfectly produced." And that "after this business has been well performed, as little delay as possible should be suffered to take place before the manure is applied to the soil; as from the combination of oxygen or pure air with the carbonaceous material of the dung, and of azote with hydrogen, under these circumstances, such fluid matters are formed as constitute its most beneficial properties, but which are afterwards continually wasting so long as it remains unapplied to the ground or soil."

It is suggested that "on these accounts, as well as those which have been already stated, manure heaps should not be made too large, but of such sizes only as that they can be expeditiously turned over, and put upon the land. And another advantage which attends the having different heaps and their not being large, is, that one can be prepared and carted away at a time, without the other's being in the least injured by any delay that may happen from unforeseen causes of any kind."

It has been well observed in an useful periodical work on husbandry, that, "in many situations where the above mentioned articles are plentiful, they are suffered to go to waste, though they may be used with great advantage for littering the stables and fold-yards. Ferns and rushes do not rot so soon as straw, but make a rich manure, and, if well turned over in the spring, are sufficiently rotten in June." In winter and spring, when dung is taken from the stable or fold-yards to the fields, it is conceived better to throw it up with forks than allow the carts to be taken upon the dung hills, a practice which prevents a speedy or complete fermentation. At these times, the quantity of manure may be much increased by mixing with the dung large quantities of rich earth, taken from old dikes, sediments of ponds formed by running water, and such other places as were most likely to afford it, well mixed with fresh or dissolved vegetable matter."

The conductor of that work has, however, well observed, that the practice of mixing earth with dung requires to be managed with a delicate hand, especially in forming a dunghill with materials that have not been previously subjected to fermentation, for as in carting upon it by pressing and consolidating the mass, it greatly retards, and in some instances, almost entirely prevents fermentation; indeed, by mixing any considerable quantity of soil with dung in an unfermented state, by pressing the straw and other matters into a small space, it so effectually excludes the air, that the dung, at the distance of several months, is found in a state very little different from what it was when put into the heap: and after all, when it is, in common language, said to be rotten, it is, upon examination, found to be only decayed, and the produce, in place of abounding with rich mucilaginous substances, which all well-fermented dung does, is found to consist almost entirely of vegetable earth. There is, however, it is said, a mode of applying earth to dunghills, that is not only safe, but highly beneficial: "It consists in covering the whole surface of the dunghill lightly, either with common earth or broken peat, every time the stables or fold-yards are emptied; a covering of that kind not being heavy enough to press materially upon the mass, does not retard the fermentation, and has the great additional advantage of preventing the loss daily sustained about most farms by evaporation, and the dissipation of the greatest part of the valuable gasses generated during the process of fermentation, all of which are entangled and retained by the earth; which, by that means, not only acquires high fertilizing powers, but renders the dung more valuable." And that "when a proper system is followed of carrying out the manure from the stables and yard to the dunghill—as once a-month, if it is spread equally over the whole, and a covering of the kind just mentioned laid above it, a considerable addition may be made to the quantity of manure upon every farm yearly, not only without risk, but with very great advantage." This sort of manure has been found upon light gravelly hills, or sterile clays, particularly useful. It is observed, that "the rich earth alone would no doubt have very much improved such ground, but, by being mixed with dung, it probably became impregnated with something of a fertilizing nature, which would otherwise have been lost." In some cases, "instead of mixing as above, the earth has been occasionally laid a foot or two deep, as a foundation to build dunghills upon; at other times in situations where the drainings of fold-yards, or the urine of fat cattle, could easily be conveyed into it, and no doubt considerable advantages may be reaped from these methods of increasing the quantity of manure. In regard to the propriety of using rotten or rank dung, the latter is supposed very improper management, though pursued by some farmers, who do not wish to hasten putrefaction by leading out and turning, not only because these operations are troublesome and expensive, but because they believe that the quantity of dung is thereby lessened. They certainly lessen the bulk, but probably not the quantity of good manure. Perhaps they prevent the loss of some very fertilizing particles, which are exhaled by the solar heat, or otherwise injured by the weather, when the dung is applied in its rough state, and consequently not properly covered in. There can,

however, be no doubt of a small quantity of rotten dung making land more productive, than a much larger one of such as is rough or half rotten.

It is supposed, that "by mixing lime with manures composed of earth, and dug in the more advanced stages of their preparation, some increase of quantity may likewise be produced; and at the same time, by its uniting with the nitrous acid during its formation, may prevent that substance being thrown off into the atmosphere in a gasseous form, or readily washed down from the composts by rains; and thereby preserve a material that has long been found useful in promoting the growth of plants."

And as great waste of manure is continually taking place from the evaporation of the more liquid parts of manure heaps, where they are much exposed to the influence of the sun or winds, and the washings of the rains, it would tend greatly to the saving of such matters, and at the same time considerably promote their complete putrefaction and decay, to have them placed in situations that are much shaded by trees or other means. It is suggested, that, in farm yards, moveable coverings of some light kind of material might probably be highly advantageous for this purpose. By means of this nature, the manure heaps, in such places, may be effectually screened from the action of the sun in the summer, and prevented from being injured by the heavy rains or snow that fall in the winter season. And as a further inducement to adopt such methods, the manures which have been preserved from the effects of the weather in this way are said to have been found, by practical trials, to be far more efficacious in promoting the growth of crops, than under other circumstances; and of course capable of going much further in their application.

In different places, in order to procure manure from the articles of food and other matters produced on the farm, different modes have been pursued. Some have strenuously contended, that the most advantageous plan is to have the whole of the hay and straw consumed by the different animals, without employing any of them in the way of litter, floors or standings for them being constructed in such a manner, as that they can be tied up and kept clean and dry merely by sweeping, without being littered with straw or other similar materials; while others maintain on the ground of actual experience, that the method of eating the hay by the stock, and employing the whole of the straw, as well as other matters, in the way of litter, is by much the most certain and effectual in promoting the increase of manure. On these different opinions, it has been well observed that, "though each of these methods may be practised, with more or less advantage, according to the nature of the farms;—as where there is much grass and little tillage land, the former may be preferable; but where the quantity of grass is small, and that of arable ground large, the latter;—it is probable, that a judicious combination of both may be the most beneficial, especially where, in addition to the common articles, coarse vegetable and rich earthy matters are provided and made use of in the way which has been mentioned, as by such a combination the full effect can only be produced. In the former method, the loss by means of digestion and animalization is probably much greater than has been generally supposed by those who have maintained the superior utility of the practice."

The practice of soiling horses, and different kinds of cattle, with rich green food, as clover, summer-tares, and other artificial grasses, cut fresh every day during the summer season, and placed in cribs in the sheds or foddering yards, the bottoms or floorings of which have been prepared and strewed with earthy materials and litter, in the manner directed above, is a practice by which great additions may be made to the dung-hills, as the evacuations of cattle fed in this way are very considerable. The earl of Dundonald has remarked, "that experience only can teach, or warrant the belief of how few acres of ground, under the culture of artificial grasses, when cut green, and daily given to working horses and other cattle, will suffice for their maintenance. The artificial grasses, or plants, best adapted to this purpose, are, he says, red clover, tares, and saint-foin. None of those succulent plants with large stems and leaves answer so well to be depastured as to be mown; not only on account of the injury they receive in being bruised by the treading of cattle, but by being constantly cropped and kept short, they are deprived of the nourishment which they principally receive by their stems and leaves. Saint-foin is, he thinks, best suited to chalky or dry soils, and to the southern parts of Britain. It has often been tried without success in the northern parts of England, and in Scotland. Winter tares have also been sown, but have not been found to answer any valuable purpose. Clover and summer tares, therefore, should be the only plants of which the cultivation on a large scale should in these parts be attempted; and every prudent farmer will take care to have a full supply of them, as in the event of a superabundant quantity for green food, these crops are equally proper for hay. Tares should always accompany the culture of clover, to supply the deficiency of herbage between the first and second cuttings of the clover."

It is stated, that "the quantity of manure that may be formed in this way is, probably, much greater than can be supposed by those who have not actually made a trial of the method: by some French writers it is stated, that from three or four hundred sheep, kept in this mode, manure sufficient for nearly an acre of land may be daily procured; and the manures thus obtained are likewise asserted to be preferable to dung procured in the common method." It has likewise the advantage of preventing the great waste that unavoidably must take place in feeding off such crops, and of bringing the whole of them immediately into use; besides, the manure thus produced becomes of a superior quality, from the vast quantities of worms and other insects that are generated during the hot summer weather.

The author of Practical Agriculture states, that "by means of covered sheep-folds, a great increase might also be made annually to the stock of manure. If this neglected, but highly beneficial, practice, says

he, were regularly employed here, as is the case in many other countries, by having proper sheds and inclosures for the purpose constructed, of any slight materials, near to the fold-yards, or other more convenient places of the farm, so that the sheep might have fresh air and sufficient liberty to run about, and at the same time have the means of being sheltered from rain, snow, and the coldness of the winter season, the advantage to the flock would likewise be considerable, besides the great supply of manure that must be provided. In order to promote the latter advantage, the bottoms or floorings of such sheds and inclosures should be covered with such earthy materials as have been recommended for the cattle yards, and also littered upon in the same manner; all of which ought to be removed and cleared away to a heap, or the common dung-steads of the farm-yards, as often as they become perfectly saturated and blended with the dung and urine of the sheep, and fresh materials of the same kind supplied. In bad weather it will be advantageous to keep them constantly in these covered folds, and feed them with hay in standing racks; but when it is fine they may be suffered to go into the pastures in the day-time, and only be put into the folds during the night." He further adds, that "the practice of keeping sheep in covered folds is made use of in Flanders for the purpose of raising manures, with great success; and very dry sand is sometimes employed for the bottoms of the folds instead of litter." And that, "where the house-lamb system is carried on to any extent, the preparing and littering the sheds and yards, into which the ewes are occasionally put and the lambs kept and suckled, might be practised with great advantage in respect to the production of manure, as animals under such kinds of management are constantly found to void urine and dung in much larger quantities than in the ordinary courses of feeding." See *Sheep-fold.*

And the ploughing down of full rich green crops of different kinds in their most succulent states, is also another means of increasing manure that may occasionally be adopted with great advantage.

The practice of feeding off different green crops on the land by sheep, bullocks, or other animals, is also another method by which much fertility may occasionally be given to the soil, at a cheap rate, as the expence of carriage is prevented, and a considerable saving of manure effected. It is stated, by Mr. Middleton, that by this mode of management the great loss of urine and dung that unavoidably occurs in the other methods may be the most effectually prevented; "for in the stables, cow-houses, sheds, fold-yards, and dung-hills, even under the best management, there is, says he, a great waste, perhaps of half, including dung and urine; under ordinary management three parts of this manure is lost; but in the soiling of tares, turnips, cole, clover, &c. in the fields there is *no* loss; the whole is immediately applied, without the cost of carriage, to the enriching of the soil." But in this way there must be much more waste than is here supposed: by evaporation, from the action of the sun and wind over so extensive a surface, much of the valuable matters of the manure, in such situations, must be daily carried away; and the more fibrous or ligneous parts of the materials, which are rejected as food by the cattle, from their being thinly scattered over a large surface, becoming dry and hard, must be longer before they decay, or are rendered fit for the purposes of manure, than where they are collected together in large quantities and in more confined places.

There is another mean of increasing manures to a very great extent, which is by adopting such methods as may effectually prevent the soil and urine of privies, and the various animal and vegetable materials that are continually thrown into them, in cities and large towns, from being uselessly retained in deep pits, or places constructed for the purpose, or inconsiderately washed away and wasted by being conveyed into rivers or ponds by sewers and drains. Mr. Middleton has stated, that, from want of suitable modes of preserving such substances, the annual loss, in this country, is probably not less than five millions of cart loads, which, if turned to the uses of agriculture, would be worth to the cultivators of the soil two millions and a half, and to the community five millions of pounds sterling! And the eagerness which is manifested in many other countries to preserve and promote the increase of such manure, shews that it is a substance of vast utility, and that an abundant source of fertility is thus neglected, and lost to the public. It is supposed, by a late practical writer, that "the most easy and convenient methods of preserving substances of this kind in the country would be, probably, by having pits formed for the reception of them, as near as possible to the dung-steads in farm-yards or other places, and prepared with floors of clay, or some other material through which the liquid matters could not readily pass; these might be connected with the privies by proper drains, and have covers fitted to them, in order that a quantity of mould, peat-earth, saw-dust, lime, stems of coarse garden plants, or other substances of the same sort, might be occasionally placed in them, and removed to be blended with the common dung heaps, as often as they became fully reduced by putrefaction, and well saturated and impregnated. But in large towns or cities, where such manures are produced in great quantities, reservoirs or basons of large sizes should be constructed with floors of the above kind, and be connected with the privies of different parts, by means of sewers or drains. Such reservoirs ought to be so situated as to be capable of being emptied with ease and facility, as often as necessary, by persons appointed for the purpose, and their contents carried away in the night-time. Where there is the convenience of rivers, however, as in London, and many other populous cities and towns, a large proportion of such manures might, in most cases, be readily emptied from basons of this sort, formed on their banks for the purpose, or perhaps from the extremities of the common sewers themselves, by means of proper sluices, into covered boats or barges, and thus cheaply carried to a distance, for the advantage of agriculture; a method, in some respects, practised with success in Sweden," as stated in the first volume of Communications to the Board of Agriculture.

And " as this kind of manure is extremely liable, from the agitation of the carriage in which it is moved, to become so liquid as to be conveyed with great difficulty, it is probable, that by having such earthy or other substances as have been mentioned above, or as could be conveniently procured in such large cities or towns, such as the long littery dung from livery stables, lime rubbish from the pulling down of old houses, and the fresh earth dug up in preparing the foundations for new ones, mixed and blended with it in the pits or reservoirs, for some time before they are cleaned out, the difficulties attending the carriage of it might not only, in a great measure, be obviated, but the disagreeable smell issuing from it be much corrected, and the quantity of manure greatly augmented. By some method of this nature, under the management and direction of proper persons, vast stores of fertility might, it is conceived, be provided in such places for the neighbouring districts, which inattention or popular prejudice at present withhold from the uses of agriculture." See *Night-soil.*

In particular situations, as near the sea, where shell and other small fishes can frequently be procured in large quantities, by having them well mixed and incorporated with good surface mould, turf or peat-earth, or other matters of that sort, a vast increase of good manure may also be provided. The weeds cut from the sides of the rocks, and which are thrown up by the tides, when collected into heaps, and mixed with small proportions of lime and suitable quantities of mould or earth, may likewise contribute greatly to the increase of the compost heaps in such districts.

It has also been suggested by Dr. Anderson in speaking of calcareous matters, " that the recent shells obtained from fishing towns, operate much more powerfully as an animal manure than as a calcareous matter, when first applied; and that it is not impossible but that man may, in time, fall upon some contrivance for obtaining this animal calcareous manure in much greater abundance and perfection than it has hitherto been obtained. There is," he observes, " a small species of fresh-water *wilk*, which increases so fast, as in a surprisingly short time to fill a considerable space with solid wilks, if a few of them have been placed in a proper receptacle for that purpose, and water duly administered to them. If then," continues he, "ponds were prepared for this purpose, and properly stocked with this animal, and if they were allowed to increase till a bed of them, of considerable thickness, was accumulated, might they not then," he asks, "be taken out in abundance to be employed as a manure? These, if bruised under a stone like a tanner's wheel, to reduce the shell to small fragments, would certainly," he says, " form as rich and efficacious a manure as could possibly be devised; nor could there be any difficulty in disposing the ponds in such a manner as to afford a constant annual supply."

There is another material capable of augmenting the manure heap very much, in the rich vegetable mould and other matters contained in the bottoms of ditches, and in boggy, hollow places, where water frequently stagnates, and large crops of aquatic or other plants alternately vegetate and decay. This should be occasionally dug up and applied to the soil, for which it is proper, either in the state in which it is found, or after having been formed into compost heaps with dung, lime, or other substance of a similar nature.

In clay, though not actually a manure, there is a substance that may also be employed with great advantage on sandy and other light soils, and by that means save the more valuable manures. It has been made use of with great effect in its crude state, in the practice of an improving Suffolk farmer, but it would seem to be the most serviceable for this use after being imperfectly burnt in clamps and kilns, probably from the proportion of oxygen or pure air that is thus combined with it, or with the metallic matters which it contains. It is well remarked, by a late writer, that " it is necessary, in order to increase the stock of manures on farms to the greatest possible extent, to be careful that none of such animal or vegetable substances as are capable of being converted into manure, be thrown away or consumed by fire, but that they be all conveyed to the dung-steads in the farm-yards or other places, or laid in heaps of themselves, and suffered to pass into fermentation, by which they may be speedily reduced to manure. Where the matter thus made use of chiefly consists of weeds and the stems or roots of coarse plants, such as peas, beans, cabbages, docks, nettles, &c. their decay may be greatly promoted by a little quick-lime being blended with them. Such heaps should also be covered over pretty well with some of those earthy matters that have been mentioned above." And it is added, that as " the different materials which are made use of for the purpose of manure, pass through different stages of decomposition and decay, in each of which such matters of the solid or fluid kinds are formed, as are capable of contributing to the nutrition and support of vegetable crops, but which are liable to be dissipated or carried away by the agency of various causes, it may be necessary to guard against such waste by keeping the dung-heaps covered in every situation, as much as possible, with earth or soil, both in the early periods in which heat is evolved, and at the later ones, when ammonia or volatile alkali is formed; as by such management the processes of decomposition, when too rapid, may be restrained, and the elastic matters that are gradually set at liberty be absorbed by these coverings, while the more fluid ones are detained by the earthy bottoms on which they had been placed, and thus the whole of the valuable properties of the manure be preserved."

Manuring *of Land*, the application of the various substances that are capable of being employed as manures to the soil, in such a way as to produce the most beneficial effects in the production of crops, whether of the grain, grass, root, or other kinds. In this business various circumstances are necessary to be considered, such as the state or conditions of the manures, which are to be made use of, the nature of the ground on which they are to be laid, the kind of crop that is to be promoted by them, and the season of the year in which they are put into or upon the land; for as it has been shown that changes are continually

taking place from the moment the materials of the dung-heap are thrown together, to the period in which they are reduced into a black carbonic earthy matter; and that in most of the different stages through which they pass in this process of decomposition, such substances are formed as are capable of contributing to the nutrition and support of vegetable crops; it is conceived "probable, that in cases where manures are to be turned into the ground, and such crops cultivated as require a supply of nourishment for a considerable length of time, they should be employed in their long or more imperfectly reduced states, as by the heat which is evolved in the commencement of their dissolution, the process of early vegetation may be greatly promoted, and their gradual decomposition and decay afterwards, under the ground, afford a more durable and regular supply of nutrient materials, and thereby contribute more effectually to the growth of the crops; but that where they are to be buried in, or applied to the surface of the soil, and intended merely for the benefit and support of such crops as are of short duration, or quickly arrive at their full growth, they may be more advantageously made use of after they have been more fully and completely reduced, as in this state the manure is, in the case of grass lands, not only capable of being spread out in a more regular and uniform manner, by which it becomes more evenly as well as more generally carried down to the roots of the plants by rains, but it is in the most suitable condition for allowing the young plants the means of springing up with facility, and at the same time, whether used under or upon the soil, of affording the crops that abundant supply of nourishment which is necessary to their speedy growth and great luxuriance, and by these means to contribute the most perfectly to the promotion of their increase." And in addition to "these advantages of long, or imperfectly decayed manures, they have others that depend on the soil into which they are turned, and the nature of the crops that are sown or planted with them. Where they are employed in such stiff, clayey, or loamy grounds, as have a great tendency to become dry and hard, and thereby incapable of admitting the tender fibrous roots of grains or other plants to spread or extend themselves, and draw in more abundant supplies of nourishment, they may be useful by keeping the earth around them in a more open and porous state, from the slowness of their decomposition, and the gradual and continued manner in which the different elastic matters are set loose and united with the soil. Hence, when barley, or such kinds of grain as require a rather light and open state of soil, and those bulbous or knobby rooted plants, such as potatoes, that require much room to shoot and extend themselves, are cultivated on such stiff soils, they are generally found to be the most productive where such long or imperfectly reduced manures have been made use of in the preparation of the land." And further that "as in the slow and gradual decomposition of the materials which are made use of for manures, when slightly deposited beneath the soil, there is much less waste of heat and those elastic matters which contribute so greatly to the support of vegetation, than where they are made to undergo the various processes of dissolution in large masses, as in dung heaps, they may probably sometimes on that account be most advantageously employed in this state." Also "on this principle the ploughing down of fresh vegetable crops, in many cases, in their most succulent states, may be a more economical as well as more beneficial practice; especially in such light and dry kinds of soil as will more readily admit of their gradual putrefaction and decay, than to cut and take them off for the purpose of being by other means converted into manure. It seems likewise probable, on the same grounds, that for the production of crops of bulbous-rooted vegetables on the more stiff and tenacious soils, the matters made use of as manures may be employed with the greatest advantage, when put into the earth before they have undergone any great degree of decay by means of putrefaction, as in this way there is no waste, the whole being ultimately converted and applied, though more slowly, to the support of the crops for which they are immediately employed."

In the fourth volume of Communications to the Board of Agriculture it is stated as the opinion, of a practical farmer, that stable dung never answers better than when carried on to the land as soon as made. He laid it on a piece of wheat in frosty weather, and at harvest the crop was all laid to the ground. And on grass lands, it is supposed when laid on in the spring, to screen it from the cold winds and occasion it to be more forward, and that in the summer the strawy part protects the land from the sun; and in either season it is soon grown in and nearly lost to the eye.

In regard to the time or season of applying manures "with the greatest benefit and advantage, though in practice it must, in some measure, depend on the state of the land, the nature of the crop, and the convenience of the farmer, it should, in cases where they are buried in the ground, be as nearly as possible to the periods in which the seeds, or the roots which they are designed to support, are sown or placed in the earth; where they are to be laid upon the surface of the land, it ought probably to be just before the crops of grass, or other vegetables, begin naturally to spring or shoot forth." As in this practice of depositing and blending the manure with the soil, nearly at the time the crops are put in, there is scarcely any waste of the fertilizing properties of such substances, which, as they gradually proceed in their decomposition and decay under the ground, must otherwise be the case, the roots of the plants not being in the most proper states for taking them up and converting them to their support. Besides, in stiff, loamy, or clayey soils, they have a tendency, as has been remarked above, to produce a degree of lightness and friability that is suited to the early process of vegetation." The author of Phytologia has well remarked that "the atmospheric air, which is buried along with the manure in the interstices of the earth, and which for many weeks, or even months, renders the soil loose and

easily impressed by the foot on walking on it, gradually evolves, by its union with carbon, a genial heat, very friendly to vegetation in this climate, as well as the immediate production of much fluid carbonic acid, and probably of a fluid mixture of nitrogen with hydrogen, which are believed to supply much nutriment to plants."

The application of such manures as are made use of in the way of *top-dressings* in the early spring, is a practice by which it is observed "they are laid on in the most favourable period for affording their nutritious principles, and for their being drank up by the roots of plants, consequently become useful at the time they are most wanted for the promotion of the crops, and the great waste which must otherwise be caused, either by the excessive falls of rains and floods in the winter season, washing down much of the valuable properties into the adjoining rivers and ditches, or the evaporation of their more volatile or elastic matters by means of the summer heats, is most effectually guarded against and prevented." It is suggested that the practice common in some places of applying manure to grass lands in the latter end of the summer or beginning of autumn, after the first crop of hay has been taken from the ground and the after-grass has begun to make shoots, is not by any means so favourable as that of early spring, as in the latter case the generation of those materials that contribute to the support of vegetation is greatly promoted by the constantly increasing heat of the vernal and summer months; while in the former it is constantly checked and retarded by the increasing coldness of the autumn and winter seasons. Besides, the manure by being spread out upon the surface of the land, under such circumstances, must be the cause of great loss, by contaminating the after-grass, and rendering it incapable of being eaten off by cattle or other kinds of live stock." But that "where a second crop of hay is to be taken, it may sometimes be put on at such times with advantage to it, especially if the weather be not too hot, and the manure in a perfectly fine and reduced state, so as not to impede the mowing. It has been well remarked by Doctor Fenwick, in his ingenious reflections on manures, "that it is scarcely possible to suggest a worse mode of using manures on grass lands, than that which is almost universally practised in the neighbourhood in which he resides;" and it is the same in many other parts of the country, as is evident from the reports that have been lately published by the Board of Agriculture: "When," says he, "a severe frost has bound up the land in a state of impenetrable cohesion, the farmers, wheel on their dung, perhaps even when snow has covered it. While the frost lasts, the land can derive no advantage from the manure, and when a thaw supervenes, it is evident that the wash from the melting snow, or from the rains which generally fall in such weather, must deprive the mass of every part that is soluble. The ground, in the mean time, retains the frost for many days, and is therefore incapable of absorbing the wet which falls upon its surface; and even when the influence of the milder air has reached it, it can imbibe but little, being in general previously filled with water, and the quantity which flows over it being too great for soil under any circumstances to drink up." It is supposed by the same writer, that in support of this destructive and wasteful practice, however much it may have been defended on the ground of the farmer's leisure or convenience, and the little injury done to the turf or sward of the land, there can only be one reason alledged, which is, that manure, when spread early in the winter, may protect the roots of grasses from the severity of frosts. And this too, the author of Practical Agriculture thinks, "is probably a mistaken notion, as it is known to every one that the common grasses are seldom injured by the severest frosts; and other kinds of grasses may probably not suffer less injury from the application of manure at such a season than from the severity of frosts." He therefore concludes that "on all these accounts, farmers should contrive as much as possible to apply the manures, intended as top-dressings to grass lands, as early in the spring as it can be conveniently done, which may be easily managed on those that are dry, and on such as are inclined to be wet and poachy, it may probably be greatly facilitated by having small light carts constructed for the purpose, and placed on broad cylinders as wheels." And he is convinced, from the trials which he has made in applying manures to grass lands at such periods, that the trouble of the farmer will not only be rewarded by much larger crops of hay, but also by a considerable increase in the quantity of the after-grass; and, besides, his crops in both instances will be more forward than in the ordinary methods of putting them on, either in the autumn or the winter months, which in many cases is a circumstance of great importance." Others, however, consider the early autumn as by much the best season, as may be seen under the head of manuring new laid down grass lands. See *Laying down to grass.*

Mr. Young observes, in his useful calendar of husbandry, that "the proper season for laying on several sorts of manure, such as soot, coal-ashes, wood-ashes, lime, malt-dust, &c. and in general all those that are spread in too small quantities to require a whole winter's rains to wash them in," is in February. The use of these manures, and other light dressings at this period, is, he says, very beneficial; "but, throughout the management of purchased manures, experiments," he says, "should be formed for a year or two, before the practice is extended, to see which, at a given price, will suit the land best. Without this precaution, a farmer may probably expend large sums of money to little purpose. Nor would he advise him to trust to the mere appearance of the effect soon after the manuring; for some of them, particularly soot and malt-dust, will shew themselves after the first heavy showers, in a finer green than the rest of the field; but the proof of the effect does not arise from fine greens, but from weight of hay; for he has himself found from experience, that the latter is not always an attendant on the former. Contiguous half-acres, or roods, should be marked out, the prices of the manures calculated, and on each piece a separate one spread,

all to the amount of 20s. an acre, for instance, at hay-time, the crops should be weighed. It will then be known which manure, at the given prices, suits the soil best. This knowledge will, he says, prove true experience, and a very different guide from general ideas." And "this is likewise, he adds, the season for spreading superficial dressings on the green wheats, such as soot, ashes, malt-dust, pigeons' dung, poultry dung, rabbits' dung, &c. and many other sorts in the neighbourhood of great cities. It is very good husbandry; but the profit depends on the expences." He therefore recommends "trying them in small portions (a rood, for instance, to each) before extending the practice to whole fields, especially those which are not dungs. As to the latter, provided the prices be not extravagant, there can be no doubt of their answering to all soils. Whenever a farmer has the choice of manures, never, says he, let him hesitate about which to take. He may lay it down as a maxim, that dungs of all sorts are excellent. Other manures may be the same, but they are not, he thinks, so universally beneficial to all soils."

And it is stated, that furriers' clippings are sown by hand from the seed scuttle, at about 3d. per quarter, in March, on the land intended to be sown with wheat or barley, and immediately ploughed in, after which the seed is sown and harrowed in, when such pieces of the clippings as are left above ground by the harrow, are pricked or shoved into the ground by the end of a stick to prevent their being devoured by dogs or crows, who seize them greedily. From two to three quarters are usually sown per statute acre. These clippings are said to answer well on light dry chalk or gravelly soils, where they are supposed to hold moisture, and help the crop greatly in dry seasons, but they have but little effect on wet soils. And horn shavings, which are of two sorts, small and large, are used in the same way and quantities as the above article, except that they want no pricking; and the large are generally ploughed into the land three months before sowing wheat or barley. This sort of shavings answers well in most soils and seasons, except very dry ones, when they will not work. The small shavings are much the most useful. Woollen rags are also sown by hand and ploughed in three months before sowing wheat or barley: the quantity used is from six to ten cwt. per statute acre. Woollen rags like furriers' clippings hold moisture, and are adapted for dry, gravelly, and chalky soils, and succeed in dry seasons better than most manures, but they do little good on wet soils. London rags are found much better than those collected in the country; but the danger of catching the small-pox in chopping and sowing them, deter many farmers from making use of them. Sheeps'-trotters, and fellmongers' cuttings are used in the same way as furriers' clippings, from 20 to 40 bushels per acre, and need pricking in, as dogs and crows are very fond of them. They do not answer on wet land, or in very dry seasons; indeed nothing does succeed in excessive dry seasons on these soils. Malt-dust is also sown by hand from 24 to 32 bushels per acre, at the same time as barley, and harrowed in with the seed. It suits most soils and seasons: but it quickly spends itself, and is therefore never sown with wheat: as a top dressing to wheat in March at about 30 bushels per acre, it would probably succeed on these sorts of soils. Pigeons' dung is used in the same manner as malt-dust, and does good in any soil or season. Soap boilers' ashes have also a great effect on cold sward. Hogs' hair, when applied in the same manner as clippings, are said to answer well. And seal hair, rabbits' dung, and lime have been tried upon these kinds of soils, but not found to answer in any advantageous manner.

In regard to the depth of depositing manures in the soils, it is observed by a late writer, that as "the putrefaction and decay of animal and vegetable matters, whether above or beneath the ground, is greatly promoted by the free admission of air and a suitable degree of moisture, it is evident that they should not be buried so deep in the earth, as that they may be prevented from readily receiving the aid of such causes in forwarding their decomposition; nor, as the process is known to be much retarded by the substances being rendered too dry, should they be placed so near the surface, or be so thinly covered, as to permit the action of the sun and winds, before the crops have risen to such heights as to prevent it from dissipating and carrying away their nutritious properties. The introduction of the manure to a middling depth, as three or four inches, would, of course, on these accounts, as well as from its contributing more expeditiously and more fully to the vegetation of the crops that may be put in with it, seem, in general, to be the most advantageous practice; but on the lighter and more friable soils, it may be advisable to plough it into a greater depth than in such as are heavy and tenacious. In every case, however, whether the manure made use of be in a long or a more reduced state, it should be perfectly covered or ploughed into the earth. The practice of burying manures deep in the soil, has been defended by some on the grouud of its being the nature of elastic matters to rise or force themselves towards the surface; but when they are placed to a considerable depth in the earth, as the process of decomposition is thereby stopped, or suffered to proceed in but a very slow and feeble manner, little or nothing escapes for the support of vegetation, or it is furnished in so very slow and sparing a way, as to be of scarcely any service to the immediate crops. Thus in the cultivation of such crops as are placed in rows or drills, where the manure is put into a great depth and covered pretty thickly with earth, on digging them up at the end of many months it may frequently be observed nearly in the same state it was when first put into the ground. And the same thing is often noticed by gardeners, where imperfectly reduced or long dung is placed in deep trenches and covered to a considerable thickness with mould." And it is added, that "in order that manures may produce their effects in the most perfect manner, they should be spread over the surfaces of the grounds as evenly as possible, whether they be intended to be turned into

soil or left upon its surface as top-dressings:" a point that "may be greatly facilitated by placing the manure out at first in very small heaps, as by such a practice it may be spread over the ground with much greater ease and exactness; and on grass lands much less injury will be done by the bottoms of the heaps."

It is obvious that on tillage lands, manures should always be turned in, or otherwise covered, as soon as possible after they are spread out; for if this be neglected, much loss may be sustained, especially in hot seasons, by the quick evaporation that takes place in such cases. The best practice is of course, not to carry more out from the dunghill at a time than can be conveniently spread upon and ploughed into the earth in a short time afterwards. It is observed in a periodical work that the shortest possible space of time should be suffered to elapse between the spreading out the manure, and the ploughing it into the lands, as well as between this last operation and that of sowing the seed. And it has been remarked that, "in spreading manures employed as top dressings on grass lands, much advantage will be gained by breaking and reducing the clods or lumps into as fine a state as possible, as by such means they are not only applied more perfectly, but washed by the rains much more readily to the roots of the grasses. The springing of the young grasses is also less retarded where the manures are rendered fine and powdery, than where they are left in a cloddy, rough state." The nature of the soil, and the purpose for which the manure is applied, should likewise be carefully attended to in this business, as no one method is adapted to every use.

With respect to the economy of their application, it is stated, that "it seems not improbable but that some degree of saving may occasionally be made, by applying them on lands under tillage, as well as others, nearly at the time the seeds and roots are put into the ground, or when the grasses begin to shoot; as from the whole of the manure being in this way made to contribute directly to the support of the crops, a less quantity may be sufficient for the purpose: how far they may be safely diminished on this principle, can only be shewn by actual experiments and accurate deductions made from them; but there are sufficient grounds, from what has been observed, for supposing that it may be considerably more than can be easily apprehended by those who have not adverted much to this circumstance." And "another economical mode of employing manure is, by placing it in the drills or hollows formed for the reception of different crops which are cultivated in rows, as peas, beans, cabbages, potatoes, &c: by this method, that part of the ground which is intended to bear the crop, is only manured, the intervals or spaces between the rows not receiving any, from which, where the business of putting the manure into the drills is properly performed, a great saving must of course be made."

According to the conclusions of the author of the Experienced Farmer, "the saving of manure in this way is so great, as to constitute one of the chief advantages of the drill system of cultivation. His calculation is, that by "drills being made two feet asunder, and each drill six inches wide at the bottom, there will be just one fourth part of the ground covered with manure; for as six inches multiplied by four, gives two feet, which will be the distance from drill to drill, and as four multiplied by four makes sixteen, it follows, that if the whole of the land had been covered with manure, sixteen loads would have been required for what is as fully and beneficially performed by four, that is, by one quarter of the quantity used by the old method of dressing, supposing it of the same thickness and quality." And besides, from the manure being in this way kept more closely together, and the crops placed immediately upon it, they must, he suspects, receive the advantage of the dressing in a more full and complete manner than under other circumstances.

Doctor Dickson observes in his useful work on Practical Agriculture that "as it appears probable that in the decay of different materials in the soil, all the nutritious matters as they are formed, immediately become useful for the purpose of vegetation, without any waste being sustained, as must always be more or less the case where they are deposited together in heaps, it may be an economical practice, in cases where the crops to be benefited by them require a regular and lasting but not large supply of nourishment, or where the ground is required to be kept in an open and rather light state, for a considerable length of time, to employ such manures in their less decomposed states, as by the ploughing down of green succulent vegetable crops, and the turning in of long strawy substances. By adopting such means, says he, the more perfectly formed manures of the farm may be reserved for such crops of luxuriant vegetables as demand more speedy and abundant supplies of nutrient matters."

In what respects the advantage of using one sort of manure in preference to another, he says, it may be remarked "that as animal matters are found in general to undergo more speedily the process of putrefaction or decomposition, than those of the vegetable kind, and as in most instances they afford those mucilaginous and elastic principles that contribute so largely to the support of vegetable life in greater proportions; such manures as are either wholly or in a great measure composed of them, must be the most beneficially employed, where quick and abundant supplies of nourishment are required, as in the growth of all the more gross and luxuriant crops, whether of grain, plants, or grasses; and that as those vegetable substances which contain saccharine, farinaceous, oily, saline, or mucilaginous principles in the largest quantities are ascertained from experience to proceed the most readily into the state of dissolution or decay, and consequently to afford more fully and more expeditiously the nutrient food of new plants, where manures are principally formed from them, they should be preferred to such as have been made from the harder and more ligneous vegetable substances, that contain such properties in scarcely any, or much smaller degrees, for all the purposes of agriculture." And that, lastly, "such substances as are found to contain those elementary materials of

which vegetables are principally constituted in their more soluble or loosely combined states, as carbonaceous matter in the black earths or moulds, and oxygen, azote, and hydrogen, in burnt clay, raddle, manganese, and calamy, substances which have hitherto been employed, as well as in water and air, should be made use of in preference to those which possess them in slight proportions or scarcely at all."

The particular modes of preparing and making use of the several articles that are capable of being applied to lands so as to ameliorate and improve them in the production of different sorts of crops, will be more fully explained under the particular heads to which they respectively belong.

MAPLE *Tree*, a tree of the deciduous kind, cultivated for the purposes of timber and ornament in plantations and pleasure grounds.

There are several species and varieties of the maple, as the great maple, or sycamore, the common or smaller maple, the ash-leaved Virginia maple, the Montpelier maple, the plane-tree like Norway maple, the scarlet flowering maple, the sugar maple, the Tartarian maple, the Italian maple, the Pensylvanian mountain maple, and the Cretan maple.

The great maple has the leaves divided towards the base into three large and two small lobes, the edges being unequally serrated, the racemes pubescent and hanging down, the flowers of a yellowish green colour, and the wings of the capsules erect. It grows to a great height, often with a clear stem or bole, and spreading top. It comes early into leaf, as about the middle of April, and these have a pleasing green colour; but from their exsuding a clammy juice, are liable to be soon eaten by insects, which lessens its value for purposes of ornament. The bunches of flowers are in full bloom about a fortnight after the first appearance of the leaves, but from their bad colour produce little ornamental effect. It was formerly much employed in planting walks, avenues, &c. but has lately given place to others of the more ornamental kind. It is probable, however, that near the sea-coast it may be planted with advantage, either alone or for the purpose of sheltering other trees, as it is known to withstand the attacks of the sea air with peculiar hardiness. On being wounded it exsudes a great quantity of liquor, of which good wine is made.

There are two varieties of the great maple or sycamore, one with broad leaves and large keys; the other with variegated leaves; the latter, when blended in large plantations, affords a pleasing variety. This tree is frequently known by the name of *sycamore*, *mock plane*, and *plane tree*. See *Sycamore*.

The common maple has the bark rough and deeply fissured, the leaves growing in pairs on long petioles, being divided about half way down into three lobes, the side ones subdivided into two smaller ones, and the middle one into three, which are obtuse; the flowers are greenish, hanging in thin, loose, short clusters at the extremities of the branches; the pedunclcs when broken off while young, are lactescent. The receptacle of the flower is spongy, and divided into eight rays, a stamen being placed between each. This is a tree of much humbler growth than the former, and by no means so ornamental; it may, however, be useful in extensive plantations and pleasure grounds. It is also very good for timber, being close in the grain of the wood. When cut down it also affords an excellent underwood.

The ash-leaved Virginia maple is a very strong shooting tree, of quick growth. It is well calculated on account of its pale green leaves, which vary in form from those of the other species, being composed of distinct lobes, to constitute a pleasing variety in plantations, but they fall soon in the autumn. It should be made use of in situations that are not much exposed to the winds, as it is said to be apt to be split by them. The wood is soft and brittle.

The Montpelier maple is a tree that grows about twenty feet in height; the leaves resemble those of the common maple, but are of thicker substance, and not so large, have a shining green colour, and continue their verdure late in the autumn, which renders the tree more valuable. This sort is not common at present in this country. The blow of the flowers is soon over, and has not much beauty. It is occasionally succeeded by ripe seed, and is common in the southern parts of France and in Italy. It is chiefly useful for the variety it affords in ornamental plantations.

The Norway maple rises to a large size; the leaves are smooth and of a shining green colour, fully as large as those of the first kind, and, from the tree abounding in a sharp juice of a milky appearance, seldom eaten or much injured by insects. It is more ornamental than those of the sycamore; the trees having in the spring when the flowers are in full blow, from their fine yellow colour, a most beautiful effect. It is met with in the mountainous parts of most of the northern states of Europe. It is useful for affording shelter, and also as a timber tree. There are two varieties, one with variegated or striped leaves, and the other with cut leaves.

The scarlet-flowering maple is a dioecious tree, the leaves of which are composed each of five sharp-pointed lobes which are slightly indented or serrated; are smooth, of a pale green on their upper surface, and sea-green colour underneath; and grow on long, simple, taper, reddish foot-stalks. The flowers come out in clusters from the sides of the branches before the leaves. They appear in April. There are two varieties—the Virginian scarlet-flowering maple, and Sir Charles Wager's maple. Both of them are propagated for the sake of the flowers, which are of a scarlet colour. The sort called Sir Charles Wager's, produces larger clusters of flowers than the other; on which account it is in more esteem.

The sugar-maple is a large growing tree sometimes arriving at the height of forty feet, and has broad thin leaves divided into five principal parts, which are again indented or cut at the edges into several acute segments. Their surface is smooth, of a light green colour, whitish underneath, and grow on pretty long footsalks. The flowers come out in the spring about the time of the Norway-maple, and are succeeded by

seed which sometimes ripens in this country. In America the inhabitants tap this tree in the spring, and boil the liquor, which affords an useful sugar. The sycamore, the ash-leaved, and the Norway maples also abound with a saccharine juice, from which sugar might probably be prepared with advantage.

The Tartarian maple grows to upwards of twenty feet in height. The leaves are heart-shaped, undivided, and their edges unequally serrated. The flowers comes out from the wings of the leaves in bunches of longish form, appearing early in the spring, and are occasionally succeeded by ripe seed in this climate. It is a native of the southern parts of Russia.

The Italian maple has a trunk ten feet in height, straight branching, and covered with a grey bark. The branches are flexible. The leaves are middle-sized, thin, three or five lobed, toothed, and rounded. The flowers are in a very loose pendant raceme on pendunales very long, branching, and bending; they are larger than those of the other sorts, composed of five lanceolate petals yellowish, and veined. It is common in many parts of Italy, and is a lofty tree, and from its having a spreading head adorned with large and beautiful foliage, deserves the attention of ornamental planters. It may be also useful as a timber tree.

The Pensylvanian maple is but a small tree, which in some situations may be considered as a shrub. It sometimes grows to the height of about fifteen feet, with a slender stem covered with a whitish bark, and sending forth several red branches. The flowers are in long pendulous racemes of a greenish yellow colour. It affords a variety in ornamental plantations.

The Cretan maple is a low tree having much resemblance to the Montpelier sort. The leaves while young are ovate, but afterwards have much similarity to those of ivy, being only of a much thinner texture, and having their petioles covered by a soft hairy down. It is only useful as an ornamental tree. There is a variety of this tree in which the leaves continue green most part of the year when sheltered, and which is denominated the evergreen Cretan maple.

All the sorts and varieties of the maple are of easy cultivation, each being capable of being raised by seed, and many of them by layering, cuttings, and budding. They thrive well in most soils and situations, provided they be not too moist: the common sorts succeeding the best in such as are deep and inclined to moisture, but not hard or stiff, and the American kinds in those that have a dry and rather close state of mould or soil. In raising them in the first method, as the seeds do not in all the sorts ripen well in this country, the best way is to procure them from the places where they grow naturally. A cool shady place is the most suitable for this purpose. The mould being made fine, and nursery beds marked out four feet wide with length proportionate to the quantity, in these the seeds are to be regularly sown in the autumn, sifting over them the finest mould to the depth of half an inch. When the plants are come up, they must be kept clean from weeds, and frequently watered during summer. In the spring following, the strongest may be drawn out and planted in nurseries, in rows two feet asunder, and at the distance of a foot from each other in them, leaving the others to gain strength. In the second spring, these also must have the same culture, and they may remain in the nursery without any other trouble than keeping the ground clean in the summer, digging between the rows in the winter, and taking off all strong and irregular side shoots, till they are fit to be planted out. The trees raised in this way grow faster and arrive at greater heights than those from layers: but they do not in general produce such quantities of flowers; which makes the latter mode more eligible for those who want these plants for low shrubbery uses. In these cases they should always have four or five years growth before they are finally planted out. It is however advised by some, that the seeds of the common or Norway maples, should not be put into the soil immediately after becoming ripe; but be dried and preserved in sand till February or March, as the season may prove favourable; when they may be sowed in drills or beds eighteen inches broad, with alleys the same width, and covered three quarters of an inch thick with mould. In the following February or March, the alleys should be dug, and the roots of the plants cut about five inches under ground, which may be easily performed by means of a sharp spade, drawing the plants out where too thick. These may be replanted in any good mellow soil, in rows eighteen inches asunder, and eight or nine inches from each other in the rows. In October, when the plants in general will be about two feet high, both the seedlings and those that were transplanted should be raised, shortening their tap-roots, cutting off any cross lateral branches, and removing them into rows two feet and a half apart, and fifteen inches distant in them, in order that they may continue for a year or two. Remove them again at the same season the succeeding year, and plant them in rows five feet asunder, and two and a half from each other, that they may continue four years. These will now be from twelve to fifteen feet high: and if required of a still larger size, they may be removed, and planted again eight or ten feet asunder; when any time after two and not exceeding eight or ten years, they may be finally planted out where they are to remain. The use of removing these trees frequently when young is, that they are apt naturally to grow with tap roots; which this management prevents, and makes the plants root better, and become more easy in their growth when transplanted at a large size. Though all the species are capable of being propagated by layers, it is never practised for the common maple. In this method the young shoots may be laid down at any time, in the autumn, winter, or early in the spring; but the first is probably the best: by the same time in the following year they will have struck root, and have become good plants, when the strongest may be set out in the places where they are to remain; while the weakest may be planted in the nursery, in the same manner as the seedlings for a year or two, in order to gain strength.

In propagating by cuttings, though all these trees

are capable of it, it is a method chiefly practised on the ash-leaved and Norway maples, as they take root this way more readily. The cuttings should be taken from the bottom part of the last year's shoots early in October, and be planted in rows in a moist shady place. In the spring and summer following they should be watered, as often as dry weather makes it necessary, and be kept perfectly clean from weeds. In the autumn they will be fit to remove into the nursery; though if the cuttings are not planted too close they may remain in their situations for a year or two longer, and then be finally set out without the trouble of being previously planted in the nursery. These trees are also to be raised by budding and grafting, but as the other methods are more eligible, these are seldom or ever practised, except for the variegated sorts and the large broad-leaved kind. The latter indeed is to be continued in no other way than by budding it on stocks of the common sycamore; as the seeds, when sown, afford only the common sycamore. But the seeds of the variegated kinds produce variegated plants; which renders the propagation of these sorts very expeditious where plenty of seed can be had. But where it is not to be obtained, in order to propagate these varieties, recourse must be had to budding; in performing which some plants of the common sycamore one year old, are to be taken out of the seed-bed and set in the nursery in rows a yard asunder, and about a foot and a half distant from each other in the rows. The ground must be kept clean from weeds all summer, and be dug, or, as the gardeners call it, *turned in* in the winter; and the summer following the stocks will be of a proper size to receive the buds, which should be taken from the most beautifully striped branches. The best time for this operation is about August; as if it is done earlier the buds will shoot the same summer, and when this happens a hard winter is apt to kill them. Having budded the stocks the middle or latter end of August, the eyes or buds, being inserted on that side of the stock which faces the north towards the beginning of October, the bass by which it was tied may be renewed, as it will begin to pinch and confine the bark as well as the bud too much. In the spring, just before the sap begins to rise, or the trees begin to shoot, the head of the stock should be cut off in a sloping direction just above the inserted bud: by these means, and that of rubbing off such shoots as come from the stocks, the shoot from the inserted bud will be rendered more strong and healthy. The trees thus raised may remain in their situations for a year or two longer, or be transplanted into the places where they are intended for, in the autumn or spring following; care being constantly taken to keep the land between the rows well dug, so as to prevent their being injured by the growth of coarse weeds, and the side buds trimmed from their stocks.

It may be further observed that the autumn season is upon the whole the best time for planting these and other deciduous trees, when they are strong and well rooted; yet when very young they are apt to be injured by frosts, and to be thrown out of the ground in severe winters, when planted in that season of the year.

MAPS *of Estates*, such plans or outlines of the lands as are necessary to direct their management in the most easy and economical manner. Mr. Marshall, in his useful work on Landed Property, advises that the different distinct parts or farms into which they are divided should be outlined, coloured, and introduced on a general map, as well as each separately delineated more particularly on a small pocket one, so as to show the farms with distinctness, or the lands intended to be laid into them, with the wood lands, waters, &c. &c. that are in hand. The pocket maps should exhibit at once, the outlines, the names, and the contents of the different fields, or pieces of land of which they are severally constituted, which, by being coloured according to occupancy, the several fields of the existing farms, (or intermixed parts of farms intended to be united,) though scattered may be readily distinguished. And "if, says he, separate columns of contents be indorsed on the backs of the maps, one of them of the intended farm, the other of the existing farms or parts of farms, with their totals subjoined; all the doubts and perplexities which are wont to arise on large estates, from the intermixture of farm lands, will be avoided."

The maps of farms should, he thinks, be of a portable size, as ten inches by eight, and be bound up in volumes corresponding to the general maps; so that the superintendant manager in going over any part of the estate, may have with him the maps that belong to it. Each map should be folded double, and be hung in loosely within flexible covers, by a guard or slip of paper pasted on the back, in order that when opened each may lie flat and fair, and be conveniently portable when shut.

MAR, a provincial term signifying a river or small lake.

MARCH, the third month in the year. It is a season in which the business of the farmer is various and pressing, and which requires, especially on a large farm, the best arrangement, and the fullest exertion of all his force of men and cattle, as the seeding of land is a critical matter, and in which much depends on being prepared to profit by every favourable opportunity. Such lands as were left unfinished or unsown last month, must be first attended to and completed as early as possible in this. See *February*.

Where the land is sufficiently dry for the plough to work, this is a proper month for putting barley crops into the ground. Under these circumstances, this is, in general, found a better season than in the following months; but it must never be attempted where the land is in a moist claggy condition, and not in a fine mellow friable state of mould on the surface, as this is essential to the success of crops of this sort. See *Barley*.

Mr. Young advises, that oats should be sown at this time, "in preference to any other season," avoiding the common error of sowing them after other grain crops, and of the land not being in a fine state of preparation. This sort of crops should stand in their proper place in the courses, and never without

seeds, except they be drilled, and then lucerne very properly accompanies them; nor ever be put into land which is not in perfect good heart. So managed, they are always found an advantageous crop; in most situations, greatly before barley; in many conjunctures, superior even to wheat; though there has been a contrary opinion among some farmers. Mr. Young also supposes, from different experiments, that oats will equal, and in many cases, exceed crops of barley; as the superior quantity of that produce will constantly be found to more than answer the inferiority of the price, which, however, in some instances, exceeds those of the barley kind.

It has been observed that oats are generally sown before barley, except in Hertfordshire, and one or two other districts; but it is probably an indifferent matter, and the meer child of custom, which is too often the case in farming.

Where wood is scarce, the seed of furze may now be provided, and the plant cultivated to great advantage, on poor or exhausted soils of any kind, which want rest, and it may be sowed with the oats. See *Furze.*

But it is probably better to cultivate it without any grain crop.

Upon light lands of great natural fertility, spring wheat may be tried, and should, in the early part of the month, be put in. Its profits even on such soils; compared with other grain crops, are very questionable. It ought ever, either to be drilled or sown with seeds, that some benefit may be secured. See *Spring Wheat.*

This is also the proper period for sowing all sorts of pease, which, when the weather is favourable, should never be delayed to a later season. On light soils it is most advantageous to sow white pease, as they answer the end of cattle-feed equally well with grey, and if the sample be fine and good as boilers, fetch a much higher price at market. See *Pease.*

The sowing of beans should likewise be finished in this month, where they have not been wholly put into the ground in the preceding, which is often the case in the northern districts.

The seeds of various kinds of artificial grasses, may now likewise be sown with the corn crops, and in some cases without them. Where alternate husbandry is practised, this is essential. The chief grass of this sort is clover, but on the poorer sorts of soils where it does not abide, trefoil and white clover may be employed, and under the convertible system of husbandry many other sorts.

It is supposed by some, that "it ought to be a standing rule in husbandry, to sow no spring-corn (broad cast at least) without grass-seeds of some description, for a temporary ley, to continue one, two, or more years, agreeable to the farmer's convenience, and the nature of his soil. This practice is a prime instrument in the regular courses of crops; it affords the land a necessary respite from corn-bearing, at the same time liberally affording more advantageous products; lastly, it leaves a clean refreshed soil with the best possible seed-bed for wheat." Should circumstances render it desirable to sow grasses among wheat, it may be done early in the present season.

With respect to clover, the red or broad-leaved species is the most valuable, as food, green or dry, for cattle of every kind, and as seed for the market. The practice of mixing ray-grass with this, should only be had recourse to on the poorer sorts of soil.

This is also the principal season for sowing saintfoin on soils which are proper for it, on which it is highly profitable. Chicory must now likewise be sown, and the sowing of tares for the spring be finished.

The seed of cabbages should be got into the bed, as early as possible in this month for a second sowing. The proper sorts for cattle are the Scotch, and other large, hardy, flat sorts, and as soon as the plants are of tolerable size, it is the best method to transplant them immediately into the field, as at this season, when left long in the bed, they are apt to run. The season of setting them out, extends from the middle of the following month to the middle of May; beyond which, it cannot probably be extended, with the prospect of a full crop. To the former ploughing, one should now be given; the land being kept upon the ridge. To the land designed for the summer crop, this may also be done.

The lettuce seed for crops for the feeding of hogs, should now be drilled in, on land properly prepared for the purpose in the previous months, after its being scarified, in equidistant rows at one foot. This sort of crop is said to be of much advantage in the system of keeping large quantities of hogs.

Crops of lentils may also be put in where the soils are of the calcareous kind. They are useful for being cut into chaff for horses and sheep.

The seed of the turnip-cabbage must now also be sown, for the purpose of plants to set out in June.

On the deep rich soils the seed of parsnips should be put in on the beginning of this month, as on lands of this description they are crops that pay extremely well. And on the deep sandy loams, and other light sorts of ground, crops of carrots should at this season be sown.

The seed of mangle-wurzle may now also be dibbled in along the tops of the ridges, two or three feet in width which have been previously manured and reversed to cover the dung; though this is not now much cultivated.

Crops of mustard and radishes, where they can be grown to advantage, may be now likewise sown. And also, woad about the middle of the month.

This is also the proper season for planting hop cuttings, or the forming of hop plantations, in the attempting of which Mr. Young advises the young farmer to have persons properly acquainted with the business, and to recollect that it is a sort of culture that demands a much larger acrable capital than any other, with a very considerable annual expence. Besides, it does not answer in general so well on a small scale, or in small plantations, and requires large supplies of manure, many hands, and is in the end a very precarious and uncertain crop. Boggy situations are favourable for this sort of culti-

vation, but in all cases the farmer should think frequently before it is attempted.

About the middle of the month, the old plantations should be dressed, having the hills opened, the vines pruned, and mould or compost applied to them.

The operations of scarifying and hoeing the drilled wheat crops should not be deferred longer than this month. The first is well effected by the use of Mr. Cook's first harrow and scarifier. The broad-cast and dibbled crops should likewise be well hand hoed.

Water-furrowing the new sown grounds should likewise be executed in an effectual manner, as soon after as possible, letting them be afterwards well cleaned out by the spade, making those where seeds are sown deeper. Attention to this is of great importance to the crops.

Top-dressings should now be sown over the young wheat crops. Various substances are made use of for this purpose, such as soot, coal ashes, peat ashes, peat dust, &c. They are sown from a seed scuttle at the expence of a halfpenny the bushel. Various other sorts of light manures of this nature may likewise now be sown over the lands intended to be sown with wheat or barley, and immediately turned in and the grains sown.

The turnip fallows should have a second earth in this month.

Particular attention should at this season be paid to the fattening beasts in the stalls or yards in respect to food, water, litter, and warmth; as well as to the marking the progress or increase which they make, that their food may be properly regulated.

The sheep of all kinds should likewise be at this season kept well; as where this is not the case, what has been done before will be nearly lost. In this view the provisions of proper sorts of food should have been particularly attended to, such as stubble, turnips, Rouen, Burnet, Swedish turnip, watered meadows, &c.

The cows, lean, and young cattle should likewise be well attended in the yards, properly fed and littered. Also the weaned calves. The former should be confined to the yards, and prevented from getting any grass in the fields.

The teams should now be properly attended by the horse keeper, and the farmer be careful to see that they perform a proper quantity of labour, whether they be horses or oxen. It is of much importance to do as much work as possible in dry weather in this month. Carrots are at this season in the most proper state for horses.

The process of paring and burning may now proceed on different sorts of land, by means of the plough or breast spade, according to the nature of the lands. It is an operation that is highly advantageous in many cases, and which is the most expeditiously performed in the first mode. In this practice, it is of consequence not to make the heaps too large; eight, ten, or fifteen bushels of ashes are sufficient; much must however depend on the weather, as in bad weather they must be larger. The thickness of paring has also much effect, thin flags burning the most quickly. The ashes should be spread as soon as possible, and be turned in by a thin furrow. It is an excellent preparation for various crops.

Liming may be at this time well performed, and dung be carted out for the planting of potatoes and cabbages: the seed of the latter being drilled where the plants are to grow, either now or in the following month.

The grass and clover lands should be stone-picked and cleaned for mowing during a dry time in this month, if possible; but not too closely in the latter cases, as harm is said to have been sometimes done by it.

The poultery should be now more attended to, especially towards the latter part of the month; as they will most probably begin to lay fully if the weather be mild.

This is likewise a principal season for destroying moles, as they now begin to run more; the mole catcher should therefore be well looked after by the farmer in this and the following month.

MARE, the female of the horse kind of animal. Mares intended for the purpose of breeding, should be selected with great care and attention, so as to be as free as possible from faults or imperfections in their forms, and be well suited in their kind to the purposes for which they are designed. The practice of making use of such mares as may happen to be on the farm should never be adopted, as it is prejudicial to the raising of good horse stock.

Mares may be put to the horse when three years old, but it is a better practice to defer it a year longer, where it can be done with convenience. Some advise mares to be kept in the house some time before they are put to the horse, but this seems of little consequence when they are in proper health.

The best season for putting mares to the horses, is in the spring, about April or May, in order that the foals may be dropped sufficiently early, which is of consequence in their rearing afterwards.

The length of time that they usually go with foal, is about eleven months, which is a circumstance that should be kept in the mind of the breeder, though there is often considerable deviations.

Mares should always be kept well while in foal, in order to have a fine healthy offspring.

The custom of performing much work with the mares while in foal is improper, as being attended with danger, as well as liable to check the growth of the foals; when this is practised with farm mares, they should only be gently wrought, and that with great care. See *Horse*.

MARK, a term applied to a horse, which is said to *mark* when he shews his age by a black spot, like the eye of a common bean, which appears, at about five and a half, in the cavities of the corner-teeth, and is gone when he is eight years old; when he ceases to mark, and it is said, he *has rased*. See *Age of a Horse*.

Land-MARK, any thing placed as the division of lands. Stones are mostly made use of for this purpose, but sometimes wooden posts. These sorts of

marks were very common while lands remained in a state of commonage or common field, and are still met with in many districts.

MARKET, the town or place where any kind of articles, whether for the purpose of consumption as food, or other means, are exposed to sale. The advantages of having these near and convenient, are of vast importance to the farmer in the disposal of his different products. And in this view it becomes the duty of every farmer, before renting a farm, to carefully ascertain its situation in regard to markets for the sale of agricultural productions. The markets in the more fertile and populous parts of this country are in general, Mr. Donaldson says, good, and by means of turnpike-roads, inland navigations, or sea-carriage, easy of access; but were the regulations which have been proposed to be adopted by government respecting the sale of grain established, and one general standard for weights and measures fixed upon, they would be still more improved. The state of the markets in the remote parts of this part of the island as well as Scotland is very materially different; and while the proprietors of these districts remain so inattentive to their own interests, it is not probable, he thinks, that any material alteration will take place for the better. The loss and inconvenience which the Welch and Highland farmers are often subjected to, by being obliged to dispose of their cattle on credit, are very great, and require the exertion of the chief proprietors in the particular districts to apply with effect in order to remove them. In these districts, it is supposed, the cultivators of grain are as ill situated, in regard to markets, for the sale of the produce of their farms, as those who keep breeding stocks of cattle and of sheep. The effects of the want of markets, as described by the author of the Agricultural Report of Pembrokeshire, applies, he says, very particularly to them. "The number of inhabitants, who live by handicraft business, or who buy their provisions, is but small in proportion to those employed in agriculture, which occasions the demand for corn and butcher-meat in our markets to be small. Hence, those who grow a large quantity of corn find a great difficulty in selling it. We have corn-dealers at the ports, who purchase corn during the autumn and winter months, at a price always much below what is sold at the same time in the open markets. When wheat is six shillings the bushel in the market, the dealers will hardly give five, and other grain in proportion. The reasons for this difference between the dealer's price and the market price are these: He buys with a design to export his corn to Bristol, or some other English port; he must take care in buying to provide for store-house rent, porterage, freight, insurance by sea, commission on sales at the port he sends it to; and, lastly, for his own trouble and capital employed. Besides all these expences, he runs another material risk: Our corn is generally so damp, that it will not keep in the lofts without being laid thin, and turned at least once a-week. If, in going to a port, a vessel meets with contrary winds, and is delayed on her voyage, the cargo frequently heats to such a degree as to reduce its price below prime cost, and then the dealers suffer a great loss by the venture." From this account of the state of the markets in the remote parts of this country, it is supposed, "may be inferred, the advantages which the proprietors of such districts would derive by establishing manufactures, whereby markets would be brought home, as it were, to every farm. Where that cannot be effected, inland navigations, where practicable, as being infinitely preferable to turnpike-roads for the carriage of corn to market, and for bringing manures in return, ought to become the next object of the proprietor's attention. By these the possessors of distant corn farms are often put nearly on a footing with those in the more immediate neighbourhood of the best markets in the country. But it may frequently happen, that it would be impracticable to establish extensive manufactures, such as would have the effect of creating a market for the surplus-produce of a district, and physically impossible to form canals, so as to open a communication with other distant markets: in such cases, good level well-made roads, Mr. Donaldson thinks, is the only alternative. These, although an expensive mode of conveyance, are highly beneficial, particularly in inland districts remote from markets, and where it is impossible to form canals. Corn and meal are, he adds, frequently carried in very great quantities from the southern counties of Scotland to the Edinburgh and Glasgow markets, which, without turnpike-roads, would scarcely be practicable, at least the expence to the farmers would be so great as to amount almost to a prohibition; and would necessarily compel them to turn their attention to breeding and grazing, rather than the tillage system of husbandry, which, under such circumstances, would certainly turn out the most profitable." The degree in which the situation of a farm is, in regard to markets, must obviously influence both proprietors and tenants in making choice of particular rotations or modes of cropping in preference to others. "Where no exertions can approximate markets to a farm, which would otherwise be well adapted to the cultivation of grain, breeding and grazing cattle, or other species of live stock, is, Mr. Donaldson supposes, the best method in which such farm can be occupied. These, if not sold in the district, can be carried to distant markets almost without roads, and at a comparatively trifling expence. Were the markets for the sale of cattle in the north of Scotland and in Wales, as well regulated as in the other parts of this kingdom, the most beneficial consequences would ensue, as, except in these districts, scarcely any improvement can be suggested. The dealers in cattle residing in the various districts of Scotland, except those in the south and south-west, generally, he says, move their cattle southward at two seasons, August and October; at which periods, what may be called the two great national markets for the sale of black-cattle are held at Falkirk in Stirlingshire. There it is not uncommon to see, says he, 30 or 40,000 black cattle exhibited for sale in one day; these being either purchased

by dealers from England, or by some of the principal people in that line in Scotland, and thence driven forward to markets in the former part of the country. Probably nineteen out of twenty of the Scotch cattle enter this country by the way of Carlisle; and matters are so contrived, that there are cattle-fairs, one succeeding another at proper intervals, during the whole course of the journey from the last place to the southern parts of Surry. From Carlisle to the southern parts of Yorkshire the droves are, he observes, conducted along the same line of road. They are then branched off from the great London road in different directions; some going through the eastern parts of the country towards Norfolk, Suffolk, and Essex; and the remainder through the western part of Nottinghamshire, Leicestershire, Northamptonshire, Buckinghamshire, &c.; and such as are not sold in these districts, are sent to Barnet in Middlesex as a centre, and are there exposed to sale. When any of them remain unsold after Barnet fair, which, owing to a combination of unfavourable circumstances, sometimes happens, they are sent forward to markets in Surry, Dorset, &c. which also succeed each other in the same manner. "From this arrangement, he supposes, were the farmers in the remote districts to receive ready money for their cattle when sold, it is presumeable, that from the competition which generally takes place among the dealers at the provincial fairs, they would receive a fair adequate price, considering the risk of lameness or death, bad sales, and the great expence attending driving cattle to such distant markets."

It is remarked by the writer of the Agricultural Report of the West Riding of Yorkshire, that a "very considerable corn market is held at Knaresborough in that county, where dealers from the western parts of the riding attend, and purchase from the farmers in that neighbourhood; a great part of which is resold at Skipton market in Craven, and carried still farther westward, where corn is scarce, and gives employment to a number of people who are concerned in this traffic. It is, he conceives, under circumstances of this kind that public markets for grain can be considered as advantageous to the growers or purchasers of corn. The first cannot get his commodity disposed of at home, hence willingly goes a stage to meet his merchant; and the latter being sure to meet with a supply, attends upon market day, with his horses and carts, for conveying it to the place where he is to use it, or dispose of it again. By this mode, no time is lost, no unnecessary labour incurred; whereas, were all the grain in the kingdom to be sold in the public market, as some wild imaginations recently proposed, a great waste of both must necessarily happen.

Let us just suppose, continues he, that such a law had been passed, and that the grain sold at Knaresborough was not to be drove to the west bounds of the riding, but that it was wholly to be consumed in the neighbourhood of that place; and say where would be the advantage arising from setting down the sacks in the market? It might happen, that a baker or maltster purchased the very wheat or barley which was grown by his next door neighbour, but which, in consequence of such a mistaken law, could not be sold without being first offered to sale in this public manner. Would not the trouble of driving it to market by the farmer, and of driving it back again by the baker or maltster, be just so much lost labour to them, without affording the smallest advantage, nay, rather occasioning a positive loss to the public consumer, upon whom every expence of this kind must necessarily fall in the end?"

Mr. Donaldson very justly concludes on the subject of grain, from what has happened in the scarcities of this article in France during the administration of M. Neckar, and more recently in this country, that "while every person must agree, that the regulation of the public markets of the country falls naturally and properly under the direction of the legislature, it is believed, there are none who suppose that, during an impending scarcity in this island, it is either a prudent measure, or one likely to alleviate the evil, that the servants of the crown should become the national importers."

The unfettered speculations of the merchant are, he says, the only resource to be depended upon under such circumstances for an abundant supply of the markets. See *Corn Laws*.

It is well observed, by Mr. Middleton, in respect to the causes that increase the price of animal food in the markets, that "a scarcity of vegetable food for the fattening of cattle, from whatever cause it may arise, whether from a droughty summer, or a severe winter, uniformly produces full markets, and a consequent fall in the price of the cattle thus prematurely forced to them:" but that "this temporary great supply and low price is, as certainly, quickly followed by a corresponding dearth of fat cattle, and considerable advance in the price of animal food. This circumstance, therefore, though it first lowers the price to below, and then advances it to above par, has a tendency, *on the whole*, to augment the prices; because at such a time, the beasts and sheep are sent to market with much less beef and mutton on their bones than they ought to have. Hence a dry, burning summer, gluts the market with cattle less than half fat; four or five months later the markets are very thinly supplied, and then of course the prices rise to an extraordinary height. Every sudden and great advance in the rate of animal food may, he thinks, primarily be traced to this cause. There are, he says, of course other causes which tend to produce this effect, but they are of slow operation; such as the increasing prosperity and opulence, which enables a greater number of individuals to live on butchers' meat than formerly; while, in the opinion of some people, the present war has greatly increased the number of persons who subsist principally on animal food. But he thinks, that a prosperous peace would have advanced the price much more, by means of general industry, and the consequent increase of wealth, by such means.

It is remarked by Mr. Marshall in his excellent work on the landed property of England, that, "when we consider how much the value of farm lands depends on their locality with respect to markets, it

becomes an object of high importance to their proprietors, to meliorate their situation in this respect. And he suggests that there are three methods of improving the value of them in what respects markets, as by the facilitating the conveyance of the produce to distant markets; through the means of roads, railways, or water carriage; by establishing new markets, in situations where inhabitants have increased, since the establishment of those which are now frequented; and by an artificial increase of inhabitants; by drawing together the consumers of produce; by encouraging manufactures, upon, or in the vicinity of them, For while a manufactory continues to flourish, the value of the lands around it cannot fail to be increased." But he thinks that, "before an adventurous scheme of this kind can be prudently carried into effect, the evil as well as the good, which it may bring to the estate, requires to be calculated. A populous manufactory, even while it flourishes, operates, he says, mischievously in an agricultural district:—by propagating habits of extravagance and immorality among the lower order of tenantry; as well as by rendering farm labourers and servants dissatisfied with their condition in life. And the more it flourishes, and the higher wages it pays, the more mischievous it becomes in this respect. Moreover, lands bear a rental value in proportion to the rate of living, in the district in which they lie; so that while a temporary advantage is reaped, by an increased price of market produce, the foundation of a permanent disadvantage is laid. And whenever the manufactory declines, the lands of its neighbourhood have not only its vices and extravagance entailed upon them; but have the vicious, extravagant, helpless manufacturers themselves, to provide for. This however only applies to particular kinds of manufactories." In this country, we have, he observes, "instances of manufactures being highly beneficial to agriculture. The linen manufacture of Yorkshire, and the woollen manufacture of Devonshire, are so; and have been so, during a length of time." And "the most intimate connexion between them is, he says, where the grower manufactures his own produce. And this pristine connexion is still found in the island. In North Wales, the character, or callings, of sheep farmer and woollen manufacturer are joined in the same person. The wool is carded and spun, and the yarn woven, under the roof of the grower. If the farmer, himself, does not throw the shuttle, he employs a laborer, or laborers; who assist, alternately, and as the seasons or circumstances require, in the works of agriculture and manufacture." And further that "a similar kind of reciprocal benefit arises from the cotton manufactures of this country, where not only the spinners, but the weavers assist, occasionally, in the works of husbandry;—in weeding, haymaking and harvest works: an advantage which, in an hazardous season, is at once a private and a public good. And add to this another advantage of village manufacturers. When, in the uncertainty of commercial concerns, the demand flags, for a time, the country finds, that, instead of having a load of enfeebled artificers—mere manufacturers—to support in idleness, it thereby acquires an additional supply of useful hands, enured to the works of the field, to forward its cultivation, and assist in its improvements. While at all times, the encrease of inhabitants which this valuable species of manufactory supplies, encreases the demand for marketable produce, in the immediate neighbourhood of its growth."

And in the Rural Economy of the midland district, the same writer thinks, "that markets ought to be adapted to the mutual advantage of the producers and consumers at large, but particularly to those of the peculiar town or neighbourhood. And therefore that hucksters may be injurious to such markets, both by being too freely admitted as well as by being wholly excluded, as mere market towns mostly depend for their supplies upon the market day, when, in a time of scarcity, such dealers may in a very short time clear the market, and leave the inhabitants destitute of the week's provisions; while, on the contrary, when totally precluded from even purchasing the surplus, the market itself, as well as the inhabitants, must be injured; as the producer will of course endeavour to find another market where he can sell his produce with certainty, without the risque of having it to bring home again, or of disposing of it at an under price to the monopolizers of the town; in consequence of which the market becomes indifferently supplied, and the articles of inferior quality and more expensive."

It would therefore, it is supposed, be a regulation of great utility, as has been found in actual practice in this district, for the market to open at a stated time, and to permit no huckster to become a buyer till an hour afterwards; as by such means the inhabitants are certain of a supply, without the market sustaining any injury.

Mr. Middleton states in his excellent Report of the State of Agriculture in the county of Middlesex, that "in regard to the markets, there are in the country part of the districts nine weekly ones held, namely, at Barnet on Monday morning; at Southall and Finchley on Wednesday; at Uxbridge, Brentford, Hounslow, and Edgware, on Thursday; at Staines on Friday; and at Enfield on Saturday. That at Uxbridge-market a great deal of corn is sold, and there is a large public granary over the market-place, for the purpose of depositing it from one week to another. And that at Hounslow-market there is a considerable show of fat cattle; such of which as are not disposed there, are sent on to Smithfield-market, in the city of London, which is famous for the sale of bullocks, sheep, lambs, calves and hogs, every Monday; and again, though in a less degree, on Friday. On the latter day there is also a market for ordinary horses." It is added, "that this is the only public market within the bills of mortality, for the sale of live cattle."

He gives the following statement of the number of black, or neat cattle, and sheep, annually brought for sale to this market, from the year 1731 to 1795, being 63 years; which he has divided into seven averages of nine years each, namely,

Years.	Cattle.	Sheep.
1732	76,210	514,700
1733	80,169	555,050
1734	78,810	566,919
1735	83,894	590,970
1736	87,606	587,420
1737	89,862	607,330
1738	87,010	589,470
1739	86,787	568,980
1740	84,110	501,020
Average	——— 83,906	——— 564,650
1741	77,714	536,180
1742	79,601	503,260
1743	76,175	468,120
1744	76,648	490,620
1745	74,188	563,990
1746	71,582	620,790
1747	71,150	621,780
1748	67,681	610,060
1749	72,706	624,220
Average	——— 74,194	——— 559,891
1750	77,765	656,340
1751	69,589	631,890
1752	73,708	642,100
1753	75,252	648,440
1754	70,437	631,350
1755	74,290	647,100
1756	77,257	624,710
1757	82,612	574,960
1758	84,252	550,930
Average	——— 75,351	——— 623,091
1759	86,439	582,260
1760	88,594	622,210
1761	82,514	666,010
1762	102,831	772,160
1763	80,851	653,110
1764	75,168	556,360
1765	81,630	537,000
1766	75,534	574,790
1767	77,324	574,050
Average	——— 83,432	——— 615,328
1768	79,660	626,170
1769	82,131	642,910
1770	86,890	649,090
1771	93,573	631,860
1772	89,503	609,540
1773	90,133	609,740
1774	90,410	585,290
1775	93,581	623,950
1776	98,372	671,700
Average	——— 89,362	——— 627,805
1777	93,714	714,870
1778	97,360	658,540
1779	97,352	676,540
1780	102,383	706,850
1781	102,543	743,330
1782	101,176	728,970
1783	101,840	701,610
1784	98,143	616,110
1785	99,057	641,470
Average	——— 99,285	——— 687,588

Years.	Cattle.	Sheep.
1786	92,270	665,910
1787	94,946	668,570
1788	92,829	679,100
1789	93,269	693,700
1790	113,708	729,660
1791	99,838	729,800
1792	107,263	752,569
1793	116,488	729,810
1794	109,064	717,990
Average	——— 101,075	——— 707,456

He observes that "he has not been able to procure an account of the number brought to Smithfield in 1795 and 6, but he is pretty sure it must be greater than that of the preceding year, on account of the unusual advance in the price of animal food having occasioned a very large quantity of lean cattle to be prematurely sent to market."

"In the above account it may be seen," he says, "that the supply has been advancing with some degree of regularity both in the number of cattle and sheep, during the last forty-five years. The number of cattle now sent to market, is more by 26,881, than it was twenty-five years ago; and of sheep147,565. And as it is a matter of general notoriety, that the cattle and sheep of England have also been gradually and progressively increasing in their individual weight, owing partly to the attention paid of late years to the improvement of the breed, and partly to their being much better fed now than formerly, and indeed much better than they could possibly have been before the introduction of turnips and clover; it is not perhaps an unreasonable, or unfounded conjecture, to suppose that the increase in point of weight, has kept pace with the advance in respect to numbers, during the aforesaid period. If so, it will follow," he conceives, "that, including number and weight, the annual increase in forty-five years is, in neat cattle, upwards of 72 per cent. and in sheep near 53. Upon the whole, he thinks he can safely affirm, that including all the other supplies of animal food, and considering that they also, as well as cattle and sheep, come to market much better fed, and consequently much increased in weight, above what they were forty-five years ago, the consumption of the metropolis is at this time full one half more than it was then." And he adds the following as a comparison between the weight of bullocks, &c. as it was one hundred years ago, and as it is at the present time, viz.

	100 *Years ago.*	*Now.*
Bullocks, at an average, weighed	370lbs.	800 lbs.
Calves, ditto	50	140
Sheep, ditto	28	80
Lambs, ditto	18	50

The annual consumption of London is therefore stated to be somewhere about 110,000 head of neat cattle, and 770,000 sheep: And the intelligent writer adds, "that any person, possessing some degree of judgment in cattle, and at the same time the desire of looking at a great variety of live stock, cannot

perhaps spend a few hours more satisfactorily, than in examining the market at Smithfield. He will there, he says, very soon discover, that, for want of a greater attention to the excellence of breed, both in neat cattle and sheep, a very large proportion of the produce of the soil of this kingdom is wasted in producing bones and offal, instead of meat. It is indeed astonishing," he thinks, "that men, at least in the present day, should with so much difficulty be prevailed on to breed beef and mutton, in preference to horns, skins, and bones."

Besides these there are others, as *Leadenhall-Market* —which is the greatest in London, for the sale of country-killed meat, and is the only skin and leather market within the bills of mortality: and *Newgate-Market*—which is the second great place for country-killed meat; and at both these markets, pigs and poultry killed in the country are sold, together with fresh butter, eggs, &c. to an astonishing amount. These last and many other markets are held daily, and almost constantly well supplied.

"The three markets of *Smithfield*, *Newgate*, and *Leadenhall*," he says, "supply the butchers round London almost entirely, and to the distance of twelve miles; partly indeed to twenty miles. It is a general opinion among the butchers, that they can buy live cattle in Smithfield, cheaper than at any other place. The cattle exposed for sale at this market, have been drove until they are empty, weary, wasted, and foot sore, and consequently shew to a great disadvantage: so much so, that graziers who have followed their cattle, especially sheep, to Smithfield, frequently do not know their own stock, and when they have been shewn to them, they were shocked at their deteriorated appearance. If they should not then be sold and slaughtered, the wasting would continue so much, that it would require several weeks of rich food to raise them to their former fatness." And "the bullocks and sheep drove to these markets are, he adds, not only over-heated by the journey, but they are also often most savagely beaten with bludgeons, goaded with darts, and hocked about their legs in the market during perhaps ten hours, and then drove to the slaughter house (if they have the good luck to escape thieves in the characters of bullock hunters), and knocked down while their blood yet in that inflamed state, and their flesh bruised. Such meat must, he conceives, be very detrimental to the health and longevity of man. Much better is that which is killed in the country without driving, when the animal is in full health, and sent to Newgate and Leadenhall in clean and cool packages. If this could be done by all, it would, he thinks, remove a great nuisance from London, would probably improve the health of its inhabitants, and certainly prevent many, and sometimes fatal accidents."

There is also a *Fish-market*, which is held every morning at Billingsgate, where all the dealers are served very early: first those who keep shops in various parts of the town; and next, the hawkers, who during the forenoon cry them through the streets. This market, he says, receives a considerable portion of its supply of fresh fish by land-carriage, from every distance within the limits of England, and part of Wales. Much is also brought from the sea up the Thames in boats: some even from Norway and Newfoundland, as well as intermediate distances, packed up in ice. The quantity of dried and pickled salmon, of cod, herrings, and shell-fish, is also very great. The whole probably, he thinks, amounts to about one sixteenth of the beef and mutton.

And it is added that there is likewise one *Corn-Market*, which is held at the Corn-Exchange, in Mark-lane, principally every Monday, but in a less degree every Wednesday, and Friday.—In this market an immense quantity of grain is disposed of, but no statement of the exact amount has been given.

There are three public markets for hay and straw in this county, namely, Whitechapel, Smithfield, and St. James's; all of which are held every Tuesday, Thursday, and Saturday. And London is also in part supplied with the same articles from a market held every Monday, Wednesday, and Friday, in Southwark. It is also observed that, "the barracks on Hounslow-heath furnish a ready market to the farmers in that neighbourhood for their hay, straw, and oats, as well as a fund from which to obtain a supply of manure. In this neighbourhood, some farmers sell their hay and straw to jobbers, who take it at the barn door, alter the weight of the trusses, draw it away in their carts, and re-sell it."

In these markets "hay is all sold by the load of 36 trusses, each truss weighing 56lb. except new hay which weighs 60lb. till the 4th day of September, and afterwards 56lb. only: by which regulation a load of new hay, till the 4th of September, yearly, weighs a ton, and after that day only 18 cwt. And hay is sold daily in large quantities at the different hay-markets, and a regular book kept by the clerk of each market, for the inspection of the public, mentioning the names of the seller, the buyer, the salesman, and the price of each load. This seems, it is observed, to have been intended to secure a fair and honest dealing; but it fails, almost entirely, effecting so good a purpose; great impositions being practised.

"The best meadow hay, he says, is principally bought for the feeding of gentlemen's saddle and coach horses at from four to six guineas per load; the more ordinary, by the livery-stable keepers, coach-masters, and retailers, at from three to five guineas. And the hay of rye-grass and clover, mixed, is generally bought by coach-masters, &c. for ordinary draught horses. The sainfoin and clover hay is generally bought for the brewers, distillers, and carmen's horses, for the rack, and for cutting into chaff, at from five to six guineas and a half the load.

It is likewise stated that the straw from different kinds of grain brought to the London markets, is sold by the load, which consists of 36 trusses, of 36lb. each. Wheat straw is generally used in the stables, for bedding of horses. The rye straw is used by brick-makers, to cover their hacks, by collar-makers, and for packing. The barley straw for packing, and by gardeners. The oat straw is also used for packing, and the winter support of cattle, as saddle horses in straw yards, &c. The bean straw serves to litter

farm yards, and farmers' stables. And the pea straw and tare straw to feed farmers' horses in the stables, and saddle-horses in straw-yards. There are the same regulations at the different markets with respect to straw as hay, and the price of each sort for some time past, has been from 25s. to 45s. per load of 11½ cwt. and 9lb.

The *Coal-exchange* or market is, the same author says, in Thames-street, "where the great dealers buy and sell. But the consumers are not permitted to buy there, owing to the dealers having obtained a completely infamous monopoly of the market. The annual quantity sold is about 600,000 chaldrons. A chaldron of coals, as delivered to the consumer, is thirty-six heaped bushels, but it is a much larger measure between the ship owner and the dealer, and even to such consumers as buy five or more chaldrons at a time: an allowance is then made in the term *ingrain*, which increases the chaldron to full forty bushels."

It is obvious that the due regulation and establishment of suitable and convenient markets are of the utmost importance to the success and improvement of the agriculture of the kingdom, as by such means a proper stimulus or encouragement is held out to the farmer to extend his means of cultivation.

MARLE, a soft unctuous substance of the calcareous kind, found extensively in some situations, at different depths under the ground. It is met with in different forms in different places, and distinguished from its appearances into *shell*, *clay*, and *stone* marle. The first of these sorts is supposed to have had an animal origin, as being constituted of testaceous matters, in greater or less degrees of fineness, from the slow decomposition and attrition which they have undergone for a succession of ages, intermixed with a portion of earthy substances. This is generally found in such places as have at some time been covered with water, consequently are more or less pure, and contain greater or smaller proportions of the calcareous principle, according to the differences in the nature of the dispositions of the muddy or other earthy matters, with which they are blended by the sediments of such waters. In common they, however, are found to contain a larger proportion than the ordinary kinds of lime.

The second sort has, in general, a large quantity of clay in union with the calcareous material, on which account it has a greater power of absorbing and retaining moisture than most of the other sorts. Marle of this nature varies greatly in regard to its colour, being found of a *brown*, *blue*, *red*, and *yellowish* appearance. The third sort is met with combined with sand, in different proportions to the calcareous and clayey materials, upon which the difference in its hardness depends. And when it has a thin, flakey, or laminated structure and appearance, it is termed *slate* marle. On account of the portion of clay that enters into the composition of these marles, they are capable of being softened in a gradual manner, by the operation of water upon them, and at last to fall down into a powdery form. Dr. Ainsley long since remarked, that all marles contained some portion or other of clay, in combination with their calcareous matter, while in lime it is generally sand that is united with it.

It has been well remarked by Dr. Wilkinson on the authority of Dr. Black, in the 21st vol. of the Annals of Agriculture, that "all marles effervesce or raise up frothy bubbles when acids are applied to them, and, as water alone frequently produces the same effects when poured on dry clay, it may be necessary, in order to guard against mistake in making trials upon substances suspected to be marles, to let them remain a little time in mixture with water, previous to their being subjected to the test of acids. The best or richest marles being such as contain the largest proportion of calcareous earth; it frequently becomes a matter of importance to farmers to be able to ascertain the quantities, some being found so poor in this material as to have only a twentieth or thirtieth of their weight, in order to decide on their advantage in preference to lime, chalk, or other substances to be brought from a distance. A simple and easy method, founded on the knowledge that this earth commonly contains about forty per centum of its weight of fixed air or carbonic acid, is proposed by the professor. It is merely by saturating the marle with the muriatic or some other acid, and marking correctly the loss of weight which it sustains by the extrication of the fixed air. Thus, if two hundred grains of marle be introduced into a vessel with a little water, and muriatic acid poured upon them until the bubbles cease to rise, the loss of weight being then found to amount to forty grains, the marle contains one hundred grains of calcareous earth. The proportion of calcareous earth contained in different marles may also be determined by dissolving it by means of the muriatic acid, diluting the liquor with water, passing it through a filtering paper, and then precipitating the calcareous earth from the clear liquid by a solution of some fixed alkaline salt."

The following simple methods suggested by Mr. Donaldson also tend to shew, that such substances as are examined are marle, though not by any means in so correct a manner as by the above processes.

First, by air.—"If, says he, a lump of true stone or clay marle be exposed to the air, it will, in a short time, break into small pieces. Secondly, by fire.—When a piece of real marle is dry, break it into as small particles as possible, and put a handfull into a hot coal fire; it will crackle in the same manner as if salt had been thrown therein. Thirdly, by water.—Put a piece of dried marle into a wine-glass, and pour gently as much water thereon as will cover it; if true marle, it will gradually dissolve into a liquid, or soapy substance, and at the same time shoot up many sparkles to the surface of the water. Another, and the most certain criterion, by which to prove marle of all kinds, is, says he, to put a little in a wine-glass, and pour gently over it a small quantity of aquafortis, or some other strong acid: if it effervesce, it is a sufficient proof of its being marle; and the degree of the effervescence at the same time ascertains its quality." These

simple modes should, however, only be had recourse to when the means of a complete analysis are not capable of being put into execution.

But though there are the above differences in the natural appearances of marles. they agree in being all capable of being reduced into a fine powdery condition by being exposed for some time to the effects of the atmosphere. By this means they become ultimately capable of being blended minutely with the different materials of the soils upon which they are laid. But as this common property of falling down into powder in consequence of the absorption of moisture and carbonic acid or fixed air from the surrounding air, is much greater in some sorts of marle than others, it may afford some difference in their utility as manures when applied to lands. See *Manure*.

In the examinations of Dr. Coventry, professor of agriculture in the university of Edinburgh, some moss-shell marles are stated in the Farmer's Magazine, to have been found to contain eighty-four per centum of pure chalk, or carbonate of lime, which is more than lime generally possesses, the refuse being chiefly peaty substances, which is a circumstance, it is said, that makes the refuse of them more useful as a manure than that of limestone, which is mostly sand or clay. These marles are also capable of being converted into quick lime, by burning; and their solutions change vegetable colours to green, possessing all the other properties of caustic lime.

This substance is further distinguished by its feeling fat and unctuous; and its looking, when dry, after having been exposed to the weather for some time, as if it was covered with a hoar-frost, or sprinkled with fine salt, and even when mixed with the land intended to be manured by it, the whole surface has a whitish appearance. The more marles effervesce with acids the more valuable they are as manures. In hot weather, good marle will slake with the heat of the sun, like lime; especially when rain follows a hot day.

In Staffordshire, the farmers reckon the soft blue marle, which is most commonly found under clay, or low black ground, at the depth of seven or eight feet, the best for arable land, and the grey sort the best for pastures. That which is of a brownish colour, with blue veins in it, and little lumps of chalk or lime stone, generally lying under stiff clays, and very hard to dig, is most esteemed in Cheshire. The marle which is usually found at the depth of about two feet, or a yard, on the sides of hills, and in wet boggy grounds which have a light sand in their composition, is very fat and close, and reckoned the strongest; for which reason it is particularly useful on sandy lands. It is often called peat-marle, or delving marle. What is sometimes called paper-marle, frequently lies near coals, and slakes like leaves or pieces of brown paper, being of a somewhat lighter colour. That which some call clay-marle, is very fat, and sometimes mixed with chalk-stones. There is another sort of marle which breaks of itself into square cubical bits. These two last kinds generally lie under sand or clay; sometimes about a yard deep under the former, but often much deeper under the latter. The stone, slate, or flag marle, which is a kind of soft stone or rather slate of a bluish colour, is generally allowed very good. It easily dissolves with frost or rain, is found near rivers and on the sides of hills, and is a very lasting manure.

In many districts of this kingdom marle discovers itself to the most negligent eye; particularly on the sides of broken hills, or deep hollow roads. Many rivers are bordered with a vast treasure of this sort, which is plundered by every flood. Boggy lands frequently cover it; and, in them, it seldom lies above three feet deep. It is somewhat lower under stiff clays, and marshy level grounds. The lowest parts of most sandy lands abound with it sometimes at the depth of three feet, and sometimes at seven, nine, or more. The depth of the marle itself can seldom be found; for when the upper crust of the earth is removed, all that can be seen or dug is marle, to so great a depth, that there are few, if any instances of a pit's having been exhausted.

The manner in which this earthy material is found, is probably different in different sorts.

It has been observed by the author of the Agricultural Report of Perthshire that, "shell marle is there found for the most part in small lakes or in land-locked bogs and mosses, where there had been formerly a lake or pond, during the multiplication of the animals. The wilks, which produce the marle, live, he says, only one year, and multiply prodigiously. They are often found to adhere to the long grass, which grows in pools, where they breed; and when the grass decays, it is laid in horizontal lamina on the marle bed, by the weight of the animals. These lamina ascertain the number of years, in which the marle-bed has been forming, in the same manner as rings of trees denote their age. When the wilks happen to generate in springs or other small collections of water, which are in moors or other high ground, they are frequently, says he, carried down, in the wet season, to the first still water; but if the stream is not able to carry them to a pond, they are sometimes left in the face of hills, and form beds of marle in that situation. In Glentilt, a property belonging to the Duke of Athol, there is, he adds, marle collected in this manner, on the declivity of a hill, to the depth of thirty feet, which, at a distance, has the appearance of a white rock. And according to some, not only wilks but bivalves produce shell marle."

These wilks are of a blackish colour and about the size of a pea; and are found in rills or springs in the months of May and June, sticking to stones and grass. Wherever the wilks are observed in lakes, bogs or meadows, it will, he thinks, be proper to bore for marle; or if they be found in spouty land, or in rills of water that flow into lakes or into marshes that stagnate, it may be also proper to bore for marle in these lakes or stagnant water. Marle is found under most sorts of substances, but more commonly under moss, soft mud and sand; more rarely under clay.

This substance is commonly sought for and discovered by means of boring with a tool for the purpose, somewhat in the manner employed for coal and other

fossil materials. Dr. Robertson says, that "the boring rod or wimble is made of iron, in pieces of about four feet long, which screw into each other. In the undermost or first piece is a kind of tube, about two and a half feet long, pointed sharp, open on one side, and one of the edges raised higher than the other, like a gimlet; so that when turned round, it may fill itself with the substance which surrounds it. Into this tube, which is open at the top, is put a piece of wood, as long as the tube itself, and of a conical shape, corresponding exactly to its figure. To this piece of wood is fastened a rope, of the size of one's little finger, and longer than the whole rod when all the pieces are put together. This piece of wood must stick so fast as not to come out, when the rod is pushed down into the earth or moss, below which marle is expected to be found; but must not be so firmly fastened, as not to be easily drawn out by the rope to which it is fixed."—When it is wished to bore, the piece of wood is put into the tube; screwing "the piece of the rod, which is fitted to the screw on the top of the iron in which the tube is formed; then pushing down the rod into the earth or moss, allowing the rope to go down with the rod, without twisting round it: and when these two first pieces of the rod are pushed down their full length, screw on the upper piece of the rod, which ought to fit the screws of all the other pieces, and must have a hole in the top of it, large enough to admit of a piece of timber, two inches diameter and four feet long, with which you are to turn round the rod three or four times, having previously drawn up with the rope the piece of wood which had been put into the tube. When the tube is thus turned round, it will be filled with the substance next it; and when drawn up, will show what that substance is. You can bore deeper and deeper, by screwing on more pieces of the rod, below the piece into which the handle is received that turns it round; but for facility in unscrewing, there should be a hole in every piece of the rod, that will admit a piece of iron, of the thickness of a man's thumb and eighteen inches long. It will be necessary to have two of these pieces of iron, so as to hold the rod steady with the one, while you screw or unscrew any of the pieces with the other; and this must always be done, in putting down and taking up, when a great length of the rod is required, as it cannot be managed in either of these cases, all in one piece."

This substance is very common in Ireland, where it often lies not above a foot or two below the surface of the soil. In France, however, though they have marle in many places, they are often obliged to dig very deep for it, particularly in the province of Artois, where it generally lies eighty or ninety feet under ground, in beds about five feet thick, at the bottom of which there is frequently water, which breaks in upon the workmen. On account of this great depth of the marle pits, extraordinary care is taken to set up marks, and rail them in, to prevent the fatal accidents which might otherwise happen. In many districts of this country there are also pits of this sort of great depths.

When, however, the marle lies at such great depths, it can in very few cases be raised for the purposes of manure. In most situations where it is employed in this intention, it is found only a few feet or yards below the surface, and it is usually raised by digging pits, and where there is much water draining them either in the common way, or by the use of pumps. When they are not very deep, the best and most ready method for getting out the marle is to open a sloping mouth, sinking the pit gradually, wide enough for a cart to drive in and out: and to work the marle away circularly, keeping the pit ten or fifteen feet deep, by which means the expence of filling the carts will be much lessened.

When raised from below loughs or ponds, it may sometimes be necessary to have recourse to boats for conveying it to their borders, in order to its being conveyed upon the lands.

When the pits are opened upon the land, it will be necessary that they be made as convenient as possible for carriage and draught, and that the least possible injury be done by them to the grounds. Attention should likewise be paid to the facility of laying them dry. When large pits are dug, masses of considerable size are often let down by undermining, and forcing large piles in above them. In these cases great care should be taken, as they are very apt to give way suddenly.

This is a substance that may be made use of on most sorts of soil that are of a sufficiently dry quality to admit of its being applied. It has been found highly useful on those of the sandy, gravelly, and moory kind; upon the more heavy sorts it may likewise be found beneficial in many cases. This would at least seem to be the case with shell marle, which Dr. Robinson says, of all others abounds most in his district, containing more oil than any of the other kinds. In common with them, he thinks it pulverizes the soil, and prepares the vegetable food for being absorbed by the roots of plants: in common with them also, it communicates to the soil the power of attracting the fertilizing influence of the air; but it surpasses them, by adding mucilaginous matter of its own to the soil, being the *exuviæ* of animals, and thereby increases in no small degree the quantity of vegetable food.

Marling *of land*, the process or operation of putting this sort of material upon the ground so as to effect its improvement.

In the application of all manures, the farmer must be regulated in a great measure by the quality of the soil, and the strength of the manure, of whatever kind it may be, in which experience is the surest guide. In marling, it is particularly necessary to find the true proportion which the land requires, and much better to err in laying on too little, than too much; as more may be added at pleasure; whereas by over-doing it, the first year's crop often fails, from the body of the marle not being sufficiently opened; and in that case, it will sometimes be three years before the ground comes to a proper state. The best directions that can be given to the farmer in the application of this manure to light soils, is to

lay on the quantity which will give the degree of cohesion wanted in those soils. A general rule cannot be laid down in this respect, as the quantity of marle requisite to effect the desired end, must be different in proportion to the degree of lightness of the soil.

The quantities most commonly employed are from seventy to eighty loads. Upon lands of the sandy kinds, Mr. Young advises from fifty to sixty cubical yards per acre; but on those of the loose, wet, loamy sort, upon which this sort of manure produces great improvement, it should, he thinks, be laid on to the amount of a hundred yards.

In regard to the most œconomical method of doing this sort of work, it is, he thinks, that of contracting "for the whole job with some little farmer or horse keeper who works for hire." It is not uncommon, he says, in Suffolk to give 8d. a cubical yard for all expences whatever, except that of spreading, which those farmers that have attention to correct management do by the day, as it is of much importance to have it well performed; for where this is not the case, some parts of the field will have it in the proportion of two hundred loads, while others have not more than fifty.

In the same county 9d. and 10d. per yard have, it is said, lately been given to such small farmers for teams sufficiently strong for this sort of business.

The mode of practice and success of Mr. Rodwell in this sort of work, as stated in the second volume of Communications to the Board of Agriculture, are highly encouraging.

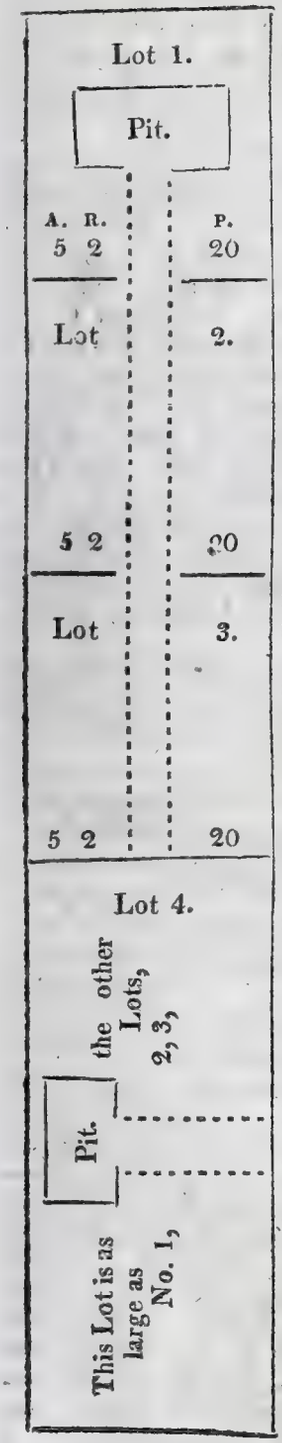
On obtaining a lease of a farm, of 1400 acres at 150l. a year, of the poor dry heathy kind of land abounding with fern, gorse, and more particularly ling, of little value, and affording only a scanty support to ill-fed sheep; his "operations were to inclose with thorn hedges, marle, or clay, and break up 300 acres of the heath; and in the first seven years of the lease he finished what he meant to improve in that term; he marled or clayed 600 acres, at 70 loads an acre, being 42,000 large tumbril loads. In this work he employed three teams, two of his own, and one he hired, for several years. It is, he says, severe work, and the second year he lost nine horses, attributed to feeding on pea-straw from the new broken heath, a circumstance that deserves the attention of improvers. In the 11th year of his lease he applied to his landlord for a renewal; on which the farm was valued again, and he took a fresh lease of 15 years to commence at the termination of his old one, at the rent of 400l. He immediately clayed and broke up 200 acres, at 100 loads an acre, 40 bushels per load, inclosing all with quick hedges and ditches 5 feet wide and 4 deep; after this, he improved 100 acres more in the same manner. In the two leases of 28 years, he clayed or marled 820 acres; and he has clayed or marled so much over the second time, at 70 loads an acre, that the quantity he has carried in all, is very little short of 140,000 loads. Upon taking a third lease, he was, in 1798-9, particularly steady to this work, and in 49 weeks and 3 days carried 11,275 cubical yards, paying by measure of pits, and not by loads, which were filled and spread by 4 men and a boy, and carted by 6 horses and 2 tumbrils."

It is added, that "in this business of carrying clay or marle he has practised handbarrowing; the men can make good earnings at 10d. a yard, wheeling it 30 rod; and down to 7d. a yard at shorter distances; and he is much inclined to think, that if we had workmen used to the operation, and handy at it, like those employed in navigations, that this method would be of all others the cheapest, especially on the heavier soils. But by far the greatest part he has done by tumbrils, the expence of which put out is 5d. a yard for team, and 2½d. a yard for labour, and paying for laying picks, wedges, &c. also for stones that rise, increase the whole expence to 8d. per yard, which is at least ½d. per yard cheaper than he can do it with his own teams: the reason of which is, that the man who contracts with him drives his own horses, and looks after them; at 8½d. per yard, 140,000 yards have cost him 4958l. excepting the small proportion hired at ½d. yard lower."

He comes now to mention a few circumstances which he hopes may tend to render this communication useful to others, not having the experience which he has acquired. He says, he shall use but few words, but they shall be founded on positive experiment or attentive observation. Clay is much to be preferred to marle on these sandy soils, some of which are loose, poor, and even a black sand. By clay is to be understood a grey clayey loam, some of it brick earth, and all has with vinegar a small effervescence. Marle is a white greasy, chalky, substance, that effervesces strongly with acids. He makes a universal rule, on a second improvement, to lay clay on the fields marled before, sometimes marle where clay was spread before; but this not general, as clay answers best on the whole. On 90 acres, clayed 100 loads an acre, he has had after two crops, the one turnips, the other barley, cole-seed, and sold it on the ground for 1000 guineas; then turnips, a famous crop, followed by barley, on 75 acres, 16 coombs an acre; and by oats on 15 acres (poorer land) 10 coombs an acre. These crops are for the soil *great;* but in general his products have been highly to his satisfaction.

The expence of this sort of work, where it is thrown from the mouths of sloping pits into the carts, will, according to Mr. Young, be "upon an average, threepence to threepence-halfpenny per cubical yard, the filling and spreading; and about fourpence-halfpenny for the teams, carts, and drivers: in all, eightpence per load, or cubical yard, or three pounds six shillings and eightpence per hundred loads. Which will,' he says, "be a proper quantity for an acre of land: the benefit will last for twenty years, and the land always be the better for it."

The variations in the expence, must however, from the circumstances of conveying it from different distances, be considerable; which in the Survey of the county of Lancaster, are thus shown by Mr. Holt.



Suppose lot 1, be thirty rods square, and the pit right in the centre, so that its greatest distance from the pit be fifteen rods every way. The cartage will be 18s. per rod; and, to save fractions, call the field six acres; then the account will stand as under:

Cartage, per rod - -	18s.
No. of acres - - -	6
	108
No. of rods laid per every acre - -	6
	648
Total amount of expence of lot 1. - -	£32. 8s.

Now, if lot 2 be marled out of the pit in lot 1, the additional expence of it will be 12s. per rod, or 54l. being forty-five rods from the pit.

And if lot 3 be to be marled still from the same pit, the additional expence will be 26s. per rod, or 44s. the whole; the distance from the pit being seventy-five rods, and the expence 79l. 4s.

Again, lot 4, being as large as the other three, and the pit in the centre, the extreme distance will be forty-five rods each way, and the cartage will be 21s. per rod, of sixty-four cubical feet, and which will amount to 113l. 8s.

The comparative estimate stands thus: lot 1, 32l. 8s.—lot 2, 54l.—lot 3, 79l. 4s. Total amount of which is 165l. 12s.—Three times 32l. 8s. is 97l. 4s.—Balance saved by having a pit in each field would, he says, be therefore 68l.8s.—The expence of lot 4, is 113l. 8s.; and from which substract 97l. 4s. and the balance is 16l. 4s. The above will, he thinks, evidently prove the advantage of proximity to the marle: but a pit in the middle of a field is not only an eyesore, but a nuisance; therefore, if possible, should be avoided. Nor is the advantage so great in the middle as may be thought; since, in coming out of the pit, there being only one pace, some part of the ground must of necessity be gone twice over; whereas, if on one side of the field, and central, all the land lies immediately before the pace of the pit.

He states the expence of marling upon Bootle Marsh, about the year 1780, to be as follows:

	£.	s.	d.
Getting and filling, per rod of 64 cubic yards	0	10	0
Spreading - - - - - -	0	2	2
Carting; the average distance from the middle of the pit to the middle of the land, 60 rods	1	9	0
	2	1	2

In this calculation, he says, there are six carts, five in motion, each goes the distance of twelve rods, whilst one stands in the pit to be filled. The size of each cart is 20,736 inches (cubical), usually drawn by three horses; the weight of the load about 15 cwt. and two cubical yards of marle make about three loads. The number of workmen are six fillers and getters; usually two right-handed men at one wheel, and two left-handed at the other, with one filler behind: one getter is generally sufficient.

	£.	s.	d.
Getting, filling, and spreading, to the acre of 64 yards to the rod, on Bootle Marsh, was	3	19	1
Cartage - - - -	9	8	0
Digging for the marle, clearing the head, expences at finishing, &c. per acre -	2	7	0
	15	14	1

There were, according to his acconnt, about 6½ rods laid upon the acre on this occasion. The men got 2s. 6d. and the carts 7s. 6d. per day. Getting and filling marle, it is remarked, is very laborious work, and requires the utmost exertion to obtain these wages; and that this work, after all, can only be effected by young men in their prime, cheered by the company of fellow-labourers, and frequent refreshments. Five working days, he says, are reckoned equal to six at other work, for they usually begin at half past four in the morning, and rest one hour at breakfast, from eight to nine; rest again from twelve till two, and then work till six; and generally get out nine rods per week.

The present price (1795) is—	£.	s.	d.
For getting and filling, per rod	0	12	0
Spreading - - - - - -	0	2	6
Carting - - - - -	1	13	0
	3	7	6

And in the Middlesex Report it is stated to be this: "Four men digging and filling eighty cart-loads, at 4s. a score, spreading included, is 16s. One man and four horses, two days, at 12s.—1l. 4s. Total expence per acre, 2l."

An able and intelligent farmer who has had considerable experience on a farm of twelve hundred acres, remarks in the Annals of Agriculture, that "from different trials of his own, at a very great expence, and the observations he has made on his neighbours' and the Norfolk farmers' manner of improving light sandy lands, by clay and marle, he is clearly convinced, that about seventy square yards, each of which contains about a cart load, is the properest quantity to be laid upon an acre of land, pole measure. If

more be laid on, the longer, he says, it will be before it incorporate with the soil, and of course, the longer before any benefit can be received from it. He once saw an instance, where a farmer laid on 120 loads, or square yards per acre, and gave this reason for it, that the land was so poor, he was sure he could not hurt it. But the consequence of it was, that after an expence that would have purchased the fee-simple of the land, he could not see, for many years, that he had done it any good, as it produced no better (if so good) crops, as lands by the side of it that had not been clayed at all, but otherwise farmed the same. It has now, however, evidently, the advantage of the other lands, having been done above twenty years. This trial was in the middle of a shiftable field, where, by the course of husbandry, two crops are taken to one summer tilth; and, where this is the case, claying, &c. seldom (or never he might say) answers the expence: for claying and marling being only a first, or beginning of improvement, by going on directly with a course of ploughing, which cannot well be avoided in shiftable fields, it is often buried and lost before it mix properly with the soil, especially if turned in too deep by the first earth, of which great care should be taken. He would therefore recommend claying or marling only upon inclosed lands, unless where large breadths lie together, that can be farmed in any manner the occupier pleases; and in that case (as well as in inclosures,) he would advise that the lands should be laid down with clover, rye-grass, and trefoil, the spring twelvemonth before laying on the clay or marle, and to remain at least six months after it, that it may have time to sink and eat itself into the flag before it is ploughed up, and then there will be little or no danger of losing it, as it will already be in some measure incorporated with the soil." And he thinks, that "no pains should be spared to break all the lumps, and get it fine by repeated harrowings and rollings, and having all the stones picked and carried away, that the grass may get through as soon as possible, for stock to be grazing upon it, which is the great and finishing improvement; for, as he observed above, claying or marling seldom or never answers where you go on immediately with a course of ploughing in the common way." It is added, that "in his opinion, as much, or more, depends on the management of lands after claying or marling, than in the mere laying it on, which, however, is very expensive, and therefore a very persuasive argument in favour of that sort of management that will be the most likely to make it lasting." He thinks, that "little need be said about the different quality of clay or marle, as every one must be content to use such as is found on his own premises, for he never heard of any in the counties of Suffolk or Norfolk that would answer long carriage. He has seen, however, in the county of Kent, a sort of marle that the Essex farmers buy, which, after being sent many miles by water, he is informed they find answers carrying five or six miles by land. Clay that is freest from sand, and marle that is soft and greasy, are certainly, in his opinion, the most valuable; and even blue clay, that is condemned by most farmers, he has found to answer very well on light sands, but they generally lie at too great a distance from each other to be prudently got together." It is further stated, that "where there are different sorts of manure equally convenient upon the same premises, which is sometimes the case, *viz.* pure clay, white soapy clay marle, clay with much marle in it, loamy clay and cork; he should certainly prefer the former for light sandy lands; on sands of a stronger nature, that have a mixture of loam with them, he should choose the soapy marle, or that mixed with clay marle, whichever was most convenient; but any of the inferior ones must be used, rather than submit to long carriage, especially on a large scale."

In regard to the expences, in his opinion "the first is the *filling*, which, he says, including spreading, is 25s. a hundred, or 2½d. a load, with an allowance by some farmers of 2s. 6d. by others of 5s. for opening the pit, and 1s. a load for all the large stones they throw out at the time of filling; the farmer to find drifts and stakes, for letting down what they call the *falls*." And with respect to "the team it must consist of four strong trace horses, and two shaft horses, which, for such strong work, must have very high keeping. He cannot therefore lay their labour at less than 2s. a day each, and the carter at 1s. 6d. a day, which, supposing they carry, one day with another (allowing for wet weather and hindrance by accidents, &c.), 30 loads a day, will be about 5¼d. per load more, making in the whole 7¾d. a load for filling, carting, and spreading."

Taking the quantity of marle which is necessary on a medium, at 75 loads per acre, he makes the following statement of the expences of this sort of work:

Expences.

	£	s	d
Seventy-five loads, which, at 7¾d. a load, is per acre, - - - -	2	8	5¼
Harrowing and rolling several times, to pulverize and spread it equally on the surface, per acre, - -	0	1	6
Wear and tear of carts and harness, including accidents, at a farthing per load, per acre, - - -	0	1	6¼
Loss of seed, as it should always be laid upon a layer, and be some months before it is ploughed in, per acre,	0	1	0
	£ 2	12	5½

It is observed by Mr. Donaldson, that "in Lancashire, they have abundance both of stone and clay marle: the former is applied to the strong clay soils, the latter to the light, loamy, and sandy lands. The medium quantity laid on the acre, is about three cubic roods, of eight yards to the rood. The expence, in a great measure, depends on the distance of carriage; but generally runs between six and ten pounds the acre. It is commonly laid on grass lands, a year or two before they are broken up, although sometimes on lands in a course of tillage. In either case, great care is taken to spread it as equally as possible on the surface, and to break any lumps on which the weather has not had sufficient influence;" he also adds, that "the application of clay-marle to the light sandy soils in Suffolk, has been the means of greatly improving those soils;

and the crops which they produce, after being marled, if the lands be not too severely cropped, are so superior, as fully to warrant the expense. The quantity laid on the acre is about eight loads, or nearly 2500 bushels; this has been fully shown above. And, in the Isle of Man, they lay on clay-marle at the rate of nearly two hundred tons the acre."

But he says, "it is to the county of Norfolk that we are to look for the wonderful effects produced by marle. These are so great, that lands which, forty or fifty years ago, did not rent at eighteen-pence the acre, now give upwards of twenty shillings. There are two kinds of marle in that county; the one of a white, or rather yellow colour, consisting almost entirely of calcareous earth; the other may properly be denominated clay-marle, but from the small quantity applied to the acre, it must be of a very rich quality, compared to other marles; otherwise it could not operate so powerfully on the soil. Of the first, from ten to fourteen loads are sufficient for the acre; and of the last, from thirty to forty. The mode of application varies. Sometimes it is used as a preparation for a crop of barley or turnip; and is frequently laid on clover-ley, before being broken up for wheat; its use in this district will be more fully seen below."

He, however, remarks farther that, "if the above county has been benefited by the marles above mentioned, that of Forfar, in Scotland, has reaped as great advantages from shell-marle. Shell-marle, of a most excellent quality, has been for a good many years discovered in various parts of that county; and the improvements that have taken place, in consequence of the general and judicious use of that valuable manure, exceed, he says, perhaps any thing of the kind that ever happened in the same period, in any other county in the kingdom. The average quantity laid on the acre, is about four hundred cubic feet; and in respect to the mode of application, it is in every respect, he says, similar to that mentioned above, as the practice in Norfolk. Great caution is, he thinks, necessary in using marle, and in adopting proper rotations of cropping after it is applied. If a large quantity be laid on at once, especially on light lands, or if marle be laid on a second time, in the course of a few years, and a number of severe crops afterwards taken, the lands will be greatly exhausted. This was experienced in many instances, he says, when marle was first used as manure in Forfarshire; the tenants, for the most part, ignorant of the effects it would produce, laid on large quantities; which creating a great fertility, they went on sowing oats, and other severe crops, till the soil became little better than a dead substance. This alarmed the proprietors, and induced them to include certain covenants in their leases, so as to prevent any prejudicial consequences in future. These have, he observes, been the means of establishing a more regular system of marling husbandry in that county, than perhaps is to be found in any other part of the island. When a field is marled, the tenant is bound to lay it out in grass, with the next or succeeding crop; and to allow it to remain three or four years in pasture. When broken up for corn, a certain specified number of crops only are to be taken, before it is again laid out to grass; and so on, during the currency of the lease. The tenants are also debarred from laying on marle a second time on the same field, in the course of one lease, which is commonly for nineteen years, unless it be properly mixed with dung, or other substances. Thus the improper practice of over-cropping the land after marling, and the no less injudicious custom of repeated marlings at short intervals, are, he says, both prevented; and under these restrictions, which are in general very steadily adhered to, marle is found in that district a most beneficial manure, and the lands continue in a progressive state of improvement. Although it appears doubtful whether marle, unless laid on in large quantities, be advantageously applied to strong clays, yet it seems universally agreed, that for all light, dry, sandy, and gravelly soils, it is the best manure yet discovered. That being the case, every occupier of such lands ought to be extremely attentive in searching for marle; and the proprietors and farmers in those districts where it has been lately discovered, will essentially promote their own interests, by bringing into general use a manure, which has been found in so many other districts a source of real wealth, and a means of substantial and extensive improvement."

According to Dr. Robertson, "this substance, in Strathern in Perthshire, is sold from eight to ten pence the boll, being eight cubical feet. The ordinary allowance for an acre is from forty to sixty bolls. A gentleman on the Nairn estate, betwixt Perth and Dunkeld, told him that the farmers in that district go even the length of one hundred bolls to the acre; but most of the land in that county is a deep strong loam. The most experienced improvers, he says, allow forty bolls, for a second marling, after an interval of fourteen years. The interval now adopted in the Stormont is nineteen years, especially on the estate of Balharry and the country adjacent. On all light land its effects are powerful and immediate; but it requires to be managed with caution. Many places of the Stormont, and indeed in all Strathmore, have been almost laid waste by the excessive application of this stimulating manure and over-cropping the ground. At Bradiston the soil, he says, lost all the power of cohesion, and became so light by this cause, that it had no sward; the surface and the soil were blown away with the winds, in the same manner as dust is raised from the roads; and dens were made in some instances to the depth of five or six feet. About Bakie, along the road from Coupar to Meigle, and in many other places, the same injury has been done to the soil, by the injudicious use of marle. He saw one field west of Blairgowrie, which had been so reduced, that after it had lyen fourteen years or more in grass, it had scarcely gathered a decent sward. Mr. Smyth of Balharry, to whom he owes much of his information relative to that country, told him that the land

of Fullarton had been marled every second year for a succession of ten or twelve years, which at length put the ground from carrying oats, but not from barley; which management and effect still continued in 1795. This fact seems, he says, to indicate that oats will exhaust marled land more than barley; or that the dung given to the barley crop corrects the exhausting quality of the marle."

"But the marle discovered in Strathern has, he observes, been applied very successfully to the lands in that neighbourhood, for a long time, because a succession of scourging crops is not allowed. No such consequences have followed as these in the Stormont. The expence of dragging it out of the loch amounts to three-pence the boll, and a stratum of moss, from nine to sixteen feet, must be removed, before the bed of marle in one end of the lake can be wrought. Sir William Murray showed him a field of thin gravelly moor laid down with marle alone, every acre of which, by such a dressing, was equal to the maintenance of four sheep. In some parts of the same moor, which had not been ploughed at all, the heath was banished in three years by a top dressing of marle, and succeeded by a fine close grass."

In the trials of Mr. Chatterton, detailed in the fourth volume of Communications to the Board of Agriculture, made on a farm that had been marled at some very distant unknown period before, and had, in consequence, been altered in its soil from a weak sandy gravel to a rich loamy gravel, to the depth of ten or twelve inches, or such a depth as had been moved by the plough; on discovering a pond from which marle had been taken, the year after his entering upon the farm he began with the marle. The first piece to which he applied it was that of some old mowing ground, which was situated high, and was near a sharp gravel; it had but a very dry poor sward, producing only a small proportion of ordinary hay. He covered five or six acres with marle, laying about forty loads upon the acre, and after it was spread, was extremely attentive to seize a proper opportunity to harrow it small or fine, as it is seldom, he thinks, in a fit state for that work except upon a change of weather. The first year, he says, the improvement did not make much appearance, but in the year following it was astonishingly great, both in the quantity and quality of the hay, and continued so as long as he remained upon the farm, which was about six years, being greatly increased in value. In the following year he applied the same quantity per acre, to a few acres in the middle of a field that was then under the plough; which was spread and ploughed in; after which oats were sown, and the crop upon the marled part was superior in strength and richness to the other part of the field; but it did not seem to have undergone so great a change as the portion of grass land just noticed. It is probable, he thinks, that the reason might be, that the piece sown with oats had never been marled before; while the other, from the strength and firmness of the soil, seemed to have had marle laid upon it at some time, as the top soil was much more free from pebbles, though underneath there was a very strong gravel. When the field was in the state of grass-seeds, after the oats, the colour of the grass was observed to be the strongest and richest in the place where the marle had been applied: but as the whole was pastured together, the difference in the quantity of produce could not be ascertained. It is added that several other fields were marled while in the state of tillage, with about the same number of loads per acre, all of which answered very well under the plough, seeded well with grass, and became rich pastures; but that where the land was the most gravelly and sharp, the greatest change was produced.

In the practice of Mr. Kiddle, as stated in the same work, a vast superiority was found in the use of clay marle, in the proportion of sixty loads the acre, over that of the chalky kind, on land of the new-broken-up heathy kind, both in the turnips and crops which succeeded them, being nearly better by one half; which he thinks, strongly shows the necessity of procuring, if possible, clay or marle of the clayey kind, for such sorts of soil, even if brought from some distance, as the land is by such means doubled in value; but that if it cannot be procured, and that of the chalky description presents itself, it must at all events be employed, "as without a staple manure such land will never admit of being converted into tillage with any advantage to the cultivator; without clay or marle, land of such quality acquires no firmness, and no turnips can be grown upon them, as in the early part of autumn, they will be subject to the 'anbery,' and after being infected with it, they never make any progress in their growth, or are of any use for the cattle, particularly those that are in a forward state."

In the Rural Economy of Norfolk, Mr. Marshall says that "marle has been so long in use in that district, that there are few farms without marle-pits upon, or near them; so that searching for marle is at present seldom requisite, and the art of discovering it not much studied. The herb colts-foot *(tusilago farfara)* abounding on the soil, is considered as an indication of a jam of marle being situated near the surface. But, whether this is, or is not, an infallible guide, time and accidents or intentional researches have not failed to discover beds of marle in almost every estate, and, in some places, on almost every farm, situated sufficiently near the surface to be worked with advantage. Of the quality of marles, the farmers in this district are, in a great measure, uninformed. That which falls most readily, and "gets to work" the soonest, is in the best esteem; but, in general, the quantity of "uncallow" (namely, the coping, or covering of earth, which lies upon the head, or jam) "is more attended to than the intrinsic quality of the marle. The depth of uncallow is generally very unequal: perhaps on the same jam of marle it will vary from one or two to six or eight feet deep, the surface of the jam usually rising into inequalities, termed heads." And "the depth of the jam is equally uncertain: he has seen one worked twenty feet

deep; but in general he believes ten or twelve feet may be reckoned a middling depth. "The bottom of the jam, being generally a white absorbent sand, no pump or artificial drain is requisite to free a Norfolk marle-pit from water, which no sooner touches the sand than it vanishes, as through the grate of an open drain."

It is added that "in working a marle-pit, the top-soil is thrown back for manure: the remainder of the uncallow thrown to the bottom of the pit, and levelled for the carts to stand upon. When the jam is low, the marle is thrown immediately from it into the carts; but if it be too high for this operation, piles are driven in a row a few feet from the face of the jam; and, as soon as a crack is formed, water is poured into it, more especially when the marle is dry and stubborn; and by this means many loads are thrown down at once; either to the bottom of the pit, or on to a platform level with the body of the cart; into which the marle, in this case, is thrown with great ease. Taking up the bottom of the jam is the most difficult part of the operation; the marle being first to be cast up on to the bottom of the pit, and afterwards to be thrown into the carts. But by thus bringing up the bottom, two valuable things are obtained; a drain for the water, and a most convenient receptacle for the next line of uncallow. The labour bestowed on marle previous to its being put into the cart, whether it be incurred by throwing down, loosening by pecks, crows, &c. or fetching up the bottom, is termed 'casting'—the act of throwing it into the cart being called 'filling.'—The price of casting was then, three-pence to six-pence a load, according to the circumstances of the pit (the uncallowing being generally done by the day); and the price for filling two-pence to two pence half-penny, according to the size of the loads carried. He has known three-pence a load given for filling and spreading large loads: the price of spreading, alone, is about one shilling an acre. The number of loads carried out in a day by one team, varies, of course, with the distance to be carried: when the pit happens to lie in or contiguous to the ground to be marled, thirty loads have been carried: but five and twenty is, he believes, considered as a good day's work."

In regard to the quantity set upon an acre, it is, he says, "equally various; depending upon two things:—upon the judgment of the person who marles, and upon whether the land has, or has not, been marled heretofore. It is known, from common experience, says he, that land which has been recently marled receives no apparent benefit from a second dressing of the same manure: but it is equally well known that, after some length of time has elapsed, a repetition of marling will generally answer. It is a notion pretty generally adopted, that, in this case, the quantity ought to be greater than it was the first or preceding time: and it being formerly the practice to set on a great quantity at once, seldom, perhaps, less than forty loads an acre,—this notion has, probably, deterred many persons from doing that which would have have been serviceable to themselves and their country. But there is not, he believes, any general rule known, respecting either time or quantity: he has had frequent opportunities of making observations on a farm which affords a striking instance on this subject. Two or three different tenants had failed successively on this farm; though by no means high rented. The greatest part of it had, within the memory of man, been marled with not less, in all human probability, than forty loads an acre; and the tenants who failed despaired of reaping any benefit from a second marling after so short an interval of time: but this farm falling into the hands of a more judicious tenant, he has, by marling, (and by other acts of good management) accumulated, in little more than twenty years, a farmer's fortune; during which time he marled upwards of one hundred acres; and has found, from long experience, that twenty-five loads an acre is notwithstanding the recent marling, a sufficient quantity. He does not mean to intimate that the same management would every where produce the same effect; but he will venture to say, that no man having marle upon his premises ought to neglect to try its effect, by accurate and repeated experiments, upon every piece of land in his possession, without being led away by any received notion, or general rule. The quantity set on, upon land which is not known to have been marled, or out of which the marle is worn, is, at present, less than formerly." But in the southern hundreds, to which marle is obliged to be fetched a great distance, ten or twelve loads are considered as a dressing; six or eight are frequently set on: while in the more central and northern parts of the district, where marle is common on almost every farm, twenty to thirty loads an acre are generally allowed, and sometimes forty loads. "And when it is known, from experience, or taken for granted without proof, that land, either through a recent marling or other cause, is not improveable by marle alone, a small quantity is frequently mixed up with dung; either by bottoming the farm-yard, or the muck-heaps, with it; or by mixing it layer for layer with the dung in the heaps. In either case, they are afterward turned up, and thereby mixed more intimately together. With this preparation, marle has been found to answer, where, in its natural state, it had no effect."

In respect to "the symptom, or indication, of a piece of land requiring to be marled, is taken from the plants which prevail upon it. 'Buddle' (*chrysanthemum segetum*, corn-marigold) is considered as a certain intimation that the land it abounds upon requires to be marled. 'Smart-weed' (*polygonum Pennsylvanicum*, pale flowered persicaria) is likewise an observable symptom. It is, he believes, an undoubted fact, that marle, in a manner, extirpates these plants from the soil; and that 'quicks' (*triticum repens*) are considerably checked by it."

Mr. Young thinks that "all farmers who have marle under their fields, and do not make use of such a treasure, are to be condemned. In some countries, it is, he says, the common manure; and almost every where to be found when dug for; in such places, the farmers have nothing to do but to resolve on the undertaking: they all acknowledge the expediency of the work, and seldom dispute the great profit of it; but, in other parts, the knowledge of marle is very

confined. It may perhaps be discovered half a century before it comes into general use. In tracts of waste land, or sheep walks and warrens, let at a shilling, or two shillings and sixpence an acre, marle being discovered, and rendering such land capable of yielding noble crops of turnips, clover, and all sorts of grain and pulse; the uncommon effect, and the amazing advantages made by it are so striking, that the use spreads fast. But, on the contrary, when marle is found under richer soils (inclosed countries, for instance, of ten or twelve shillings an acre), the case is different: it will not make such an improvement as on the poorer lands; and, as great fortunes are not suddenly made by the use of it, the farmers in some districts will not be persuaded to use it with any spirit, possibly not at all: they think that a rent, comparatively higher than the other tracts, will not allow of their spending such sums about it: that they will not reap equal profit is, he says, undoubted; but why not accept of twenty *per cent.* advantage? Should they reject it, because they cannot command fifty? If tenants are backward in making use of marle on lands of ten or twelve shillings an acre, their landlords should set them the example, and shew that the work will answer well."

This sort of manuring may go on at most seasons, when the farmer has sufficient leisure, as during the winter months, as January and February, and in the summer season, as June, July, and August: when it can possibly be done it may also go on with spirit in the autumn, as November and December. In this work three-wheeled carts are of vast utility, from their great ease and convenience to the cattle or teams that are made use of in its performance. See *Manure*.

MARROWS, a provincial word used to signify fellows in speaking of cattle, as oxen, &c.

MARSH, a term applied to a track of land on the borders of the sea or any large river into which it flows. These tracks of land are mostly level, and converted to the purposes of grazing either with sheep or other animals.

In some districts, lands of this nature are divided or distinguished into two kinds, *Salt Marshes* and *Fresh Marshes*. The former is likewise sometimes simply termed *Salts* or *Saltings*. They are the parts or portions of marsh grounds which lie without the walls or embankments.

Speaking of the marshes in the southern parts of the island, Mr. Bannister observes, that they are subject to be overflown at every spring tide, or at other times, when, by the violence of the wind, or the impetuosity of the tide, the water flows beyond its usual limits. "The goodness of the salts is in a great measure analogous to the fertility of the adjoining marshes; and the extent of them differs according to the situation, as in some places the tide beats directly against the wall, whilst in others the salts or forelands are of a considerable breadth." He likewise adds, that "in some places the grass from salts is annually mown, and yields a short, delicate hay, that proves a very salubrious provender for sheep; but care must be taken to prevent its being carried off by the tide, for which reason it is often found necessary to bring it into the inclosures for making."

It is further remarked that "these salt marshes are very efficacious in relieving many complaints incident to cattle, and are likewise useful in furnishing a considerable range for young sheep. In feeding them, however, some caution is to be used, and it will be necessary to remove the stock over the wall on the apprehension of a high tide, but more especially on the approach of spring tides, when the salts are usually overflowed. As the return of these latter is periodical, and a high tide may generally be before seen by those who are conversant in these matters, it rarely happens that any mischief ensues when there is no breach made in the wall; though there have been instances where sheep have been drowned on the salts, from a sudden and unexpected high tide, and others, where this misfortune has been the consequence of neglect, in not bringing the stock over the wall; or, as it is termed by the graziers, locking them on such occasions."

The latter are those tracks of land that lie within the wall, and are very extensive in many parts of the kingdom. It is observed by the author just mentioned, that "Romney marsh is by far the most extensive, and withal the most fertile of any level which comes under this denomination. It contains near 24,000 acres; besides which Walland marsh and Dinge marsh, which are comprised within the walls, contain, the former 12,000, and the latter 8000 acres." He informs us that "the internal regulations of these marshes are committed to the superintendance of expenditors. These are appointed by the Commissioners of Sewers, and are to take care that the repairs of the walls are maintained in due order, and that the costs attending the same be levied on each tenant according to the number of acres occupied by him; for which purpose they are to cause assessments to be made out, with the names of the occupiers, and the rateable proportions to be borne by them respectively; and these rates, which must be confirmed by the commissioners, are termed scots; and that when any occupier refuses to pay his scot, the expenditors can obtain a warrant from the commissioners empowering them to distrain for the same, as for any other tax." These marshes are both appropriated to the purposes of breeding and feeding. See *Grazing*.

The same author adds that "the naked and exposed situation of marshes renders them excessively cold in the winter, and no less subjects them to the inconvenience of the parching heat of the sun in the summer months. To guard against these two extremes, it might perhaps be no unprofitable undertaking to form plantations of trees in different parts, which would operate as well for a shade against the sun's rays, as a defence to break off the winter blasts. Many trees might be fixed on for this purpose, which, delighting in a moist situation, seem in a very peculiar manner adapted to this use. Of this kind are the alder, the sycamore, the willow, and the poplar. Clumps of one or other of these trees being planted in different parts, would, he thinks, be found very be-

neficial, and completely answer the purposes before mentioned. To every one who hath been conversant in husbandry, it is evident with what avidity cattle of every kind fly to the shade in the summer season; at which time they will even neglect their food to avoid the scorching heat of the sun, and the more intolerable stings of the insect tribe; so that in the middle of a summer's day, it is in vain to search for a flock of sheep in the uplands. At that time the hedges afford them a secure asylum: but in marshes, where this protection is wanting, it surely would be worth the trial to set about raising a shelter, which may answer in some respects the purposes of hedges in inclosures. Besides, as these aquatics are all of them quick in forming their shoots, a few years, in a soil propitious to their growth, will furnish a constant supply of poles adapted to cutting into rails, for which there is always a perpetual demand, and which will be no inconsiderable saving, not only in the original purchase of these articles, but in the carriage or conveyance of them likewise."

It is asserted that "great profit is made by the renters of marshes in the neighbourhood of London bordering on the Thames, from joisting of horses, the pasture being deservedly accounted salubrious to that useful animal; for which reason, such horses as have been worn down by hard travel, or long afflicted with the farcy, lameness, &c. have frequently been restored to their pristine health and vigour, by a few months run in the marshes, especially on the saltings; but as every piece of marsh land in some measure participates of this saline disposition, so do they all of them possess, in a comparative degree, the virtues above mentioned; and for this reason the Londoners are happy to procure a run for their horses, at 4s. or 5s. per week."

And "another method practised by the graziers in the vicinity of London is, to purchase sheep or bullocks in Smithfield at a hanging market, which being turned into the marshes, in the lapse of a few weeks are not only much improved in flesh, but go off at a time when the markets being less crouded, have considerably advanced in price; and thus a two-fold gain is made from this traffic: and as many of the wealthy butchers of the metropolis are possessed of a track of this marsh land, they have, from their constant attendance at Smithfield, a perfect knowledge of the rise and fall in the markets, and consequently are enabled to judge with certainty, when will be the proper time to buy in their stock, and at what period to dispose of them." These advantageous modes of traffic are, he says, confined solely to those graziers who reside in the vicinity of London. "In the Isle of Sheepey, where they proceed on different principles, the graziers never wish to depasture any horses, this animal being thought by them to do much injury to the marshes, especially in wet seasons, by trampling with his feet, and is moreover very apt to wade through the ditches, and to break down the dry fences. These are arguments sufficiently cogent to induce those graziers to reject the joisting of horses; whilst those who reside in the vicinity of the metropolis, where the weekly pay is larger, and they depend greatly on this method, are justified in adhering to a custom which they find turns out so considerably to their profit and advantage."

In various districts of the island that are situated on the borders of the sea, or near the mouths of large rivers, there are many very extensive tracts of this description of land, which by proper drainage and enclosure may be rendered highly valuable and productive. This is particularly the case in Somersetshire and Lincolnshire, as well as that mentioned above. In the former of these counties, vast improvements have, according to Mr. Billingsley as stated in his able Survey, been effected by the cutting of vhynes and ditches, for the purpose of dividing the property, and the deepening of the general outlets, to discharge the superfluous water. Many thousand acres which were formerly overflown for months together, and consequently of little or no value, are now become fine grazing and dairy lands.

He states the quantity that has been thus improved under the authority of parliament on Brent Marsh, within these twenty years, in the following manner.

Names.	*Acres.*	
Wedmore and Meare	4,400	with 1,000 acres of turf bog not yet improved
Compton Bishop	300	
Glastonbury	1,500	—Ditto 300 ditto
Westhay, &c.	1,700	—Ditto 1,000 ditto
Mark	2,000	
Huntspil	1,200	
Shapwick	100	
Blackford	900	
Wookey	900	
Westbury	450	
Bleadon	400	
West Pennard	250	
Eddington	1,000	—Ditto 400 ditto
Stoke and Draycot	800	
Nyland	350	
Wells	1,150	
	17,400	

And it is added that of these seventeen thousand four hundred acres, six parts of seven are cleared of stagnant water, and rendered highly productive; while the turf bogs have been little improved. It is likewise remarked that in the parish of Mark alone ten thousand sheep have been rotted in one year, before the inclosing and draining was attempted.

The same writer states the probable expence and subsequent improvement of the complete drainage of the above named marsh and the river Axe, thus,

Brent Marsh.

Dr.

To act of parliament gaining consent, &c.	£400
——Sluice near the river Perrot	6
——Twelve miles of new drain, average depth fifteen feet,	12,000
——Lowering river Bruc three miles,	1,500
——Purchase of land	2,000
——Bridges, hatches, &c.	2,000

Brought forward	£18,500
To Sluice on Axe near Hobbs Boat	500
——One mile and half new drain,	1,500
——Lowering river Axe six miles	1,000
——Purchase of land,	1,000
—— Commissioners, Surveyors, &c.	2,500
	£25,000
To balance of profit	331,250
	£356,250

Cr.

By 9000 acres of turf bog improved at the most moderate computation 15s. per acre, making 6750l. per annum, twenty-five years' purchase,	168,750
——15,000 acres of marsh flooded land improved 10s. per acre, or 7,500l. per annum, twenty-five years' purchase,	187,500
	£356,250

This view and statements fully show the vast benefits that may be derived to individuals as well as the nation at large, by improving lands of the marsh kind by judicious draining, and other means.

Marsh *Lands*, a sort of rich pasture or grazing grounds lying near the sea, or large rivers. In some places it is termed fen. See *Fen*.

When marsh lands lie flat, it is necessary for the owner to keep all the water he can from them. The sea-water in particular is to be kept from them as much as possible; and this is usually done at a very great expence, by high banks and walls. There are two things greatly wanting in these lands, in general, which are good shelter for the cattle, and fresh water. The careful farmer may, however, in a great measure obviate these by digging in proper places, large ponds to receive the rain water, and by planting trees and hedges in certain places towards the sea, where they may not only afford shelter for the cattle, but keep off the sea breezes, which often will cut off the tops of all the grass in these places, and make it look as if mowed.

It is found by experience, that these sorts of lands fatten cattle the soonest of any, and that they preserve sheep from the rot. It would be of great advantage to them, if there were raised, in the middle of every large marsh, banks of earth in a cross, or in the form of two semi-circles, and these planted with trees; these would serve as a shelter for cattle, let the wind blow from what quarter it would, and would soon repay the expence of making.

There are, in different parts of the kingdom, very large quantities of land upon the sea-coasts that would be worth taking in, though little has yet been done in that way. The coasts about Boston, Spalding, and many other parts of Lincolnshire, give frequent instances of this, where the sea falls from the land, so that on the outside of the sea walls, on the owse, where every tide the salt water comes, there grows a great deal of good grass, and the owse is firm to ride upon when the water is upon it. This owse, when taken in, hardly sinks any thing at all, and they dig the walls from the outside of it, all the earth they are made of being taken thence, the sea, in a few tides, filling it up again: and though the sea, at high water, comes only to the foot of the bank, yet once in a year or two, some extraordinary tide goes over the banks, though they are ten feet high. These banks are fifty feet broad at the bottom, and three feet at the top; the earth being all carried in wheel-barrows, and the face towards the sea, where the greatest slope is turfed.

It is observed by Mr. Bannister, in speaking of the Romney marsh lands, that "the natural situation of marsh land, so much beneath the surface of the uplands, renders it subject to be frequently covered with water in the winter time; and as this circumstance proves highly detrimental to the land by protracting the growth of the grass, and in causing it to be sour and ill tasted, no pains should be spared, to resist the calamity, as well by keeping the ditches sufficiently cleansed, as by cutting drains in different parts of the marsh to carry off the superfluous water." And that, "as the gate-ways in the marshes are apt to be very miry in the winter season, care should be taken to heighten the ground with stones, gravel or chalk, which will render these passages much more comfortable to the drivers, no less than to the stock, especially milch cows, which being brought twice a day into the yard, would, but for this precaution, cause the gate-ways to be impervious in wet weather."

It is likewise added, that "when the summer turns out moist and growing, the herbage often shoots faster than the stock can eat it down. In this case it is common to brush over the marshes at the mowing season, though they had not been originally laid in for that purpose; by which œconomy the farmer becomes possessed of a much larger portion of hay than he had before formed an expectation of, and which in countries where this commodity fetches a good price, is an advantage whereof he is right to avail himself; for these casual brushings may probably furnish him with a quantity of winter provender, sufficient to his own use; whilst those marshes which were primarily intended to be mown, and having been designedly laid in with that view, will produce a commodity of a better quality and more saleable, that may be disposed of at market. Those graziers, on the contrary, who live at a distance from the market, and are on account of their local situation obliged to pay larger wages to their workmen, slight the opportunity of increasing their stock of hay; and in cases where the humidity of the summer hath rendered it necessary to mow the bullock pastures, in order that the succeeding shoot of grass may be the more sweet and toothsome, have made a free gift of the same to those who have engaged to clear it off the ground." On the removal of this old grass, the ground is left at liberty to send forth a more vigorous shoot in the autumn, so that these rouens at that time produce a sweet and wholesome pasturage, which would other-

wise have been choaked up with the rotten tore of the last year: yet there are cases where it may be necessary to suffer this old grass to remain on the ground, as where a portion of food is required for the cows or other horned beasts in the winter. Then this old tore, having been sweetened by the frosts, will be found exceedingly useful, and the cattle will at that time greedily devour, what in the summer months they turned from with disgust and indifference."

MARSH *Landers*, a term provincially applied to neat cattle of the short-horned breed or such as are bred on lands of the marsh kind.

MASH, in *Horsemanship*, a term applied to a soft sort of diet occasionally given to horses. It is prepared by pouring boiling water upon a small quantity, as half a peck of ground malt, bran, or other similar substances, in a pail, so as just to wet them well.—After this has been done, it should be well stirred about, till it is well mixed and sweetish to the taste, when, after becoming lukewarm, it is in a proper state for being given. It is frequently used after purges to increase their operation as well as after hard labour, and in the time of disease. They are very useful for restoring the animals in these last circumstances.

MASHELSON, a term used to signify a mixture of wheat and rye, or what is sometimes called meslin. See *Meslin*.

MASTS, a provincial term applied to acorns in some districts. It is sometimes pronounced *mess*.

MAT, a sort of covering material prepared by weaving bass or other substances of the same sort together. They are mostly brought into this country with different sorts of packages.

About Sandwich and Dover, Mr. Young says, they are made use of for covering the shocks of wheat; by which practice, Mr. Boys assures him, the sample of wheat is improved, so as that the Dover bakers give a decided preference to it. The mats cost about sevenpence each.

MAT-*grass*, a term applied to a particular sort of thick close grass.

MATFELLON, a provincial name applied to a field weed. See *Blue-bottle*.

MATTERING *of the Penis;* in *Farriery*, a disease in horses in which there is a discharge from the sheath or the yard, sometimes proceeding from taking too much liberty with mares before they are able to cover them; or from exertiug themselves too much in covering. Where the skin is fretted off, there issues a considerable discharge of fœtid matter, which may be of bad consequence if care be not taken; though at first it may be easily cured by bathing the part with a saturnine wash, weak alum water, or a weak wash composed of brandy. The horses must be taken out of the stable, as when these are applied to so sensible a part as the yard, the smarting is apt to make them lame themselves unless they have room; but it does not last above a minute.

When the excoriation or sore is internal, which is only capable of being distinguished by the matter proceeding from the urinary passage itself;—and not from the pain in passing urine as some suppose;—in this case Gibson advises the following injection three or four times a-day,

Take of rose water, a pint;
Venice turpentine one ounce;
The yolk of an egg;
Honey, one ounce;
Mix these together in a mortar: then pour the water on them by degrees, until they are well incorporated. Put the whole mixture into a phial, shaking it when made use of. A weak solution of white vitriol in rose water may also be employed with advantage in such cases in the same way.

MAUKS, a provincial word applied to maggots.

MAUL, a provincial term signifying a beetle, mallet, &c.

MAUM, a term provincially signifying certain dry mellow quality in land.

MAUND, a word provincially applied to a basket.

MAUPLE, a provincial word used to signify the maple.

MAW *skin*, a provincial word used to signify the stomach of the calf prepared for cheese making.

MAY, the fifth month of the year, in which much business of different kinds is to be attended to by the careful farmer.

Some time in the early part of it according to the nature of the season, there will be a sufficient bite of grass for the cattle being turned out upon, and the foddering in the yards with dry food must of course be discontinued; but they should never be turned out till this case, as where they are turned into grass not sufficiently advanced in growth, they will, Mr. Young observes, require such a number of acres, that the mowing ground will be greatly curtailed. Much attention is now necessary to the farm yard system, and it is advised that as soon as the yards are cleared, if the farmer be in the mixing system, the dung in them be turned over, and mixed carefully with the stuff beneath, whether it be chalk, marle, turf, ditch-earth, or whatever sort. "For this purpose, he must set many hands to work, so as to get it done as expeditiously as may be; because it should lay a little after turning before it is carried on to the land. It thereby undergoes a fresh fermentation, and becomes more rotten." In the performing of this work, Mr. Young recommends, that the men should "begin and throw the dung up against a wall, or into some vacant space, so as to have the command of a trench to work in: they should always keep this trench three or four feet wide: then they draw down with *dung-cromes* the dung, and, breaking it to pieces with a fork, throw it up on the part already mixed, in a spreading manner, so as to cover all the chalk or earth. In this manner they should proceed with the dung, to the breadth of about 18 inches, or two feet, till they come to the stuff under it; all which they should pull down with pick-axes or mattocks, and, when it is in the trench, break it further to pieces, so as to have it fine; that is, no pieces larger than a man's wrist. If water hang in any places in their trench, they should have a water-bowl ready to throw

it on to the part they have mixed. If this work is well executed, the farmer will have a large hill of excellent manure, ready to lay on to the cabbage or turnip land, to be turned in by the last earth. " This quantity, when he has managed well, " may be from 15 to 20 loads for every head of great cattle, and about 10 loads for every hog, not reckoning pigs, and not above a third of the whole marle or earth. Every trussed load of straw, when trampled into dung, will make six cart ones of dung." It is added that " the earth, which has lain under the dung all winter, and received all the urine of the cattle, is by no means to be reckoned as inferior to the dung itself. " It is," Mr. Young thinks, "become a rich manure without mixing with dung, richer than the best of marles: and he is well persuaded, that this retention of the urine in it is of such consequence, that the whole compost, when well mixed together, will be better than if chalk or earth had not been brought into the yard, at least for most soils: but, that the favourable circumstances of the conduct much exceeds the expence of it, for all soils, cannot be doubted. The principal recommendation of this farm-yard system is the cheapness of thus manuring the land: the farmer will find, that he can, in no other method, manure at nearly so small an expence. Purchased manures come higher; many of them much more expensive, in proportion to their value," and " in some situations there are no manures of any sort to be purchased; in such, the farmers, if they do not adopt such a plan, must give their land a poor chance; for it must be an admirable soil, or course of crops," he says, " to render manure unnecessary." But later experiments have led to another system of practice, which is, that of using the manure in a less reduced condition; the propriety of which should be ascertained on the particular land of the farm. On this last plan nothing will be necessary till the manure is wanted for the turnip crop.

This is the proper period, of course, to determine what fields are to be conducted under the feeding system, and what under that of the scythe. The question here to be considered is, whether one plan should be exclusively practised, or the different ones alternately had recourse to. On this subject Mr. Goring has given an useful observation in a valuable paper in the third volume of Communications to the Board of Agriculture. " He does not," he says, " admit that grass-land should be mown and fed alternately; it is certainly the way to go on the longer without manure, and as certainly the way to ruin (*pari passu*) both fields in the end. In order to maintain its proper quantity of stock (we used to say) the land must be used to it; and the more it will keep; four this year, five the next; give it a little manure, more stock will follow, and so on till it has attained its ne plus ultra, if that point be to be attained. Land that has been used to the scythe will not (*cæteris paribus*) keep so much stock and so well as an old pasture, though it may have been better manured; neither will old pasture produce so much hay as the other; each will grow as it has been accustomed to grow; but the old pasture has an inherent sweetness in it, as well as virtue, which is hardly to be seen upon the ground, but is to be felt upon the rumps and sides of the ox; or to be discerned in the number of sheep which it maintains."

The management of new laid down lands should be at this time particularly attended to, which in the most improved practice is generally by being fed with sheep, in preference to that of conducting them under the scythe. Heavy stock should rarely be admitted except where the lands are very dry, and in these cases only for a little time. Where bents rise they may be swept by the scythe, before they have run up to seed, except where the grass is thin, when they may sometimes be permitted to seed with advantage. These new lays are likewise better when fed in the same way, the second year. See *Lays, and Laying down to Grass.*

Great attention is likewise requisite during this month to the cattle stock, to see that they consume the grass in the most œconomical manner and with the least waste. The modes of effecting this in the most advantageous ways in different cases may be seen under the head *Grazing;* as many circumstances are necessary to be attended to in the consumption of the grass, as that of the improvement of the stock.

The cake and corn-fed beasts that may remain should be properly managed at this period. In some cases they may be removed to the grass without sustaining much injury, or cake may be given them along with it, in which method they have been found to go on well. The farmer therefore need not part with them on this account. See *Stall-feeding.*

Towards the latter end of the month, on the lighter sorts of soils, crops of buck-wheat may be sown, for the lands will have had sufficient time to be in a fine state of tilth, and it is a highly profitable crop where barley cannot be put in sufficiently early. Burnet and saintfoin may likewise be sown with the buck with much advantage at this season in many cases where the soils are of the suitable kind, See *Saintfoin, Burnet,* and *Buck-wheat.*

And lucern may still be sown with advantage on proper kinds of land, as they may be rendered perfectly fine and clean by such a length of time being given, which is of vast advantage in the culture of this sort of crop. The farmer should always have a proportion of this kind of crop, fully adequate to his teams. See *Lucern.*

The hand-hoeing of carrot crops should be performed at this period where it has been omitted in the preceding month, and such crops as were then hoed, should now have a harrowing, and be hand-hoed a second time towards the end of it with nine inch hoes, setting out the plants to the distance of a foot.

The early planted potatoe crops will now also require a hand-hoeing, which should be done in a perfect manner, so as to leave the surface perfectly clean and in a fine state of mellowness. The crops in rows besides a hand-hoeing should have the earth removed from them by the swing plough, so as to form ridges in the intervals, the work being done in an attentive and very effectual manner.

The late crops may likewise now be put in, and some farmers consider this month as the most proper season for the business on account of the tenderness of

this root, and its being frequently injured by frosts in the green shoots.

The cabbage crops planted out in the preceding month should have a hand-hoeing towards the latter end of this month, but only on the tops of the ridges just about the plants, the weeds being cut up, and the mould left fine, being brought up a little round the stems of the plants. And in a fortnight afterwards the first horse hoeing should be performed so as to leave a ridge in the intervals, which will be of vast benefit in promoting the benefit of the crop, and in preparing the mould for being laid to the plants in the following month.

The ground to be planted in the following month should have now an earth given it, throwing it on to the proper form and size of ridge, for being planted upon. And it should not on any account be omitted, as the early part of the succeeding month will be taken up by bringing on the manure.

This is the common practice with cabbage crops that have been raised in the seed bed, and transplanted out; but there is another method which is by many supposed to have a superiority, which is that of drilling in the seed at the beginning of this month where the plants are to stand. It was practised by the late Mr. Bakewell, and has the advantage of saving the trouble and expence of transplanting, and, what is of much more consequence, of being more certain as well as secure against the droughts of the following month, which often protract the planting till a full crop cannot be obtained. This mode should not be had recourse to, on foul land, as there is less time for preparing it. See *Cabbage*.

White corn, bean and pea crops, should now be also carefully attended to, and managed by the hoe.

The sheep should likewise be turned upon their summer pastures, and be managed according to the sort of stock which is kept. See *Sheep*.

At this period the practice of folding sheep is commenced in most of the southern parts of the island, and should be steadily pursued where it is much depended upon by the farmer. Mr. Young remarks, that many farmers give a very slight dressing: "one night in a place, and the fold three square yards per sheep; instead of which it should, he says, be two nights, and only two square yards, or but one yard. In a word, the land should be quite black, if arable; and with a pretty good covering, if grass. The proper arable lands to fold this month are the cabbage and turnip fallows: those crops will be sown and planted in June, consequently will reap the benefit of the manure directly." See *Folding* and *Sheep*.

The Swedish turnip may be sown about the middle of this month, and to the end. Mr. Young advises its being sown in the broad-cast method on land prepared by paring and burning, as bringing the plants more quickly to the hoe, and by that means preventing the fly. It may also be sown after common turnips fed on the land by sheep, and on a well reduced soil highly manured. See *Ruta Baga*.

Attention should be paid to the hoeing of the madder and liquorice crops in this month, the work being carefully performed in the former by eight-inch hoes; and the latter must be hand weeded at the same time.

Where the naked fallow system is in practice, an earth should be given to the land during this month, in order to destroy the weeds brought up in consequence of the ground being left fine in the preceding month.

Much regard should now be paid by the careful farmer to the management of swine, and when the yards are cleared of the cattle, they should be looked over and sorted: those of a proper age for being turned upon the clovers and other green luxuriant crops, should be drawn and turned upon them, as this is of much importance in the hog system; but probably a better plan is that of soiling them with green crops, as in this way much more manure is raised. See *Swine*.

The horse and ox teams should at this season be taken from dry meat, and be soiled with green food, such as lucern, tares, or clover, by which a vast advantage is gained in different respects. See *Soiling*.

It is necessary in this month to take care that the cow stock be kept well supplied with good food, in order that a full profit may be afforded in the calves or the produce of the dairy. The business of the dairy is now in the greatest height, and must be particularly attended to: and to derive the fullest profit from it, it should be under the immediate direction of the farmer's wife, as under other circumstances it seldom pays the expences.

The process of paring and burning may proceed with advantage during the whole of this month, a proper number of hands being provided to carry on the business with dispatch when the season is dry and fine for the purpose. The land is by this means readily brought into the state for turnips, which seldom fail on this preparation. The ashes should be spread out evenly on the surface, and be turned lightly in immediately afterwards.

This is the time to dig the new-planted hop-garden, earthing up the plants, and for seeing that no weeds are left to infest them. At this time the old plantations should be poled, proportioning the poles to the age and growth of the hops: and in a little time after, the binds should be tied to the poles.

The apiary should now be carefully watched in expectation of the bees swarming. This useful insect is not so much attended to by many farmers as it ought to be: not a farm-house should be without bee-hives, for the trouble they give is very trifling, and to farmers small profits should not be neglected.

Hemp and flax may be sown in this month where the farmer has ground sufficiently rich for the purpose; but they are crops that can only be grown to full advantage under particular circumstances of soil and situation, which should of course be well considered by the farmer. See *Hemp* and *Flax*.

The business of forming watered meadows may be had recourse to at this time in many cases with advantage. The different circumstances which are ne-

cessary to be attended to in such undertakings will be considered hereafter. See *Meadow*, *Watering of Land*, and *Irrigation*.

The business of soiling with green food may be fully entered upon and gone on with towards the close of the month, with different sorts of animals, the early tare, and lucern crops being generally in a state for being mown for the purpose. See *Soiling*.

The carting out of dung may at this period be proceeded upon, where the farmer is in the practice of making use of it in its raw or less reduced condition, which various facts and experiments would seem to prove to be the most advantageous in many different cases. Where it is removed at this season, it should however be turned into the soil as soon as possible, otherwise considerable loss may be sustained by the dissipation of the more liquid parts of it, from the constantly increasing heat of the weather.

MAY-WEED, a troublesome kind of weed, which is a species of wild chamomile; it is a trailing perennial plant, which puts out roots from its branches as they lie on the ground. By these means, and by scattering its seeds long before the corn is ripe, it spreads and multiplies greatly. It flowers in May, whence its name.

The best means of extirpating it are those of summer fallowing, repeated good harrowing, and burning the collected roots, as before directed, in similar cases. What escapes these clearings should be very carefully pulled up by hand; for the common weeding-hook will not go deep enough to take out the whole of the long slender tap root of this plant, of which every remaining bit that has a knot in it will produce new shoots. The farmer should not regret this small additional expence, to get rid of one of the most fatal enemies his corn can have. Mr. Lisle observes, that a "good crop of wheat in the winter time, was so destroyed by the coming up of May-weeds and poppies in the spring and summer, that it did not at last yield so much as the seed." Where proper tillage is practised, this can never happen.

MEAD, a name given to a liquor made from honey, and held in great estimation by most of the northern nations, but perhaps not esteemed here so much as it may deserve, if due care be taken to prepare it properly.

The writers who have treated of this subject, have generally given into an error with regard to the strength of this liquor, by directing too great a proportion of honey to be dissolved in the water. The usual practice of making it so strong as to bear an egg, is not correct. The liquor is thereby rendered a mere stum, and this bad quality is still increased by the long boiling generally practised. It is scarcely possible to procure honey so pure, but that some extraneous substance may be mixed with it; and this cannot be perfectly separated from it, except by boiling. On this account the boiling of mead seems indisputably necessary. In order the more effectually to separate these impurities from the liquor, some whites of eggs may be mixed with it before it is put on the fire, and it will be particularly necessary to skim off the thick scum that rises, the moment the liquor begins to boil; and this must be attentively continued so long as it boils. The only intention of boiling being to separate the impurities, and to make a perfect union of the water and the honey, both which purposes are very soon obtained, it evidently appears, that the boiling need be of but very short duration. This becomes more particularly necessary, because the liquor will be the less disposed to ferment kindly, the longer the boiling has been continued.

It is perhaps owing to the single article of long boiling, that mead has hitherto laid under so great discredit; because it then never fermented sufficiently to take off its luscious sweetness; whereas, had it undergone a due fermentation, that sweetness would have gone off, and the mead would have attained a fine racy flavour. It is the practice of some to add hops to the mead. This helps to take off its sweetness, and, as the bitterness of the hops goes off, gives it a pleasant flavour. A ferment is in this case generally wanted in all liquors that are boiled, to bring on a perfect fermentation: but as the least taint in the ferment is communicated to the whole liquor, particular care should be taken that it be very sweet and good. Mead when judiciously managed on these principles, will keep for years, and be improved by age. The racking, fining, &c. of this liquor, are the same as those of others of the white wine kinds.

MEADOW, a name generally applied to such grass-lands as are annually mown for hay; but more particularly those that are so low in their situations as to be too moist for cattle to graze upon them in winter, without breaking the sward, or poaching the surface.

Meadows, from their being generally enriched with the fine mould washed down from the adjacent rising grounds, are usually of a good soil, and seldom require much other improvement, than the removing of temporary imperfections, and the superabundant moisture by proper draining. But they may likewise be of such a nature as to stand in need of a more particular treatment: as is the case where their surfaces are of a mossy, loose earthy, or of a binding clayey quality.

They are likewise further distinguished into natural and artificial, or common and watered meadows.

The former, from their being situated in the hollows and sloping sides of the vallies, where the depth of the soil has been constantly increasing by the deposition of various sorts of vegetable and other matters brought down from the higher grounds, is, it is observed by a late writer, in a considerably greater state of fertility, and evidently better fitted for the permanent production of grass, than those from which they have derived their richness. It has been well observed, in the report of Staffordshire, that this, of all others, is "the most productive of grass and hay, yielding sustenance for cattle through the summer and the winter, and producing an everlasting source of manure for the improvement of the adjoining lands. And that in all cases of extensive inclosures, the improvement of the vale land, or that formed by nature for meadow and

pasture, should be first attended to. In this view, the low lands in all situations, come under the head of natural meadows."

The latter are those which lie contiguous to rivers or brooks, whence the water can be easily carried or conveyed so as to overflow the grass at pleasure. Of these there are large tracts in several parts of this country, which, where skilfully managed, become highly profitable to their owners, affording not only immense crops of hay, but yielding an abundant early grass for the use of ewes and lambs, in the beginning of the spring long before the pasture or other grounds are ready to receive them.

But as the former sort of meadow lands, from their retention of moisture in consequence of their situation, and the great depth of vegetable matter which they contain, are observed by a late writer to be liable to throw up much coarse herbage, of the aquatic or other kind; in many cases more drainage as well as other management is necessary to bring them into the proper condition for the growth of good herbage than is requisite in the hay grounds in more elevated places.

And that, "by a more particular attention in these respects they would in many instances be rendered a vast deal more productive than they are at present, and at the same time afford a much better and less coarse herbage. They would also admit stock upon them, a much greater length of time, both in the autumn and spring season.

"The most proper season for surface draining grass lands, is in the autumn, when they are firm and dry, as in the early spring months, such lands are too full of moisture. The grips or small open drains should be cut obliquely in the most suitable directions for conveying off the superficial stagnant water. It is a practice in some cases to suffer the sods or grippings that are taken out of the trenches to remain on their sides; but it is much better and a less slovenly mode to have them conveyed from the land, and laid up in heaps in order to their being acted upon by the winter frosts and other causes, so as to be brought into a state proper for being formed into composts with well rotted farm-yard dung. Much of this sort of draining may be performed at a small expence, and the beneficial effects be very considerable, especially where the lands are very much loaded with moisture, in the quantity of produce." This may be more fully understood by consulting the article Draining. See *Draining of Land.*

Besides, such meadow lands, he says, "demand much more attention in their management in other respects, as those of their being fed by cattle, and the performing of the different operations that are proper for rendering them productive of good herbage. In these cases stock should be turned upon the lands, and manures be applied with much care, and only when the land is in such a state of dryness as not to be injured by the poaching or breaking of the sward. The higher sorts of grass lands in most instances admit of considerably more latitude in performing these different operations, as they are capable of admitting the stock as well as the dung cast more early in the spring months, and of suffering them to remain to or be applied at later periods in the autumn without inconvenience. The advantage of this attention is rendered sufficiently plain by the effects which the contrary practice produces in such meadow and other hay lands as are in a state of commonage where the stock is admitted at all seasons, and under all circumstances."

It is obvious that "these sorts of grass lands must be applied to different purposes, according to their nature, situation, and other circumstances. Those which are of the more moist and wet kinds, whether from the nature of the soil, or the peculiarity of situation, and which have been a long time in the state of sward, are for the most part kept under the scythe; while those of the contrary descriptions that are situated at a greater height, and of course, in most cases, possess a greater degree of firmness, are in general appropriated to the purpose of pasturage; though in particular situations, where grass land is scarce and consequently of great value, they are occasionally likewise converted to the purpose of hay. And as grass plants grow to the greatest height in situations where a considerable degree of moisture is constantly preserved, and of course afford the largest produce, it would seem, that the practice of keeping them under the scythe is right on this account, as well as that of their being less firm and solid in their texture, and their mostly producing a coarser herbage. The more elevated grounds, as they bear the stock generally with less injury, and often afford both a more fine and sweet seed, are with propriety converted to the use of being fed down by cattle and other animals. By a suitable management in the feeding and use of manure the latter sorts of land may even be brought to afford a considerable produce in hay.

"As it must be evident to the most superficial observation that the breaking of the surface texture of sward of grass lands must in all cases be prejudicial, not only by the destruction of plants which is thereby immediately produced, but also by the retention and stagnation of water upon them in the holes, and depressions from small portions of the turf being forced in, the necessity and utility of clearing and removing all sorts of live stock, and especially those of the heavy kinds, on both these descriptions of meadow lands when mown, becomes strikingly obvious."

A striking fact of this sort is stated in the Agricultural Report of Middlesex. "In a piece of clayey meadow land exposed to the treading of cattle during the wet season of winter, with the view of fully ascertaining the effects of the practice of suffering cattle to remain too long upon grass hay lands, it was found that after three years, notwithstanding every possible care and attention in rolling, manuring, and sowing grass seeds was employed, it was not restored to its former state of sward."

And it has been remarked that on the deep tough yellow clayey grass lands in the same district, every care is taken to prevent the least degree of poaching, as "it is well known that wherever a bullock makes a hole with his foot in this kind of soil, it holds water, and totally destroys every vestige of herbage, which is not quite replaced till several years after the hole is grown up."

The exact period of performing this business cannot be easily regulated by any fixed rules, as it must depend much on seasons; but it should never on any account be delayed after the grounds have become so much impregnated with moisture as to easily give way to the tread of animals. In the autumn season the heavy cattle seldom should be suffered to remain on the softer sorts of lands longer than the beginning of November, but in those of the more dry kinds, they may be let remain to the end of that month. Sheep stock may, in the dryer cases, be continued till February or later; and in the spring season, if pastured at all, they should not be admitted upon such lands till they begin to possess a proper degree of firmness, which will depend on the various circumstances of the preceding season. On the more low and moist sorts of meadow land, it can probably seldom be ventured earlier than the middle of March.

But it is obviously a much better practice, especially where hay is the main object, not to eat them down at all, or very little with cattle in the spring, and not so much as is the usual custom with sheep; as it is plain that by this means the cultivator will not only ensure a more abundant produce, but a much earlier one, and of course have more advantage in the making it into hay and securing it.

And where the lands are fertile and the grass springs quickly, as is often the case near large towns where manure is plentiful, it may be advantageous in the view of having a second crop, as by that means the after-grass may be cut more early, and be less in danger of being well secured; besides, in all events the aftermath will be in a more forward state, and of course ready at a more early period for the admission of stock of different kinds, which, in many cases, is a circumstance of great importance to the farmer.

The most proper periods of shutting up such grass lands as are designed for hay must, like those of eating them down by stock, depend on various circumstances that can only suit the particular cases. In general, however, it is the best practice not to delay it too long. When the lands are not eaten at all in the spring by cattle, after the sheep have been removed about the middle of February; nothing farther is allowed, according to the writer of the Middlesex Report, to enter the meadows, by which means a quick vegetation is promoted, as well as a more plentiful crop and a more early hay harvest. And in other cases it should probably seldom much exceed the beginning of April, as when eaten much later, especially in the southern districts, there is not time for the grass to produce a full crop before the commencement of the hay season, of course the farmer sustains more loss than can be repaid by any advantage in the additional feeding he may obtain. This is therefore the best practice where the view of the farmer is hay: and it should be particularly adopted and attended to in cow farms, where it is of much importance to cut early and at different times, in order to secure hay of a fine soft grassy quality, for the purpose of producing large supplies of milk. In these cases it is cut two, three, or more weeks before the usual period, as it is better not to let the seed stems rise.

After the meadows or other grass lands have had the cattle and other sorts of live stock removed from them in the early spring months, and been shut up for hay, they should be prepared for the scythe by having all sorts of obstructions picked up and removed. This work should always be executed as soon possible, before the grass begins to spring up too much and conceal them, as it is difficult to perform the business effectually afterwards.

It has been observed that "it is an excellent practice, but one that is too much neglected by grass farmers in general, to have all sorts of coarse plants of the aquatic and other kinds, such as rushes, fern, docks, thistles, and various others, effectually drawn up and eradicated both from the hedge rows and other parts of the fields, in order to prevent their running up to seed and disseminating themselves over the lands, and thus, not only fill them progressively with all sorts of trumpery, but greatly injure the herbage. In a field on an extensive hay farm in this neighbourhood, on perceiving the whole surface thickly studded with thistle plants, it was found that this sort of plants had been suffered to flower and perfect their seed annually, until the lands on every side had become fully stocked, to the vast injury of the crops. The same thing takes place with the dock and several other noxious plants, which strongly enforces the utility of the practice just recommended. The annual expence of performing the business is but a mere trifle, while the advantage will be real and permanent. The saving to the farmer would be considerable by having the work regularly done as soon as the weeds show themselves, and at the same time his young hedge plants be prevented from being destroyed by being shaded and choaked up by so many weeds. In order to take them up in a perfect manner, a narrow implement of the spade kind, such as is made use of in forming narrow drains, may be employed with advantage, as cutting or breaking them off is by no means effectual. After such plants have been removed and the ground well cleared, sowing the banks and hedge-rows with the best grass seeds, white clover and other plants, might be an excellent practice, as in this way the lands may be improved rather than injured."

And plants of the rush kind may be easily removed by preventing the stagnation of moisture near the surface, by judicious under or surface draining, and the application of substances of the saline or calcareous kinds, such as ashes, lime, drift from the roads, and other similar materials. These are best made use of in a dry season, in either the autumn or spring, but the latter is probably the best, as these absorbent matters will thereby be made use of at the time such plants begin to shoot and establish themselves, and when there will be the least danger of their operation being lessened or prevented by too great a degree of moisture. It has been observed, that in naturally coarse meadows, or such as become so in consequence of rushes growing upon them be-

fore they have been rendered sufficiently dry by draining, it forms a great improvement to apply a thin coat of sand evenly over the surface of them, in proportion of from twenty to thirty common loads. By this means the sward is rendered much finer and a much better sort of herbage brought up, white clover being predominant in most cases.

There is another method that in particular situations may be more easy and convenient, and which has been found to quickly destroy plants of this coarse kind by bringing up those of a finer description: this may appear extraordinary at first to those who have not seen its sudden and astonishing effects in this way. It is that of conducting water over the surface of such grounds; but in this intention it should not be suffered to have the least degree of stagnation, but be conveyed off with as much expedition as possible by suitable drainage.

Long since M. de Chateauvieux invented a machine with three sharp coulters for cutting the land about 6 or 7 inches deep, that the manure laid upon it might be washed into the incisions made by the coulters, and which also by cutting the old roots of the grass, many new roots were produced, and a very great miprovement afforded, particularly where the meadows were hide-bound, or over-run with moss; he called this instrument a cutting plough. Afterwards Mr. Wynn Baker added two coulters, and named it a *scarificator*, which is considered a very useful instrument for the purpose of improving both meadows and pastures. And it has been found in practice, that if the land is first scarified, and then manured, the improvement is greater than scarifying the land after laying on the manure.

This sort of business is said to be well performed by a sward dresser invented by Mr. Amos. See *Sward-dresser*.

Where meadow lands are properly situated for the purpose of being watered, they may be formed properly for the purpose, probably with the most advantage in the early autumn, but when that season cannot be conveniently employed, it may be performed early in the spring. The methods of cutting the trenches and of managing the whole of the process, as well as the vast utility of it, may be seen under the heads to which they belong. See *Irrigation and Watering of Land*.

In the beginning of November the farmer should commence the watering of his meadow lands, which in most instances affords more improvement than a dressing of the best manure that can be provided. As it is the lower parts of the ground that can be made use of in this way, much may often be effected by a proper attention to the ditches in the lands that lie at higher levels, as by keeping them in such a state that they may discharge themselves freely into a large ditch a little above the lower parts of them, from which it may be let off occasionally, so as to float the meadow grounds below, care being taken that it does not stagnate upon them.

In managing this sort of operation afterwards, Mr. Wright advises that the floater should take care to keep the land sheltered by the water from the severity of frosty nights. In the winter, as about January, it is necessary however, he conceives, every ten days or fortnight, to give the land air, and to lay it as dry as possible, for the space of a few days. "Whenever the frost has given a complete sheet of ice to a meadow, it is advisable to discontinue floating, for the frost will sometimes take such strong hold of the land, as to draw it into heaps, and injure the evenness of the surface. Attention is also to be paid to prevent the equal distribution of the water being obstructed by the continual influx of weeds, leaves, sticks, &c." And, as the season advances, still greater attention is required from the floater, as in the following month, "if the water be suffered to flow over the meadow, for the space of many days without intermission, a white scum, the same writer observes, is generated, which is found very destructive to the grass; and if the water be then taken off, and the land exposed in its wet state to a severe frosty night, a great part of the tender grass will be cut off. In Gloucestershire, two methods of avoiding these injuries are, he says, practised. One is, to take the water off by day, to prevent the scum, and to turn it on again at night, to guard against the frost; the other method is, to take the water off early in the morning, and if that day be dry, to suffer it to remain off for a few days and nights; for if the land experiences only one drying day, the frost at night will do little injury. The former of these practices, where it is found not too troublesome, is preferable to the latter." About the middle of February the floater should begin to use the water rather more sparingly than in autumn or winter, for his chief object now is, to encourage or force vegetation. It is mostly found, that about the last week of this month, if the preceding management has been good, there will be a pretty full bite for ewes and lambs. Some advise rolling in the beginning of the year, as about January.

According to the same author "about the beginning of March the grass on the old floated meadows will generally be sufficient to afford an abundant pasturage to any kind of farming stock, and the water must be taken off for nearly a week, that the land may become dry and firm before heavy cattle are admitted. It is proper, in the first week of eating off the spring feed, if the season be cold or rainy, to give the cattle a little hay in the evening to intermix with their moist food. But the grand application of the young meadow grass is, Mr. Young says, for ewes and lambs, and attention should always be paid to hurdling off the grass, and giving stripes across the meadow, exactly in the way that turnips are hurdled for sheep. The caution of Mr. Boswell, never to feed on these meadows any heavier stock, in spring, than sheep or calves, seems to be judicious, but must obviously depend much on soil, for upon a sound gravel, a practice may be admitted which would be mischievous on a peat meadow."

Good rich meadows, whether watered or not, are mostly ready to be cut about the middle of June.

According to Mr. Boswell, "as soon as the hay is cleared from these meadows, cattle of any sort (no

sheep) should be turned in for a week to eat the grass out of the trenches, and what may be left by the mowers. Then the water should be worked on them, care being taken to let it only dribble over every part as thinly as possible, this being the warmest season of the year. The first watering should not last longer than two or three days, before it is shifted to another meadow: there will soon be an after-grass of such a rich and beautiful verdure as will astonish a spectator not accustomed to it; and the quantity and quality will be beyond conception, compared with the state the lands were in before they were watered. He also further cautions us to guard by all means against keeping the water too long upon the meadows in warm weather. It will very soon, he says, produce a white substance like cream, which is prejudicial to the grass, and shews it has been upon the ground too long already; but if permitted to remain a litle longer, a thick scum will settle upon the grass, of the consistence of glue, and as tough as leather, which will quite destroy it."

MEADOW-*fox-tail grass*, a sort of field grass that may be cultivated to advantage on the more moist sorts of soil. It is said to be early and productive. See *Alopecurus pratensis*.

MEASURES, vessels of capacity employed in measuring grain and other articles. See *Weights* and *Measures*.

MELICA, melic-grass, a genus of grasses; of these are several species, none of which have yet been cultivated in the field for the purpose of feeding cattle or other sorts of live stock, though some of the species are said to be fed upon by sheep.

MELICERIS, in *Farriery*, a disease in horses of the encysted tumour kind, so called, from the resemblance it bears to an honey-comb. It attacks the joints, sending forth a gluey matter like honey. The common way to cure these tumours, is to burn them with a red-hot iron, in order to bring away all the matter, and to heal the ulcers with resin and wax melted with hogs-lard, washing them with cold, or rather sea-water, if it can be procured. They may probably be removed by opening and digesting out the bags containing the matter in the usual way, without using the burning iron.

MELILOT, the name of a plant of the trefoil kind, which grows in such abundance among corn in some districts, as to be a most troublesome weed. As it is hardly possible to separate it from the corn in reaping, so they are housed together, and the seeds of the melilot, which ripen about the same time as the corn, are threshed out with it; after which, as they are heavy, it is very difficult to separate them. If but a few of these seeds are ground with the corn, they spoil the flour; as the bread, or whatever else is made with it, has a strong taste and smell of melilot. The roots of the plant are strong and woody, and from them spring out several stalks, which rise from two to four feet in height according to the goodness of the land. These stalks branch out, and are garnished with trifoliate leaves, having oval sawed lobes of a deep green colour. The flowers are produced in long slender spikes, which spring from the wings of the stalks, and are of a bright yellow colour, being shaped like the other butterfly flowers, and succeeded by naked seeds, which ripen in August.

The great luxuriance of this plant renders it in, the opinion of Mr. Young, an object of cattle food.

MELLIT, in *Farriery*, a distemper in horses, in which dry scabs are produced upon the heels of the fore-feet.

They may be removed by the use of a sort of plaister prepared as below:

Take of common honey, half a pint; black soap, a quarter of a pound: mingle them well together, adding four or five spoonfuls of vinegar. Alum, finely powdered, half an ounce; of fine flour, two spoonfuls. Let them be well mixed together.

Clip away the hair from the part affected, and then apply it to the sore after the manner of a plaister; let it remain five days or more. It should then be taken off, and the part again well washed, repeating the application as there may be a necessity.

When the sore is dressed, always pull off the scab, or any crusty substance that may be upon it, and also wash it quite clean.

MENDING, a term used to signify the improving of land by means of manure.

MERINO-SHEEP, a breed of fine-woolled sheep lately introduced from Spain, hence sometimes termed the *Spanish-breed*. They are characterised by the males having horns, but the females being sometimes without them, by having white faces and legs, the latter rather long, the body not very perfect in shape, fine in the bone, some degree of throatiness, the pelt fine and clear. The weight when fattened in some degree, in the rams about 171bs. in the ewes 111bs. The wool is very fine. They are said to be hardy, and to have the property of fattening in a pretty expeditious manner. See *Sheep*.

MESLIN-CORN, a term applied to wheat and rye produced in a state of moisture.

MET, a term applied to a measure which contains a strike, or four pecks.

METALLIC SOLUTIONS, such watery fluids as have some sorts of metals suspended in them in the state of solution. These sorts of liquids were formerly supposed to have a highly noxious or poisonous effect when applied to plants as manures; but some late experiments made by Dr. George Pearson seem to lead to a different conclusion. See *Vitriol of Iron*, and *Sulphate of Iron*.

This is further confirmed by the remarks of Professor Barton, who in a letter to the Doctor states his having been several years engaged in an extensive series of experiments relative to the effects of various stimulant substances, such as camphor, &c. upon vegetables, as well as on the absorption of certain powerful mineral substances into the organical system of vegetables. "In numerous instances, he says, he has subjected the stems and leaves of plants, young and old, large and small, to the influence of the sulphates of iron and copper, and has found that both of these metallic salts are very greedily absorbed by vegetables, in so much that he has detected the presence of iron in the vessels of a branch of a mulberry, at the height

of five or six feet above the place of immersion in a solution of the sulphate of this metal."

A full account of his experiments he designs to communicate to the public in two memoirs. He observes in the meanwhile that the sulphate of iron applied to vegetables in the manner he has mentioned "is only a poison, like almost every thing else, from the over dose," as mentioned by the Doctor. "In several of his experiments, the branches of vegetables that were placed in vessels containing solutions of the sulphate of iron and copper, lived longer and exhibited more signs of vigour, than similar branches that were placed in equal quantities of simple water. It is true, that in many other experiments these metallic salts proved fatal to his plants, but this was when he employed too large a dose. In like manner he has found several years ago that camphire, by greatly stimulating, often kills vegetables; and yet when properly dosed this is a very wholesome stimulant to plants; he had also found that large doses of nitre (which is unquestionably a powerful stimulant both with respect to animals and vegetables) produce an appearance like genuine gangrene in the leaves of vegetables; and yet it is certain that nitre when it is judiciously dosed may be made to greatly assist the healthy vegetation of plants."

METEYARD, a term applied to a staff of a certain length for taking measures.

METTLE, in *Horsemanship*, a term used by dealers to express spirit, vigour, or heart. The differences between a mettled horse, a horse of vigour, and a fiery horse, are thus distinguished. When a horse is standing still, the rider who has a mind to try whether he has vigour in him should keep him fast with the bridle-hand, and apply the spurs to the hair of his sides: this is called by horsemen pinching. If the horse is impatient under this, gathering himself up, and endeavouring to go forwards, and champs upon the bit, without thrusting out his nose, it is a sign of vigour and mettle in him. Some caution is to be used, however, in judging by this, to distinguish between a horse that has vigour really in him, and one that has only a fine skin, and is rather ticklish than mettled. This is the case with a great many horses, and is found by their being very sensible of the touch of the spur, and shewing the appearance of a great deal of mettle and vigour when touched, but immediately losing the apprehension of it. These are, in fact of a dull disposition, and only have a tender skin. It may be observed, that "the mettled horse is to be highly valued; but the fiery one is good for nothing. A horse that is truly vigorous should be calm and cool; he should in general move on patiently, and only shew his mettle when it is required of him. In making purchases, the surest method is to choose such horses as are extremely apprehensive of the strokes of the spur, and are afraid at the least appearance of their coming. These, at only the closing of the legs and thighs, seem to be seized with fear, and alarmed, but that without fretting or fierceness. A horse that walks deliberately and securely, and that without requiring the whip too often, will go on briskly and without fretting; will go from the walk to the gallop, and as easily from the gallop to the walk again, and continually champs upon the bit, and trots with freedom, upon the shoulders easily, and snorting a little through his nostrils: this is generally a creature of true mettle and vigour, though it does not rise to such a fierceness as is troublesome or dangerous. If to these good qualities a horse be well upon his haunches, and have a light and easy stop, his head well placed and firm, and the feeling of his bit equal and just, the buyer seldom need to complain of the price. All the good qualities of a horse should not, however, recommend him, unless he has a good mouth and is obedient to the spur and whip."

MICE, a very destructive sort of vermin to many sorts of crops, and which should be destroyed as soon as possible. See *Vermin*.

It has been remarked by the author of Phytologia that "the destruction of grain after it is sown, by field-mice, which mine their way very quickly under newly ploughed lands near the surface, is supposed by Mr. Wagstaff, in the papers of the Bath Society, to be effected in some seasons to a very great extent. And that the tussocks of wheat, seen to arise in many fields, are owing to the granaries of these diminutive animals, which he has often found to contain nearly a hatful of corn, which grows into a turft, if the owner becomes accidentally destroyed. It is also further asserted that they feed much on the young plants, as they arise from the seed, and multiply at that time very fast. He detects their habitations by small mounds of earth being thrown up on or near the apertures of their dwellings, or of the passages, which lead to their nests or granaries; and by following the course of these passages he found and destroyed the parents and the progeny." He likewise "recommends the taking up and dividing the tussocks of wheat, thus sown in the autumn by the field-mice, and transplanting them in the spring; and also to thin other parts of a young crop, as they appear too thickly sown, which he esteems an advantageous practice."

It has also been found, that "acorns when sown, as well as garden beans, and peas, are liable to be dug up or devoured by these voracious little animals, which may be destroyed by traps baited with cheese; or best of all, by the encouragement of the breed of owls, so active in the pursuit of nocturnal vermin, and thence so useful to the gardener and farmer, who still permit their servants and children to destroy both their eggs and callow young."

It has also been found, that these little plunderers may be readily destroyed by the use of the poisonous substance, usually known by the title of *nux vomica*, which should be finely rasped down, and mixed with some sort of meal or other similar material.

MIDDING, a provincial term applied to a dunghill.

MIDDLE-HORNED, a term applied to an useful breed of neat cattle. See *Cattle*.

It is distinguished by different characteristic marks in the different varieties; which in the Devonshire sort is by a high red colour without white spots, by a light dun ring round the eye, by the

muzzle having the same colour, by being fine in the bone and clean in the neck, by the medium length of the horns and their being turned upwards, by being thin faced, fine in the chops, wide in the hips, with a tolerable barrel, rather flat on the sides, by the tail being small and set on high, by being thin skinned and silky in handling, and by the property of fattening at an early age or arriving quickly at maturity. They are admirably fitted for the purpose of draught in hardiness, quick movement, and the form of the shoulder.

The varieties of this breed are the Devonshire, the Sussex, and the Herefordshire, all of which are highly useful cattle, and differ in some slight particulars from each other, as may be seen under the head of Cattle, where a full description of each is introduced. See *Cattle*.

MIDDLE-TEETH, in *Farriery*, the same with the gatherers or nippers, in the horse. See *Teeth*.

MILDEW, a disease frequently destructive to corn, pulse, and other crops.

According to M. Duhamel, "it attacks the blades and stems of corn, which it covers with a powder of the colour of rust of iron, when at the height of their vegetation. This substance does not adhere strongly to the blades; for he has seen the hair of white spaniels full of this powder, after they have run through a field attacked with this disease. It is likewise known, that if the infected wheat is washed by a plentiful rain, the rust disappears almost entirely, and the grain suffers little from it. The French give it the name of rust, from the colour of the powder, and it seems to be the same distemper which the Roman writers call *rubigo*. He says, that the cause of this distemper is usually said to be dry gloomy weather, happening while the corn is at the height of its vegetation; and in effect, he has many times observed, that when a hot sun has succeeded such dry hazy weather, corn was rusted within a few days afterwards. It is not, he says, common in clear, dry, hot years: but when the spring is wet, the finest fields of wheat run great hazard of being destroyed by it, which generally appears upon the breaking out of the sun in the morning, after close and sultry weather, during which there has not been any dew. The rusty powder then gathers upon the blades in such quantities as to cover the earth around. M. de Chateauvieux cut off the mildewed blades, and found the trial answer: the same plants produced new blades, and throve much better than those on which this operation had not been performed, but this cannot be done except when the corn is very young. It is very fatal; as the finest wheat is suddenly brought almost to nothing, when it is entirely attacked with it.

"If it attacks the plants while they are young, and before their stems begin to rise, the mischief is sometimes not very great, provided there comes on a season favourable to their farther growth. In this case they are only weakened, as if they had been fed or mowed. They shoot out anew, and produce ears; though their straw is shorter, and those ears are smaller than they would otherwise have been. But if both blades and stalks are mildewed at the same time, the farther growth of the plant is stopt, and the grain gets scarce any more nourishment; so that the crop is exceedingly diminished."

It was observed by the same author that, "in the autumns of 1753 and 1754, when the corn was rusted, the second crop of hay was so likewise. The grass turned from a fine green, to the ugly rusty colour of the corn: it was covered with the same kind of powder, and its quantity diminished sensibly every day; and as the whole of a field of corn is not usually affected at the same time, so this distemper extended only to some parts of the meadow.

"The cause of this distemper is undoubtedly the same in corn and in grass; but its effect is not exactly similar. It may destroy annual plants, such as corn, entirely; but in perennials, like grass, it destroys only the leaves or blades. May not the preservation of these last be owing, he asks, to the taking off those leaves or blades, when they are cut for hay? But this is only conjecture; for he owns that he has not yet made any observation on this head."

These causes are however far from being satisfactory; but it is a difficult inquiry, and which has lately, especially by botanical writers, been considered in a very different point of view, as will be seen below.

The facts that have been lately presented to the public on this subject, show that it is not much influenced by soil, situation, or the nature of the climate. The answers that have been given to different queries on this matter, may probably lead to some useful conclusions.

Mr. Chatterton states, in the forty-fourth volume of the Annals of Agriculture, that "1. From what he has seen, and heard from others, it appears that all soils in this neighbourhood, Yorkshire, have had mildewed crops upon them; but, as far as he can judge, the heavy clays which had a good fallow have escaped the best." It is however afterwards observed, that "this was the case in some parishes about him, yet, for the most part, in the East Riding they suffered more severely than any others, upon whatever soil: the reason seems to be, that in general they were more luxuriant, and laid some time before they were ripe. And he also understands that crops on all soils (where thrown down) were the most affected with the disease, if it may so be called; from which it should seem not to arise from any previous cause, such as the season of sowing, the difference of seed or manure, &c. but from some uncommon bad state of the atmosphere not long before harvest, which most affected the straw that rested in an horizontal position. And farther, he has learned from a person who says he cut a field of wheat which was affected with the mildew, while in a green state (but not before the grain had arrived at a good degree of solidity), and that it is much better corn than others which were suffered to stand till ripe. On the sea-side, there appeared just before reaping time but little (in comparison) damaged in the vicinity of the beach; yet two or three miles from the sea it seemed as bad as in other places at a greater distance; and he has known when all the gardens have been ruined by frosts in the spring, at a distance from the

sea, that those upon the edge of the cliff have not suffered at all."

It is however afterwards observed, 2. That "both early and late sown crops have suffered; but which have suffered most, is hard to ascertain. 3. That it is not easy to say what situations have been most affected with mildew; he thinks it may be said all are nearly the same: he has observed upon the Wolds in Yorkshire a great deal that would not pay for thrashing; so bad was it, that hens would prefer shelling oats for their broods, rather than pick up the wheat that lay about them; and in the low lands at the foot of the Wolds, both on strong and light soils much of the straw appeared black in many fields.

"4. He thinks that both thick and thin sown crops have been equally affected.

"5. He imagines from what he has heard that old or new seed had no effect.

"6. That this subject seems to be enveloped in mystery, as several persons in this neighbourhood have had two fields of wheat adjoining each other—situations and soil alike—management similar in every respect, only not all sown at the same time—yet both may be said to have been sown in good season: the one field entirely escaped the mildew, the other so much damaged, that it was not worth thrashing. Something might here be advanced on earlier or later sowing; but, perhaps, not any thing that could in the least guide the farmer in his future management, as seasons are so various.

"7. That the crops on both kinds of land have suffered severely, and in some places both have escaped; without a general survey, it is hard to decide.

"8. But he has not heard of any difference in crops arising from difference of manure, but has not inquired much into this matter.

"9. He has not heard of the different kinds of seed being different in regard to mildew."

Mr. Amos's conclusions in the same work are, that in Lincolnshire the soils most liable to it, are "1. In general, light, loamy, and rich ones. 2. Late sown crops. 3. That there is very little difference in situations, but if any, high ones have the advantage. 4. That the quantity of seed has little or no advantage, but drilling the seed, he thinks, has, on account of the greater and uniform depth. 5. That he never knew any difference between old and new seed, with regard to the mildew in wheat. 6. That he attributes the sole cause of the mildew in wheat to mild winters, and to the inflammation of oxygen gas at the eve of harvest. 7. That fallow crops on strong clay soils have been least affected. 8. That all kinds of manures dispose wheat to mildew in such seasons; lime in some degree prevents it. 9. That he has no knowledge of the barberry having any effect at all on wheat. 10. That no kind of wheat that he knows of, is exempted wholly from the mildew. 11. That early cutting from early sowing, has the greatest advantage, but not before the milk in the grain is completely coagulated.

1st. In Staffordshire Dr. Lewis makes some observations on the disease, and means of preventing it.

2. He does not think it of consequence to the question, at what time of the season wheat is sown, because the period of the approach of the mildew cannot be even conjectured, as it has ever been variable. In this neighbourhood it so happened, that the wheat which was sown in September and November 1803, suffered in general more from the mildew than that of October.

"3. That high and consequently ventilated situations are doubtless more likely to receive a remedy to the disease than low and sheltered ones; but he believes they were all equally affected.

"4. That it has not appeared that any particular mode of sowing has been a preservative to the crop. That drilled corn, rather than broad-cast, is more easily cured, must, he thinks, be granted, if the drill be wide enough to admit a person to set his foot between the rows, because with a long pole, which, by means of straps, might be suspended from his shoulders across his breast to a proper height, he might brush off the greater part of the dew, as he walked up and down, to the extent of three yards on each hand: and indeed, in a field of broad-cast, the same means might economically be pursued, as it would surely answer to destroy a part of the diseased grain, which if left to itself would be good for but little, to save the remainder. Those crops which were strong and thick, suffered, in general, considerably more than those which were thinner. 5. That it does not appear to him that either new or old seed is of consequence to the question. 6. That the cause exists in the atmosphere, he has already said. He has no doubt, and he thinks we may fairly conclude its being of that kind which is termed phlogisticated; that particularly in the summer it is so loaded with the putrid effluvia of animal and vegetable substances, as to be incapable of attaining the height necessary to undergo the chymical process of purification by the action of the vitriolic, nitric, and muriatic particles with which the air of the higher regions is charged; and that therefore it descends in that undepurated and unwholesome fluid which we term mildew. It has frequently been observed, that in those seasons which have been preceded by a severe winter, the air is more pure than when the winter has been mild; but whether the mildew has been more prevalent after a hard or temperate winter, has not yet made a part of his observation. Late frosts and fogs are generally reckoned inimical to vegetation, though he never heard it suggested that they are in any degree connected with the succeeding mildew. That crops on fallows and those on layers have shared an equal fate. 8. Nor has there been any difference in consequence of different kinds of manure. 9. That the barberry tree is of such rare growth in this parish, that if it had any effect upon wheat, it could not but have been ascertained long since, beyond controversy; but when once an idea has gone abroad, every instance in favour is deemed a proof, while the many in contradiction are never advanced. He hesitates not to pronounce that it has *no effect* on wheat. Mr. Barker of Congreve, had last year, within fifty yards of his barberry tree, one of the best crops of wheat in this neighbourhood; while Mr. Keeling his next neighbour, at two hundred yards distance from the same tree, and

near no other, had a crop as bad as Mr. Barker's was the contrary. He knows not of five barberry trees in this parish, but there were more than fifty times as many bad crops; which proportion he dare venture to say, will be found to bear throughout England. How then can it be concluded that the tree is so peculiarly pernicious in this instance? Since writing the above, he has received an account of Mr. Makerell, who lives in the parish of Brewood, having had a fine piece of wheat, not in the least affected by the mildew, though immediately in the vicinity of a hedge almost entirely composed of barberry bushes. 10. He has never either seen or heard of any exception in favour of wheat of the bearded kind, nor indeed of any other; nor yet that any one sort suffered particularly. 11. That as the mildew totally prevents those ears which it affects, from coming to any perfection, it does not strike him that the period of its being reaped can be of any consequence, and if not it must be best to let it stand till the straw has received its full benefit."

Mr. Richard Lumbert's statements are, "1. That no soil is peculiar to the mildew. 2. That late sown crops have generally suffered most; but there have been instances of the reverse. 3. That low and sheltered situations have suffered most; but this has been, perhaps, attributable to the wheat growing more luxuriantly, from its situation, than the stamina of the land could support when it was arriving at maturity: to this may be added a want of ventilation. 4. That a huge crop may be considered a cause of mildew; for an unkind season, or want of stamina in the land, may check the vegetable mucilage before the corn is completely filled, and thereby produce a predisposition to mildew. 5. That no difference is observed in new and old seed, where the situations have been similar. 6. That the first cause of mildew is," he thinks, "a predisposition in the wheat. This predisposition is created by a decrease of mucilage in the straw, which allows the watery particles to insinuate themselves, and still further check the circulation of the juices in the stem that are necessary to the perfection of the grain, and had before become languid from the unkindness of the season, or the feebleness of the soil. When the watery particles have insinuated themselves, the straw becomes discoloured, and he has no doubt but a complete putrefaction would immediately succeed it, if it were not prevented by a circulation of air. At all times during its growth, barley and oat straw appears to have sufficient mucilage in itself to resist the effects of the watery particles; but when it is cut it becomes like the stubble in the fields, and cannot much longer resist it. 7. That fallows and layers have been equally liable. 8. That he has observed, that an over luxuriant growth in the spring is favourable to the mildew, and has noticed that that luxuriance may be produced by particular manure, such as green vetches ploughed in, &c. which seems to cause a considerable fermentation in the soil, and produces a rapid vegetation for a short time. 10. That he has not noticed a difference. 11. That early cutting and laying down is most clearly beneficial; and if the wheat is severely affected, it is almost impossible to cut it too soon."

The facts collected by professor Balsamo in Sicily and detailed in the same work, lead to the same conclusions.

It is stated as "evident that the mildew was common to the grain of all Sicily, without exception of kind, of soil, exposition, or other circumstances. It attacked, in different degrees, the barley, oats, and the plants of meadows; almost all plants, whether spontaneous or cultivated: and this consideration proves to him that the opinion which attributes the distemper to fogs and dews, is erroneous; nor is it at all probable, that any meteor should, *at one time*, be the cause, in places which, from the vicinity of mountains, rivers, and a multitude of other circumstances, had a very different climate from each other; and from the observations registered at the Royal Observatory, it appears, that, as every one knows, the fogs were rather heavier and more frequent in April and May 1803, when no mildew ensued, than in the same months in 1804, when the great mischief followed. And many cases have occurred to him of spots peculiarly given to fogs, and from which the countrymen augured a ruinous mildew, yet bright and clear crops were produced, while spots more free from fogs have been attacked." The same reasoning may, he thinks, "be applied to dews; these are more frequent and copious in the vicinity of rivers and stagnant waters, than in other places; and it is true, that in many of these last, and in more than of the first, the grain better resisted the mildew. Brucato is," he says, "a humid district, washed by rivers, and chequered by marshes, which render the air insalubrious; yet it produced this year of mildew a reasonable crop of grain. And he observed at Margana, that the wheat upon a farm situated on the banks of a river, and very humid, with a bad air, was generally better than in the neighbouring country of Vicari, notably more dry from its situation. Grain that is thin upon the ground, is more subject to mildew than that which from thickness retains much more of the dew." He remarks that "Abbé Rozier, in his voluminous Dictionary, says, that the mildew is caused by the drops of water formed by fogs and dews when dissipated by a hot sun; but in Sicily, the sun in April, and much more in May and June, is always active, and our fogs in May are proverbial." And he adds that "in travelling in the beginning of summer, through the country, it is visible, that the mildew, in its various degrees, is connected with the soil, and the divers methods of cultivation; but the variety of effects is mysterious and inexplicable, on the supposition that the cause is external to the plant."

Mr. Marshall, after stating some remarks on the nature of this disease, says, that a certain prevention of it would be a discovery worth millions to the country "Until this be made," continues he, "let the grower of wheat, not only endeavour to sow early; but let him look narrowly to his crop, during the critical time of the filling of the grain; and whenever he may perceive it to be smitten with the disease, let him lose no time in cutting it: suffering it to lie on the stubble, until the straw be firm and crisp enough, to be set in sheaves, without adhering in the binding places: —allowing it to remain in the field, until the grain

shall have received the nutriment which the straw may be able to impart. Where wheat has been grown on 'lammas land,' and the ground obliged to be cleared by the first of August, crops have been known to be cut, 'as green as grass,' and to be carried off and spread upon grass land, to dry. Yet the grain has been found to mature; and always to afford a fine skinned beautiful sample. Rye-grass that is cut, even while in blossom, is well known to mature its seeds, with the sap that is lodged in the stems. Hence there is nothing to fear, from cutting wheat or other corn, before the straw be ripe." The opinion of Mr. Young is likewise the same, he therefore, in his useful Calendar, advises the farmer to be very attentive to his wheat crops in July, as "they are every where liable to this fatal distemper, which admits but of one cure or check, and that is, reaping it as soon as it is struck. The capital managers in Suffolk," he says, "know well, that every hour the wheat stands after the mildew appears, is mischievous to the crop. It should be cut, though quite green, as it is found that the grain fills after it is cut, and ripens in a manner that those would not conceive who had not tried the experiment, which he has done many times; reaping so early, that the labourers pronounced he should have nothing but hen's-meat. They were always mistaken, for the sample proved good, while others, who left it longer, suffered severely. The fact is," he says, "now pretty generally admitted."

Mr. Marshall further observes, "that the operation of this disease is carried on by the fungus tribe, evidently appears, from the ingenious and persevering labours of botanists," as lately shown by Sir Joseph Banks. See *Blight*. "But fungi," it is equally evident," he thinks, "are an effect, not the cause of the disease. They are the vermin of the more perfect vegetables; and fasten on them, whether in a dead, or in a diseased state; but seldom," he believes, "while they are in full health and vigour. Their minute and volatile seeds may be said to be every where present,—ready to produce their kind wherever they may find a genial matrix. Such, at least, appears to be the nature of the fungus, or fungi, of wheat; for it may be liable to the attack of more than one species. In a dry warm summer, which is well known to be favourable to the health, vigour, and productiveness of the wheat crop, the seeds of fungi are harmless, so long as the fine weather continues. On the contrary, in a cold wet season, which gives languor and weakness to the wheat plants, few crops escape, entirely, their destructive effects. A standing crop not unfrequently escapes, while plots that are lodged in the same field, especially in pits and hollow places, become liable to their attack. And, by the facts above stated, we plainly see, that even strong healthy crops may, in a few days, or perhaps in a few hours, be rendered liable to be assailed;—not progressively, as by an infectious disease; but at once, as by a *blast* or *blight*. In the state of the atmosphere we are to look for the cause of the disease, in a *standing crop:* and nothing is so likely to bring on the fatal predisposition of the plants as a succession of cold rains, while the grain is forming. The coolness necessarily gives a check to the rich saccharine juices which are then rising towards the ear; and the moisture may, at the same time, assist the seeds of the fungi to germinate and take root. Thus reason and facts concur," he thinks, "in pointing out the cause, and the operation of the disease. There appear," he says, "to be two reasons why corn which happens to be struck with this disease, in a dry warm summer, is exposed to excessive injury; as facts pretty evidently show that it is. The habits of the plants render them more susceptible of injury, their rich juices more liable to be checked; and the seeds of fungi, it is probable, are more widely, if not more plentifully, distributed, by such a state of the air, than they are by a cool moist atmosphere. The natural event is too well known: and it is the business of art to endeavour to prevent it."

It is added that "if by cutting down the crop, as soon as it is found to be diseased, the operation can be stopped—as experience, in different instances, has shown it may—the remedy is easy." He says, "It may be asked, in what manner the remedy is thus effected. But to the practical farmer, the fact is all that is required. To him, it is equally indifferent, to know the operation of the remedy, as the operation of the disease. Those who have profited by the remedy here recommended, believe, that it 'kills the mildew.' And if it shall appear that the fungus of wheat requires a free supply of air to keep it alive, or in a state of health and vigour, the effect of cutting down the crop will be explained. It will perhaps be found, by experience, that the closer it is allowed to lie upon the ground, and the sooner it is bound up in sheaves (provided the natural ascent of the sap to the ear be not thereby interrupted), the more effectual and complete will be the remedy. Further, it may be suggested," he thinks, "on the evidence of attentive observation, that if wheat, which has been attacked by this disease, be suffered to remain in the field, with the ears exposed, until it may have received the ameliorating influence of dews, or moderate rain (to soften, relax, and assist the natural rise of the sap), the more productive it will probably become. And it may be still further added, that grain which is cut while under-ripe, is less liable to be injured in the field, by moist weather, than that which has stood until it be fully or over-ripe."

And a "probable mean of prevention is that of inducing early ripeness (for reasons above offered): either by sowing early; or by forcing manures; or by selecting and establishing early varieties, of wheat most especially; as early varieties of pease, and other esculent plants, are raised by gardeners:—a work which only requires ordinary attention; and which," he says, "it is hoped, will, without delay, be set about and encouraged by every attentive grower of wheat, and every promoter of rural improvements, in the united kingdom. The method of raising and improving varieties of which will be afterwards noticed. See *Wheat*.

MILIUM, Millet-grass, a genus of grasses of which there are many species, but none of which are capable of being cultivated as the food of cattle or other sorts of live stock.

MILK, a nutritious fluid secreted by animals for

the sustenance of their new-born offspring. In cases where it is taken away periodically by milking, the supply goes on, as in the cow; and hence the great value of that animal in particular, to man, who is indebted to her for three of the most useful articles of food, milk, butter, and cheese.

The quality of milk differs considerably in different circumstances and situations, and from the manner in which the cows are fed and managed; but few experiments have yet been made in order to shew on what these differences depend. But in order to have an abundant supply, it is necessary to have recourse to constant plentiful feeding of the animals with rich luxuriant green food of different sorts given in a properly varied manner, as well as other kinds of food. In comparing the qualities of the milk of different cows, the time in which they have been in milk should be fully considered, as the milk soon after calving is always much thinner, than it is afterwards. The properties of milk so far as they regard the dairy, and the management of it in respect to the making of butter and cheese, will be taken notice of in another place. See *Dairying*, *Lactometer*, *Butter*, and *Cheese*.

In cases where the mother is lost, or the young animal is too feeble to have recourse to her teats, milk with sugar, gruel, and a small quantity of spice, is sometimes given as a means of support.

MILKING, the operation of drawing the milk from the cow or other animal.

The proper milking of cows is a matter of much consequence to the cow and dairy farmer. And it has been observed that more care is necessary to this business than is generally supposed, in order to obtain the largest possible quantity of milk. "On the physiological principle of the secretions of animals being increased in proportion as the secreted fluid is more frequently withdrawn, it has been, it is said, recommended to have recourse to more frequent milkings in order to augment the quantity of that fluid in cows. And there can be little doubt but that by accustoming the secretory organs to a more frequent secretion, such a habit may be established in them as will afford a larger proportion of milk in a given time. But in order to effect this in the most perfect manner, it will be necessary to have the cows highly fed, and to observe the greatest regularity and exactness in the periods of milking, and to be careful that every drop of milk is drawn away each time, as without due regard in these respects the desired effect will not be produced. This is fully shown to be the case by the few experiments that have been instituted with the view of deciding the matter; as while the cows were consuming the more juicy spring food, there appears to have been an increase in the quantity of milk both by three and four milkings in the day; but in the autumn season there seems to have been rather a decrease under the same circumstances."

But "in order to ascertain the advantages to be obtained in this way with accuracy, the following experiments were made by Mr. Macro, and the results stated in the twelfth volume of the Annals of Agriculture to be these:

1780.		Pints.
May 21,	First meal	9½
	Second do.	13
		22½
22,	First meal	13
	Second do.	8
	Third do.	5
		26
23,	First meal	12
	Second do.	7
	Third do.	6
	Fourth do.	1
		26
October 22,	First meal	11
	Second do.	6
		17
23,	First meal	11
	Second do.	3
	Third do.	3
		17
24,	First meal	10
	Second do.	1½
	Third do.	1½
	Fourth do.	3
		16

It is however observed, that "such trials, to afford any satisfactory conclusions, should have been continued for a much greater length of time, being varied considerably in the times of milking, and nicely compared with the nature and quantity of the food employed; as it is only by ascertaining how much depends upon the simple operation of taking away the milk, and how much upon the quality and proportion of food that is taken in, that the question can be fairly decided. It is not to be supposed that merely increasing the number of milkings for a few days can have much influence in altering the state of secretion in the animals." And "some, in the intention of increasing the quantity of milk, have recommended milking, when the cows are fully fed in the summer season, three times in the course of the day at equal distances, as the convenience of the business will admit, as the most proper:—Early in the morning, about the middle of the day, and in the evening before it is too late. The exact proportion of increase in the milk that may be produced in this way over that of milking in the morning and evening only, which is the usual mode, has not, that we know of, been ascertained with any degree of accuracy; but some suppose that it may approach to nearly one-half of the whole, while others contend that it

cannot be any thing near so much. If a third were gained, by such means, it would amply repay the cow-keeper for his additional trouble and expense."

In regard to "the method of milking adopted by cow-farmers in most cases, it is only to have their milking performed twice in the course of twenty-four hours. In such cases the most proper times would seem to be about seven o'clock in the morning, and five in the afternoon; but in the neighbourhood of London, according to the Report of Middlesex, and other large towns, it is the practice to have this work performed from four to half past six in the morning, and from half past one to three in the afternoon. It is, therefore, probable that more frequent milking in the business of cow farming, especially when conducted upon any extensive scale, would not only be inconvenient but impracticable. In such cases it is supposed, that all that can be done is, perhaps, that of having the operation executed with as much care as possible, in respect to the whole of the milk being taken away each time, and by persons who are careful and perfectly accustomed to the work. Where this is neglected, much loss may be sustained not only in the immediate produce of the milk, but in the cows becoming much more quickly dry, as well as their being more subject to affections of the udder. The best advice is, to have the business performed in an expeditious manner, in regard to the whole of the animals, and with the utmost attention in respect to cleanness. A sufficient number of persons should of course be employed in proportion to that of the cows. An expert milker is capable of performing the operation on from six to seven or eight cows in the course of an hour."

The number of milkers employed should constantly be such as to have the business performed in about the course of an hour at the farthest. See *Dairy* and *Dairying*.

Milk-*Fever*, in *Farriery*, a disease frequently attacking cows soon after they have calved.

This disease is sometimes termed dropping after calving. Mr. Downing supposes it to be "frequently occasioned by catching cold, especially the receiving cold air at the mouth of the uterine vessels; sometimes it is occasioned by the beast drinking too large a quantity of cold water, while the blood is in a strong fermentation: nearly all or most of these symptoms are occasioned by cold, and are attended with convulsive fits, and a retention of the natural evacuations, which may be properly denominated a puerperal fever." But "the common signs of this disorder are an inability to stand, stretching out the legs, violent convulsions, cold extremities, an intermitting pulse, little or nothing evacuated from the calf bag, with many other obvious symptoms." He says, "the danger of the disease, and difficulty of cure, are generally to be estimated by the degree of the symptoms."

He further observes, that "in cases so evidently dangerous, speedy remedies must be applied, or the attempt to cure will be to little or no purpose."

The following medicine is advised to be immediately given:

Take of nitre in powder two ounces,
Oil of vitriol, one tea spoonful, rub the nitre and oil of vitriol together in an iron or marble mortar, then add
Valerian in powder, one ounce and a half,
Virginian snake-root in powder, one ounce.

Mix them for one dose, to be given in a quart of the following decoction, with half a pound of treacle in it, and repeated every twelve hours.

Take of Feverfew a good handful;
Balm, two handfuls;
Camomile flowers, two ounces.

Boil them in one gallon of water for half an hour, and let the herbs remain in the decoction. A pint of this decoction sweetened with treacle, is to be given the beast every two hours between each medicine, until she can rise and stand tolerably well without support.

It is further remarked that "the beast is generally seized with the disorder the first week after calving, about the third day; some are taken immediately after calving; it most frequently happens to cows in high condition, (when they ought to be let blood a few days previous to their calving), for very few poor lean cows are affected with this fever."

In the treatment in this disorder the beast must be kept warm, with suitable covering, raked about twice a day, and as little disturbed as possible: when she is laid down, the fore parts should be considerably elevated in order to favour evacuations. It is needless to offer it any food, for it cannot eat while in this state of disease.

He adds, "that many drop down, but few if any can rise again, without the help of medicine. The beast should be attended night and day, as it will have restless fits, and probably beat off the horns if left alone; it will often rise upon the knees in attempting to get upon its legs, and fall again in a position not proper to lie in. If the beast lies any considerable time with its back lowest, it will soon swell and die: the person who waits upon it, must be careful to keep it in a right posture as before described, with the head and shoulders much higher than the other part of the body.

Where the cows cannot cleanse well, he advises the following as very useful:

Take of Diapente in powder, one ounce;
Sweet nitre spirits, one ounce;
Flour of sulphur, one ounce;
Liquorice powder, one ounce.

Mix them well, and give them at night in three pints of old ale; the beast should be kept warm at the time.

Milking *Pail*, the vessel made use of for containing the milk as it is drawn from the cow. These pails are made of wood, and sometimes hooped with iron at the bottom. They are made of different sizes, and should be kept well seasoned by frequent scalding.

MILKNESS, a provincial term applied to a dairy. See *Dairy*.

MILLET, the name of a plant, which grows naturally in India, whence it was first imported into Europe. It is greatly cultivated in Italy, Spain, and the southern parts of France, for the food of men as

well as that of poultry. It may also be raised in this climate.

It is a plant that delights in a light sandy soil, prepared in the same manner as for maize; and in such lands it branches out into many stalks, sometimes thirty or forty, not unlike reeds either in their shape or leaves, of which there is one at each joint. The top of each stalk is terminated by a large, loose panicle, which hangs on one side, with a chaffy flower, which is succeeded by a small round seed, about the bigness of turnip or cabbage-seed, of a yellowish white colour in one variety, and of a dark red inclining to black in another, which are the small millet, and the large; a distinction which some make, as only varieties of the same species. It is likewise said to thrive extremely well in strong land: but will not do in stony ground, or where the bottom is of either a chalky or clayey nature.

According to Mr. Miller, it should be sown in the beginning of April, that it may ripen in August: but in warmer climates, the general rule is to sow it either between the middle and the end of May, or about Midsummer. The former crop is reaped at the end of September, and the latter about the end of October. The seed is usually sown in furrows, very thin, and covered with the plough or rake. The largest sort should be sowed thinnest, because it branches most. When the plants are about a month old, the ground should be stirred round them with a hand-hoe, as well to lay fresh earth to their roots, as they require much nourishment, as to clear them from weeds, which they afterwards prevent, by over-topping them. At the same time, the millet plants should be thinned out wherever they grow too close, so as to leave, in general, about six inches between each plant. Nothing more is necessary to be done till harvest, except that, when it begins to ripen, great care must be taken to protect it from birds, which would otherwise soon devour it. The returns of this crop are very great; it is not easily hurt by drought or rain, nor is it subject to blight. Frequent showers of rain are of great service to it whilst in its young growth.

When the crops are ripe, the panicles of the plants are cut off near the uppermost joints of the stalks with a knife, and put into baskets or sacks, in which they are carried home, where they are then laid up in heaps covered over with cloths, and after remaining in that situation five or six days, spread upon the barn floor, threshed out with a flail, and cleansed like other sorts of grain. Great care must be taken to dry it well in the sun, before it is laid up in the granary: as it soon spoils if the least moisture be left in it; being of all grains the most difficult to keep, unless it be thoroughly dry; but on the other hand, none keeps longer or better, after it has been well dried. It is not liable to the weevil; but it should be turned from time to time in the granary.

It has been constantly observed, that the late sown crops are the most defective, and that their panicles are smaller than those of the same grain sown earlier.

The small white millet is the most delicate, and the best for puddings, &c. The red is larger and coarser, and used for pigeons, poultry, and swine, after being ground to meal: it is very good fodder for cattle, either green or after its grain is thrashed out. From its numerous roots, large size, and quick growth, it is a sort of crop that exhausts the soil greatly.

MILL, a mechanical contrivance for the purpose of grinding grain and other materials, or any other purpose. Mills are of different kinds according to the power by which they are wrought; as, water, wind, steam, horse and hand mills.

Mr. Marshall, in his work on the Landed Property of England, very well observes, "that in the state of society in which water corn mills were first erected, they were doubtlessly considered as a blessing to the country. There were, then, no flour manufactories: and it was more convenient for the inhabitants to carry their corn to a neighbouring mill, than to grind it less effectually, by hand, at home. Hence, the privileges and immunities of manorial mills. To secure so great a comfort, every tenant of a manor would willingly agree to send his corn to be ground at the lord's mill: and, perhaps, was further obliged to stipulate to pay toll for the whole of his growth; though it were sent out of the manor, unground. And he asserts, that "in some parts of Scotland, this impolitic, and now absurd, custom is in force, to the present day: no farmer daring to send his corn to market, until he has delivered a proportional quantity to the proprietor, or the occupier, of the mill to which he is 'thirled;' or has previously stipulated to pay him 'thirlage,' for what he may send away: this arbitrary regulation operating, like tithes, to decrease the growth of corn. But," continues he, "in England, however, no restriction of this sort at present exists. Though, in the remote parts of the northern provinces, there are mills which claim (or lately claimed) the exclusive right of grinding the whole of the corn which the inhabitants of the respective parishes or manors require to be ground, for their own use; suffering none to be sent out of the parish, for the purpose of grinding. And in the more western counties, where grist mills are still the schools of parochial scandal, something of this sort remains,—and is piously preserved in modern leases. But, in the kingdom at large, grist mills are now going fast into disuse. Even working people purchase *flour*, instead of *corn*. And, whether in a private or a public light this," he apprehends, "is an eligible practice. They can purchase a sort which is suited to their circumstances: and they know the quality and the quantity of what they carry home. Whereas, in the proverbial rascality of grist millers, they have no certainty, as to either. Beside, in a flour mill there is no waste. Every particle may be said to be converted to its proper use." And "another valuable property belonging to modern flour manufactories is," in his opinion, "their not requiring every brook and rivulet of the kingdom to work them. In Norfolk, a great share of the wheat grown in that corn county, is manufactured into flour, by means of windmills. And such are modern inventions, that neither wind, nor water, is any longer necessary to the due manufacture of flour;—the steam engine affording, if not the most

eligible, the most constant and equable power." But "it is not his intention to condemn water mills, altogether. There is, indeed, a species of water mill which deserves the best encouragement. This is the tide mill. There are many situations, in creeks and inlets, of bays, estuaries, and tide rivers, in which this species of mill may be erected, with profit to proprietors, and the community; and without any injury to the landed property, or the agricultural produce of the country. But he is clearly of opinion, that the present number of river mills are unnecessary to the present state of society." And "there are remote situations, in which even grist mills are still required. But seeing the number of flour mills which are now dispersed over almost every part of the kingdom,—seeing also the present facility of carriage, by land and water,—and seeing, at the same time, the serious injuries which river mills entail on agriculture,—he does not hesitate to recommend to land proprietors, to reduce their number, as fast as local circumstances will allow." The chief injuries of river mills are thus brought together. "By raising a mill dam across a river, the lands above it (frequently hay grounds) are, he says, rendered liable to summer floods. By collecting water, in a body,—perhaps of considerable length,—along the bank of a valley, and there holding it in a stagnant or slowly moving state, the base of the valley (commonly rich meadow land), is liable to become a bed of superaquatic plants; or is changed to a state of morass. And they are very prejudicial to salmon fisheries. But, where a mill stream is of a fertilizing quality, those are inferior evils. There are situations in which the value of the water, for the purposes of agriculture, is ten times its worth, to turn a manorial grist mill: which, beside the mischiefs that attend it, is, in itself, an unprofitable part of a landed estate. The expences of repairs, added to timber, and the attention they require, are not unfrequently greater than the rent; which is a further motive for embracing every *fair* opportunity of lessening their number."

There are four kinds of water mills, as balance mills, overshot mills, breast mills, and undershot mills. In the balance mill the water is conveyed in a spout (called the mill trough) above the wheel, and falls into the bucket about one foot before the centre, where it acts by gravity, or the weight of the water, on nearly one half of the circumference of the wheel. The overshot mill is nearly the same with the former: only in this, the water is conveyed over the top of the wheel, and conducted into the bucket on the backside of its centre, but acts also principally by gravity. For here the impulse must be small, as the fall upon the upper part of the wheel cannot be great, because that would only tend to dash the water out of the bucket, and lose part of its effect on the wheel. In the breast mill the water falls down upon the wheel nearly at right angles to the bucket, and acts by impulse, and also by gravity, on one fourth part of the circumference of the wheel. In the undershot mill the wheel is driven merely by impulse, or the force of the current of water running under it; therefore it is evident, that an undershot mill must require a larger quantity of water than any of the other three kinds.

In respect to water mills, Mr. Ferguson observes, that where there is but a small quantity of water, and a fall great enough for the wheel to lie under it, the bucket or overshot wheel is always used: but where there is a large body of water, with a little fall, the breast or float board wheel must take place; and where there is a large supply of water, as a river, or large stream or brook, with very little fall, then the under shot wheel is the easiest, cheapest, and most simple structure.

In Plate VII. is the plan of a corn-mill calculated for oats, barley and pease, in which, *fig.* 1. *aa* is the water wheel fixed upon the shaft or axle *bb*: upon which axle is also fastened the wheel *cc*, containing 78 teeth or cogs, to turn the trundle or wallower *d*, having 9 rounds or staves, which being fixed upon an iron axle called the *mill spindle*, on the top of which spindle is an iron cross admitted into an excavation in the lower side of the upper mill-stone, carries the stone round along with the trundle *d*. *e* is a sheeve or whorl fixed upon an iron axle or spindle, having a bend or knee in it, called a *crank*; which being turned round by the band *ww*, passing from a sheeve fastened upon the spindle of the trundle *d*, gives the wire sieve *ff* a shaking motion; by which means a considerable part of the small dust falls down through as the grain runs from the mill-stones at the opening or spout *y*, over the sieve to the fanners *g g*, in order to be cleaned or separated from any loose or light refuse, and is thus properly prepared for being ground into meal. *hh* and *x* are the sills or large beams that support the levers *ii*, upon which the bed or under mill-stone is laid, represented by the circle *yy*, and supposed to be four feet six inches in diameter. There is an opening at *y*, in which is fixed a spout to convey the grain from the mill-stones to the wire sieve *ff*. This opening must be shut when the mill is grinding. *x* is an opening called the mill-eye, where the meal issues out from the mill-stones when grinding down in the box or trough *ll*. It must be shut when the mill is shealing or clearing the husk from the grain. *k k k* the cross bearers and bridge-tree, on which the lower end of the iron spindle that carries the upper mill-stone turns. *u u*, a wheel having fourteen teeth, turned by the wheel *cc*; which is fixed upon an axle round which the rope *z* rolls, to carry the sacks or bags of grain from the ground floor up to the lofts. *q q* is the machine and crank that raise the sluice to let the water on the buckets or float-boards of the wheel *aa* to turn it round. *m m* are the walls of the mill-house. *p p* is a pair of stairs leading up to the loft. *n n* are the walls of a small house adjoining to one side of the mill-house, for containing the dust and refuse as it flies from the fanners *g*. This form of the house, it is observed, is very convenient for a common meal mill, because it not only holds the dust at a distance from the clean grain and meal, which must be an advantage, but likewise the mill-house may be had of less dimensions than in the ordinary way. *o o* is a place inclosed with boards to contain the refuse as it comes from the fanners. *r r r* are the doors, and

ss windows to light the mill-house. *t* is an opening or hatchway in the floors, through which the bags of grain are carried up to the hoppers by the rope *z* coiling round on the axle of the wheel *uu*. The opening *t* is furnished with two doors moving on iron hinges, which are opened by the sack in the rope passing up betwixt them, and falls down to shut the hatchway as soon as the bags of grain are clear of them on the upper part.

And at fig. 2, is shown the elevation of the same mill. *aa* is the water wheel fixed upon its shaft or axle *b b*, upon which axle is also fastened the wheel *ee*, containing 78 teeth or cogs to turn the trundle or wallower *d*, having nine rounds or staves. This trundle is fastened upon the iron axis, having upon its upper end an iron cross that is put into grooves in the middle and under side of the upper mill-stone, by which means the stone is carried round. *g g* are large frames that support the bed or under mill-stone. *h* is a hopper on the frame above the mill-stones, that contains the grain with a spout, or what is called the mill-shoe, for conveying the corn from the hopper into the hole or eye in the middle of the upper mill-stone. *h*, the cases that inclose the upper mill-stone, to prevent the grain from flying off at any place when grinding, but only at an opening at one side, in which is a spout to convey the meal down to the box or trough *n n*, when ground. *w b*, a cross bearer that supports one end of the bearer or bridge tree, on which is fixed a brass-step or cod for the lower end of the iron spindle that carries the upper mill-stone to turn in. *w*, a lever, called the mill-hand, with a rod of wood or iron, the lower end of which moves on an iron bolt in the bearer *w b*. This bearer also moves on the iron bolt at the end, *b*. Then, by moving the longer arm of the lever *w*, up or down, the bridge-tree and upper mill-stone are either raised or depressed at pleasure, according as the meal is wanted to be ground coarser or finer. *e*, a wheel having fourteen teeth, and fixed upon an axle, on which the rope *k k* rolls round to carry the sacks of corn up to any of the lofts *r r r*. This wheel is driven by the wheel *c c*, and can be easily put in motion, and also quickly stopped when the wheel *e e* is revolving. The wheel *e* is set a-going at any time by pulling the cord *l* hanging down through the floors or lofts for that purpose; the same cord passing over the sheeves *l l l*. The other end is fastened to the longer arm of a lever that moves on an iron bolt; its shorter arm being connected with the perpendicular frame in which the pivot of the axle of the wheel *e* turns. When the longer arm of this lever is pulled by the cord *l*, its shorter one pushes the upper end of the frame towards the wheel *e e*, the lower end of which moves on an iron bolt; by this means the wheel *e* is put into the grip or hold of the wheel *c c*. There is likewise a piece of wood called a catch, one end of which moves on an iron bolt in the pillar at *n*. Near the other end, upon its lower side, is a notch or shoulder, that falls down in the off side of the perpendicular frame, and keeps the wheel *e* into the girt of the wheel *c c*, which drives it while the rope *k k* rolls round its axle. When the sack of grain, hanging to the other end of the rope *k*, is raised up to the lever *y y*, which moves on an iron bolt, one end of the lever is pushed up by the sack, and of course the other falls down, and pulls the cord *y m d*, whose other end being fastened to the catch, lifts it up clear off the frame. Then the weight at *g*, hanging by a rope going over two sheeves, and its other end fastened to the upper end of the perpendicular frame, pulls the frame, and of course the wheel *e* off the hold of the wheel *c c*. Thus the wheel *e* stops of itself in an instant. But when the grain is to be put into any of the lower floors, this machine is stopped at any time by pulling the cord *m m*, hanging down through the floors for that purpose. This is a very simple kind of sack-tackle, and may be added to any wheel having teeth to turn it. This machine is also contained in very little room. *f*, two small wheels for conveying motion to the fanners; one of them fixed upon the perpendicular iron spindle, which has a socket in its lower end to take in a square on the upper end of the iron spindle, that carries the upper mill-stone. *i i*, two large hoppers into which the corn is put when carried up by the sack-tackle, and may be conveyed from either of them down into the hopper *h*, placed upon the frame above the mill-stones. *o o*, the gables or end walls of the mill-house. *s s*, the couples, or framing of the roof. *t*, a door in the side wall. *p p p*, the stairs leading up to the lofts or upper floors. *x x*, windows to light the mill-house.

At fig. 3, is a section of the same mill. *a a*, the great wheel fixed upon the shaft or axle *b*, containing 36 buckets to receive the water to turn it round. *t t*, the fall or course of the water. *x x*, the machine or handle that raises the sluice to let the water on the great wheel. On the axle *b* are likewise fastened the wheel *c c*, having 78 teeth or cogs, to drive the trundle or wallower *d* of nine staves or rounds. *l l*, the strong frame that supports the bearers which carry the bed or under mill-stone, supposed to be four feet six inches in diameter. Above it is the running mill-stone, of the same diameter, and inclosed by the crib or case *k*, to prevent the grain from flying off at any part except the opening in one side, called the mill-eye. The surface of the lower mill-stone should be perfectly flat or straight, and part of the upper mill-stone concave, or about half an inch hollow at the centre, so that the two mill-stones are farther from each other at the middle, and approach nearer and nearer towards the outside, which gives room for the corn to go in between the mill-stones about 16 or 18 inches of the radius, where it begins to be ground by the remaining part of the radius, which ought to be parallel or equally distant from the lower mill-stone. The trundle *d* is fastened upon an iron axle called the mill-spindle, which passes through the middle of the lower mill-stone, and its lower end turns round in a brass-pot, fixed on the strong bearer *u u*, called the bridge-tree. The round near the upper part of the spindle turns in a bush of end wood fixed in the lower mill-stone; the top part of the spindle above the wooden bush is square, and goes into a square hole in a strong iron cross called the *rind*, which is admitted

into an excavation, or enters into grooves in the middle and under surface of the running mill-stone; and thus turns it round along with the trundle *d*, by means of the cog-wheel *c c*. One end of the bridge-tree *u u*, that supports the iron spindle of the trundle *d* and running mill-stone, remains fast in a mortise in the cross bearer, while the other end goes into a mortise in the cross bearer *v*, one end of which moves in an iron bolt in the perpendicular frame, and its other end hanging by the rod *v v*, that goes up through the floor, and has a lever on its upper end, called the *mill-hand*. By pulling the longer arm of this lever up and down, the cross bearer *v* is raised or depressed at pleasure, likewise along with it the bridge-tree *u u* and upper mill-stone. Thus the upper mill-stone may be raised as high from the lower one, or let down as close to it as the miller thinks proper; by which means the meal is ground either coarse or fine at pleasure, or what is commonly called, greater or smaller. Upon a frame above the mill-stones is placed the hopper *k*, that contains the corn, being open at bottom, and having a spout below it, or what is called the *mill-shoe*, which is open at the fore part, to convey the grain from the hopper into the hole in the middle of the running mill-stone, termed the *eye* of the stone. The upper mill-stone is inclosed in a round box *k*, called the *crib* or *case*, which leaves a vacant space of about an inch and a half all round, to allow the running mill-stone freedom to work when sheeling or clearing the husk from the grain. The square of the upper end of the iron spindle rises a little above the rind, upon which is put the feeder, having three or four branches that strike on the shoe as they revolve, and give it a shaking motion; by this means the corn runs constantly and equally down from the hopper *k* through the shoe into the eye of the running mill-stone, where it is introduced betwixt the stones; and by the violent circular motion of the upper one, the grain acquires a centrifugal force; which, proceeding gradually from the eye of the mill-stone toward the circumference, is thrown at last out in meal, at the opening called the eye of the mill, in which is fixed a spout to convey the meal down into a box or trough placed below to receive it. *g g*, is a belt or band of leather going in the sheeve or whorl fixed upon the spindle below the trundle *d*, and upon the sheeve at *h*, which is fastened upon an iron spindle having a bend or crank, that when turned round by the band, moves or shakes the wire sieve *s h* to and fro. By this means a good part of the small refuse passes through the sieve as the grain runs from the mill-stones along it to the hopper of the fanners *h h*. The lower end of the perpendicular iron spindle *k e*, is fixed to the feeder, and turned round along with the trundle *d*. Upon the upper end of this spindle, at *e*, is fixed a small wheel, having teeth to turn a wheel fastened upon the horizontal spindle *e e*, and upon its other end is fixed a sheeve or whorle, on which goes the rope or band *z z*, passing round a sheeve on the axle of the fanners below to drive them round and clear the dust or refuse from the grain. *f f*, is an axle, upon which is fixed a wheel having 14 teeth, and is turned by the wheel *c c*. By one end of the rope *w w*, rolling round this axle, a sack or bag of grain is carried in its other end up to the loft. By pulling the cord *q q*, the wheel and axle *f f* is set agoing, and by pulling the cord *y* it is stopped at any time; but when the bag of grain is raised above the uppermost loft, then the machine stops of itself, which is plainly seen at *fig.* 1. *m m*, two large hoppers placed on the upper floors for containing corn, from either of which it may be conveyed down to the small hopper *k*, and so through the spout shoe into the eye of the upper mill-stone, where it is introduced betwixt the stones and ground into meal. Some have supposed the springing of the bridge tree *u u*, upon which the iron spindle turns, carrying the running mill-stone, and giving the stone a dancing motion, helps to grind the corn; but this must be a great mistake, because the stiffer the bridge-tree, and the firmer it is kept, the steadier the mill-stone will revolve, and of course execute the work more equally, which is seen in practice, when the bridge-tree is not of sufficient strength in proportion to the weight of the upper mill-stone. Neither the springing of the bridge-tree, nor the extraordinary weight of a running mill-stone, does at all contribute to the grinding of a greater quantity of corn. A stone five inches thick, will grind as much corn in the same time as a stone of ten inches thick, supposing the grain equal, the mill-stones of the same quality, the same diameter, and moving with equal velocity.

In plate VIII *fig.* 1, is seen the plan of a single *Flour-mill*; in which No. 1, is the *Sheeling-mill* with *wire sieves and fanners* for cleaning or preparing wheat to be ground into flour.—*a a*, represents the water wheel, and *b b*, its shaft or axle. *c c*, A wheel fastened upon the same shaft, containing 84 teeth or cogs, to turn the trundle or pinion *d*, having 19 staves or rounds, which is fixed upon an iron axis called the spindle; on the upper end of which is a square that goes into a square hole in a strong iron cross called the *rind*, which being admitted into a groove in the under side of the running or upper mill-stone, carries the stone round along with the trundle *d*. The under end of the iron spindle turns in a brass pot or step fixed on the bridge-tree; and the round near its upper end turns in a bush of end-wood fixed in the hole through the middle of the under mill-stone. *e*, is a coarse wire harp, or searce that the wheat passes through to the wire sieve *f f*; through which any sand or small seed falls down while the wheat runs along the sieve into a spout that conveys it into the eye or hole in the middle of the upper mill-stone, where it is introduced betwixt the mill-stones: and by the circular motion of the upper stone any dust is rubbed off the grain, called sheeling. *g g*, is a wire sieve, upon which the wheat runs from the mill-stones to the fanners *h h*, where it is cleaned or separated from dust or any loose refuse. Thus the grain is prepared to be ground into flour. *k k*, a sheeve or whorl fixed upon an iron spindle having a bend or crank, which being turned round moves or shakes the wire-sieve: by this motion the sand and small seeds fall down through the sieve.

This is clearly represented at *figs.* 2 and 4. *t t*, the strong bearers or *sills* that support the lower mill-stone and cases. The circle *l l* represents the mill-stone and frame upon which it is laid. *v*, is the lever or handle for raising or depressing the upper mill-stone when necessary; sometimes a screw-nut is made use of for this purpose. *u u*, is the machine and handle or crank for raising the sluice when the water is to be let on to drive the wheel *a a*, and turn the machine. *r r*, the walls and joists of the sheeling mill-house. *o o*, the doors in the mill-house. *z z*, Stairs leading up to the lofts. *x x*, the windows to light the house.

At No. 2. is seen the *Grinding-mill* driven by the same water-wheel with *Bolting-mill*, and *Bolting-Wire-engine*.—*c c*, is a wheel fixed upon the shaft *b b*, containing 84 teeth or cogs to turn the pinion or trundle, *d e*, having ten staves or rounds, which is fastened upon an iron axis called the *mill-spindle:* on the upper end of which is a square that takes on an iron cross. This cross is put into a groove in the under surface of the upper mill-stone, and by it the stone is carried round along with the trundle. *d e*, are the strong frames that support the under mill-stone which are represented by *t t;* and the circle *r r*, represents the mill-stone with the frames upon which it is laid. *v*, is a lever by which the upper mill-stone is raised or depressed at pleasure. *k*, No. 2. is a pinion containing 15 teeth, and driven by the wheel *c c*. This pinion is fixed upon an horizontal axle, on which axle is also fastened the barrel No. 3. and on this barrel goes two leather belts or bands, one to drive the bolting-wire-engine, and the other to turn the bolting-mill, according as the one or the other is to be made use of for bolting or separating the flour from the bran or husk. No. 4. is a sheeve or whorl fixed upon an iron axis, and turned round by a leather belt from the barrel, No. 3. There is fastened upon the same iron axis a pinion, No. 5, having 24 teeth to drive the winch or reel of the bolting-wire-engine *m m* which is plainly seen in *fig.* 3 in Plate VIII. No. 6. is a sheeve fastened upon the gudgeon in the axle of the winch or reel *n n* of the bolting-mill, driven round by the leather belt *l* going upon the barrel, No. 3. *q q*, the walls and joists of the grinding and bolting mill-house. *s*, is a hatch or opening at which the bags of flour are conveyed up to the bolting-machines. *x*, windows to light the mill-house.

At *fig.* 2 in the same plate is shown a section of the sheeling-mill with the wire sieves, fanners, &c. *a a*, is the great wheel fixed upon the shaft *c c*, containing 40 flat boards or *aws* to receive the impulse of the water to turn it round. *b b*, is a wheel fastened upon the same shaft, having 84 teeth or cogs to turn the trundle or wallowers *d* of 9 staves or rounds, which is fixed upon the axis or spindle which carries the upper mill-stone round along with the trundle. *z z*, the fall or course of the water that turns the wheel *a a*, which drives the machinery. *e e*, an iron spindle for conveying motion to the windlass, sack tackle, wire sieves, and fanners. The spindle *e e* is turned round, by having a square socket in its under end to take in a square on the upper end of the iron axis that carries the trundle *d*. Upon the upper end of the spindle *e* is fixed a pinion containing 7 teeth to drive the wheel *f f*, having 36 teeth, which is fastened upon an axle, round which the rope rolls or coils, as is seen at *a*, *fig.* 4. to carry the sacks of wheat up to the lofts or hoppers. *n n*, are two large hoppers for containing grain, from either of which it may be conveyed down to the wire sieve *h h*, by which the wheat is separated from any sand or small seed as it runs along upon the sieve to the spout *y y*, which conveys it into the hole or eye in the middle of the running mill-stone, and by the circular motion of the mill-stones is sheeled, or a great part of the refuse is rubbed off the grain. The upper mill-stone, supposed four feet six inches in diameter, is inclosed in a round box *l l*, called the *hoops* or *crib*, which leaves a vacant space of about an inch and a half all round the circumference: this space is necessary to give the stone freedom to work. *g h*, is an iron spindle upon which is fixed the sheeve or whorl. No. 2. in the spindle is a crank or bend, that when turned round by the leather belt *s*, going from the sheeve No. 1. round the sheeve No. 2. moves or shakes the wire sieve *h*; which motion assists to clear the wheat of small refuse. No. 3. is a sheeve or whorl fastened upon the spindle g, turned round by a leather band from the whorl *s*, and having a crank near its under end to move the wire sieve *k k*, upon which the wheat runs from the mill-stones to the fanners *m m*, to be cleaned of all loose refuse, and prepared to be ground into flour. *u u*, a rope or band which turns the fanners, by passing round a sheeve on the spindle *g*. *w w*, the bridge-tree, on which the spindle that carries the upper mill-stone turns round in a cod or pot of brass. One end of the bridge-tree goes into a mortise in the fixed frame, and its other end in a moveable one. *v v*, is the bearer, iron rod, and lever or mill-hand, for raising or depressing the bridge-tree *w w;* by which means the upper mill-stone is lifted farther up or let down nearer to the under one when necessary. *t t*, the sluice machine and handle for raising the sluice to let the water on the wheel *a a*, to drive it. *o p*, different boxes in the lofts for containing grain. *q q*, the walls of the mill-house. *i i*, the couples or framing of the roof. *r r*, the doors in the walls. *x x*, windows to light the mill-house.

At *fig.* 3 in the same plate is seen a section of the *flour-mill*, with machines for bolting. *a a*, the great wheel containing 40 float-boards or *aws*, on which the water falls to turn it round. *c c*, the shaft or axle upon which the water wheel is fixed and gudgeon on which it revolves. *b b*, a wheel fastened upon the same shaft containing 84 teeth to drive the trundle No. 2. of 10 staves or rounds, which is fixed upon an iron spindle, having on its upper end a strong iron cross let into a groove in the middle and underside of the running mill-stone, by which the stone is carried round along with the trundle or pinion. *d*, the strong frame upon which the under mill-stone, supposed four feet eight inches diameter, is laid. The upper or running mill-stone, being the same diameter with the under one, is inclosed in the round box *e e*, which leaves a space of

about two inches all round, to allow the stone room to work. *h h*, are two hoppers, into which the clean wheat is put; and from any of these hoppers it may be conveyed down in a spout into the small hopper *v*, under which is the spout or shoe *v*, to be ground into flour. *f f*, an iron spindle, having a square socket in its lower end, which takes in a square on the upper end of the iron spindle above the strong iron cross that carries the upper mill-stone. On the upper end of the spindle *f*, is fixed a pinion containing 7 teeth, to turn the wheel *g g*, having 36 teeth, which is fixed upon an axle round which the rope rolls to carry the bags of ground flour up to the cooling benches *n* and *o*; from which it may be conveyed down, either to the bolting-wire-engine *m m*, or to the bolting machine *l l*, to be separated from the bran. *p*, an horizontal axle, upon one end of which is fixed a pinion No. 3. driven by the wheel *b b*, and having 15 teeth. No. 4. is a barrel fastened upon the other end of the axle *k*, on which there are two leather belts or bands that drive the bolting machines; the one going on the sheeve No. 5. fixed upon the bolting cloth that separates the flour from the bran. No. 6, are rollers for conducting the leather band No. 5, and straightening it when necessary. *z*, the hopper having a spout or shoe affixed to it for conveying the flour into the bolt-cloth on the reel, through which cloth the flour escapes while the bran runs out at the lower end. *p p p*, the spouts to which sacks or bags are hooked to receive the flour as it falls down from the machine. No. 7. is a sheeve fixed upon an iron axis, driven by the leather belt going round on the barrel, No. 4. Upon the same iron axis is fixed a wheel, No. 8. containing 24 teeth, to turn the wheel, No. 9. having 25 teeth, which is fastened upon the gudgeon in the axle of the winch or reel of the bolting-wire-engine. *u*, a hopper and spout for conducting the flour into the wire engine. 11, 12, 13, 14, are spouts in which the flour and bran run down from the engine into sacks or bags hooked to their lower ends. *ss*, the fall or course of the water to drive the wheel *a a* which turns the machinery. *q q*, the side walls of the mill house. *w w*, the couples or framing of the roof. *r r*, doors in the walls. *x x*, windows to light the mill house.

And at *fig.* 4 in the same plate is the elevation of the *flour mill*; in which *a a*, is the water wheel. *c c*, the shaft or axle of the water wheel. *b*, No. 1. a wheel fixed upon the same axle, containing 84 teeth or cogs, to turn the pinion or trundle *d*, having nine staves or rounds, which is fastened upon the iron axis or spindle, having on its upper end an iron cross that carries the upper sheeling mill-stone round. There are two of the staves in the trundle *d*, made so as to be easily taken out when the sheeling machines are to be stopt while the grinding mill is at work. *h h*, the frame that supports the under mill-stone *g*, and the box or case that surrounds the upper mill-stone. *k k*, is an iron spindle, having in its lower end a square socket, that takes in a square on the upper end of the iron spindle that carries the trundle *d*: and upon its upper end is fixed the pinion *l*, containing 7 teeth, to turn the wheel *q l*, having 36 teeth, which is fastened upon the axle *u u*, round which the rope No. 5. rolls to raise up the sack or bag of wheat to the lofts or to the hoppers *i i*. From either of these hoppers it may be conveyed down to the wire sieve *g*, suspended by rods of iron, and moved by the crank *p*, being turned round by a leather belt going on the sheeve *f*, fixed upon the spindle *k*, and on a sheeve upon the iron spindle *p*. Thus the wheat is cleared of sand and small seed by passing over the wire sieve *g*, before it enters the spout *e*, which conducts it into the eye or hole in the middle of the upper mill-stone. The wheat having gone through the operation of sheeling issues out at an opening in one side of the case upon a wire sieve, over which it runs into the fanners, and is cleaned. The wire sieves and fanners are plainly seen at *figs.* 1 and 2. The wheat thus cleaned, is received into a bag from the fanners, and carried up by the rope No. 5. to any of the hoppers *o o*. From either of these hoppers it will run down in the spouts into the small hopper *n*, placed on the frame above the mill-stones.

By pulling the cord No. 6. the wheel *u l*, and axle *u u*, are set agoing: and by pulling the cord No. 7. it is stopped at any time. But when the sack of wheat is to be carried to the uppermost floor, the machine stops itself.

b, No. 2. a wheel fixed upon the other end of the axle *c*, containing 84 teeth, to drive the trundle *m*, having 10 staves or rounds, which is fastened upon an iron axis called the mill spindle, the under end of which turns in a brass pot or step fixed on the upper side of the bridge tree: and its round near the upper end turns in a bush of endwood fastened in a hole through the middle of the under mill-stone. There is a square on the top part of this spindle above the wooden bush, that goes into a square hole in an iron cross, called the rind, which enters into a groove in the middle, and under surface of the running mill-stone. Thus the stone is turned round along with the trundle *m*, and is also raised or depressed at pleasure by a rod of wood or iron connected with the bearer that supports the bridge tree, and a lever called the mill-hand; by which means the upper mill-stone is raised up from the under one, or let close down to it, according as the flour is wanted coarse or fine. There are wads or channels cut in the surface of the mill-stones, which assist in grinding and throwing out the flour. The manner of laying out these wads is represented in Plate IX. *figs.* 3 and 4. The upper mill-stone is inclosed in a round box or case, which leaves a vacant space of two inches all round. Upon the top of this box is a frame on which are placed the hopper and spout or shoe *n n*, by which the wheat is conveyed into the eye or hole in the middle of the upper mill-stone. *t t*, is an iron spindle having in its under end a square socket, that takes in a square above the rind on the top of the spindle that carries the trundle *m*; by which means the spindle *t* is turned round, and by it the shoe *n* into the eye of the mill-stone, where it is introduced betwixt the stones, and by the violent motion of the upper mill-stone, acquires a centrifugal force; and, proceeding gradually from the eye of the mill-stone towards the circumference, is thrown out at last in flour at a hole in one side of the case, called the

eye of the mill, in which is fixed a spout to convey it down to the trough or box below. There it is put into a bag and carried up by the rope No. 8. to be laid in the cooling boxes *w w*, from which it may be conveyed down either to the wire-bolting engine No. 3. or to the cloth-bolting machine No. 4. and cleared from the bran. There is fixed upon the upper end of the spindle *t*, a pinion containing 7 teeth, to turn the wheel *v v*, having 36 teeth, which is fastened upon the axle *z z*, round which the rope No. 8. rolls to carry the sacks of flour up to the cooling boxes *w w*: by pulling the cord No. 9. the wheel *v*, with the axle *z*, is set agoing, and by pulling the cord No. 10. it is stopped at any time; but when the sack is raised to the uppermost box *w*, then the machine stops itself. *s*, a barrel, upon which go the leather belts *y y*, to turn the bolting machines. These are clearly represented in the plate at *fig.* 1. *r r*, the frames of the bolting machines, having spouts fixed in their under sides, in which the flour and bran run down. These are plainly shewn in the plate at *fig.* 3. *q q*, the gable or end walls of the mill-house, with windows to light the house. *x x*, the doors in the side walls.

In Plate IX. is the representation of a mill for making pot and pearl barley, and a cylinder for bruising malt, in which at *fig.* 1. is the plan of the mill. *a a*, The water wheel fixed upon its shaft or axle *b b*; upon which axle is also fastened the wheel *c c*, containing 108 teeth or cogs to turn the wheel *d*, No. 1. having 25 teeth which is fixed upon the axle *g h*. On this axle is also fastened the wheel *g*, No. 2. containing 66 teeth, to drive the pinion No. 3. having 17 teeth, which is fixed upon an iron axle or spindle that carries the mill-stone. There is likewise a wheel fastened upon the axle *g h*, at *h*, containing 21 teeth, to turn the wheel No. 4. having 33 teeth, which is fixed upon an iron spindle, on which is likewise fastened a pinion containing 9 teeth to drive the wheel, No. 5. having 86 teeth, fixed upon the frame or case *h*, that surrounds the mill-stone, leaving a space about two inches all round and on each side, to contain the barley; this case is covered with milled or plate iron, pierced pretty thick of small holes, to allow the dust, and small refuse to escape through as it is rubbed off the grain by the circular motion of the mill-stone and case that inclose it. *i i*, are pillars that support the bearers upon which the gudgeons, iron axles, and cases of the mill-stone turn. *l l*, the headstocks that the gudgeons of the axle *b b* revolve on. No. 6. a wheel fixed upon the axle *d e*, containing 55 teeth, driven by the wheel *c e*. On the same axle is fastened the wheel No. 7. in which are 66 teeth to turn the pinion No. 8. having 14 teeth, which is fixed upon an iron axis, that has a coupling box to take off the square on the gudgeon in one of the cylinders *f f*, to drive them round and bruise the malt as it passes down betwixt them. These cylinders are made of cast iron and hollow: their gudgeons and themselves must be made perfectly round, equidistant, from each other their whole length and in order that the malt may be equally bruised. *k k*, the pillars which carry the bearers that the gudgeons of the cylinders turn on. *v v*, the course of the water that drives the wheel. *m m*, the machine and handle to raise the sluice to let the water on the wheel. *r r*, the walls of the mill house. *t*, an opening at which the sacks of grain are conveyed up to the loft or hopper. *o o*, a door in the ground floor. *n n*, a stair leading up to the lofts. *p p*, windows to light the mill-house.

At *fig.* 2. is the elevation of the same mill. *a a*, the water wheel, fixed upon its shaft or axle *b b*; upon which is also fastened the wheel *e e*, containing 108 teeth or cogs, to turn a pinion having 25 teeth which is placed on the axle, *d*. Upon this axle is likewise fixed the wheel *e c*, containing 66 teeth to drive the pinion *f*, of 17 teeth, which is fastened on the iron axle or spindle that carries the mill-stone. *x x*, two wheels, one of which is fixed upon the axle *d*, having 21 teeth, that turns the other of 33 teeth, which is fastened on an iron axis, upon which is placed a pinion of 9 teeth to drive a wheel having 86 teeth, which is placed on the frame or case *g g*, that incloses the mill-stone. There is a flench of cast-iron fixed upon each side of the case, through which the iron axle which carries the stone passes, and on the flenches the case revolves in the frames. *h*, is a wire sieve below the case by which the great barley may be separated from the small. *H*, a wheel and axle turned by the wheel *C C*. Round this axle the rope *K K* rolls, to carry up the bags of grain to the boxes or hoppers, *P R*, from either of which it may be conveyed down to the machine. By pulling the cord *M M* a little, the wheel and axle *l l* are set agoing, and pulling the cord *L*, they are stopped at any time: but when the bag of grain, hanging by the rope *K*, is raised up to the lever *N N*, it pushes up one end of the lever, and of course down the other end to which the cord *L L* is attached. By this means the machine stops itself. *O O*, are the side walls of the mill house. *S*, the couples or frame of the roof. *V*, a door in the side wall: and *T T*, windows to light the house.

In regard to *wind-mills*, Mr. Ferguson observes that "the working parts of them differ very little from those of a water-mill, only the former is turned by the action of the wind upon four sails, every one of which ought, (as is generally believed) to make an angle of $54\frac{2}{3}$ degrees, with a plane perpendicular to the axis on which the arms are fixed for carrying of them: it being demonstrable, that when the sails are set to such an angle, and the axis turned endwise towards the wind, the wind has the greatest power upon the sails. But this angle answers only to the case of a vane or sail just beginning to move: for, when the vane has a certain degree of motion, it yields to the wind; and then that angle must be increased to give the wind its full effect." And further, "the increase of this angle should be different according to the different velocities from the axis to the extremity of the vane. At the axis it should be $54\frac{2}{3}$ degrees, and thence continually decrease, giving the vane a twist, and so causing all the ribs of the vane to lie in different planes. Lastly, these ribs ought to decrease in length from the axis to the extremity, giving the vane a curvilineal form, so that no part of the force of any one rib be spent upon the rest, but all move on independent of each

other. All this is, he says, required to give the sails of a wind-mill their true form, and we see both the twist and the diminution of the ribs exemplified in the wings of birds." It is added that "it is almost incredible to think with what velocity the lips of the sails move, when acted upon by a moderate gale of wind. He has several times counted the number of revolutions made by the sails in ten or fifteen minutes; and from the length of the arms from tip to tip, has computed, that if a hoop of that diameter was to run upon the ground with the same velocity that it would move if put upon the sail arms, it would go upwards of 30 miles in an hour. But as the ends of the sails nearest the axis cannot move with the same velocity that the tips or farthest ends do, although the wind acts equally strong upon them, perhaps a better position than that of stretching them along the arms directly from the centre of motion, might be to have them set perpendicularly across the farther end of the arms, and there adjusted lengthwise to the proper angle. For, in that case, both ends of the sails would move with the same velocity; and being farther from the centre of motion, they would have so much the more power; and then there would be no occasion for having them so large as they are generally made; which would render them lighter, and consequently there would be so much the less friction on the thick neck of the axle, where it turns in the wall" or other part.

The principal improvements that have been made in mills of this sort are in the form and modes of fixing the arms and sails.

At *fig.* 1. in Plate X. is the representation of a wind-mill employed in Portugal, and which, from the differences in the construction of the sails, is supposed by Lord Somerville to possess a superiority in having the broad part of the sail at the end of the levers or beams, and consequently equal resistance being overcome with less length of branches. And from this shortness considerable saving is made in the timber of both the beams and spindles, as well as in the height, first cost and future repairs of them. And he conceives that the advantages arising from using mills of this description are, that, as there are four beams, as well as four masts for the sails, they are more easily braced out to the wind, and in case of a sudden gale, are more easily cast loose, than those of the common construction. And as the sails are placed in the best possible direction by means of the beams, it is presumed that a mill built on this plan will do more work than any common mill with an equal quantity of canvas.

In cases where neither water or wind can be applied to the working of mills, horses have frequently been employed, but a better power has lately been found in steam, as has been suggested above.

Hand mills of different kinds have lately been more attended to than formerly, and in many cases they are unquestionably both useful and convenient; but from the nature of the power or force by which they are wrought, they must constantly be wrought to considerable disadvantage.

At *fig.* 2, is the representation of a horizontal hand corn mill, invented by Mr. Wright. The frame is three feet square, and three and a half in height. The stones are eighteen inches in diameter, and inclosed in the tub supported by two cross bearers; under which is a lever, having an iron pin or pivot, which runs through the centre of the bed-stone into a socket in the bridge of the upper stone or runner, to which is attached the shaft and spindle, running through the eye of the runner and hopper, and supporting the fly wheel and crank. A round piece of wood fastened on the shaft serves as a feeder; above is a screw to regulate the feed according as turned. On the side of the tub is a thumb screw fixed to the lever underneath, which regulates the stones according as turned. The shaft runs through the crown tree or cross bar at the top of the frame, on which is the horizontal fly wheel and crank; to which are attached one or two handles, by which the mill is put in motion. Under the stones is a drawer, in which are placed three sieves of different finenesses; one for taking away broad bran, another for the coarse pollard, and the third for stopping the fine pollard, and letting the flour pass into the drawer; which is effected by a sort of iron fork running through a hole in front of the drawer, and fixing on one of the sieves. The price of the mill is sixteen guineas, and one guinea for the set of sieves.

A cheap mill of this kind invented by Mr. Sargeant of Whitehaven, as an improvement on the *Scotch Quern* and *American Hand-Mill*, so as to increase the power and effect of these contrivances, and at the same time, to retain as much as possible of their simplicity and cheapness is seen at *fig.* 3. "A the bed stone; B the running stone, nineteen inches over, and weighing about eighty-five pounds; C the shoe or hopper, which the grinder feeds with his left hand as wanted; D the crank and wooden handle; E the fly, having three arms, each loaded with two and a half pounds of lead; F the iron or rynd in the upper stone." It is observed, that "it works with ease, with this inconvenience only, that the quick motion which is required to give sufficient speed to the stone, is rather fatiguing to the person employed. This he says admits of an obvious remedy where the additional expense is not regarded, by a multiplying wheel and pinion; but he prefers having two persons to relieve each other without stopping the mill. It has been found to grind at the rate of three and a half gallons per hour, worked by one person."

He has since made a little improvement in the mill. When the stone was hung upon its rynd in the usual manner he found it had scarcely sufficient weight to oppose to the resistance of the grain: he therefore fixed it down by small bolts, GG, passing through the ends of the rynd, and secured by nuts on the back of the upper stone; by which means it is less liable, he says, to derangement, and acts with greater power; it requires some degree of millership in its management and adjustments, yet nothing but what any servant in a family may easily learn.

The cost of the mill is about four guineas and a half.

Mills have likewise been contrived for other purposes,

such as breaking, grinding, and pulverizing hatched or chopped bark for tanning and other uses. For breaking, grinding, and pulverizing wood and other hard substances; for grinding of apples, and making mortar.

Mr. Weldon observes that "his former method of constructing mills for grinding bark, was chiefly of cast iron, the teeth or cutters thereof cast with them, and the method of keeping them sharp, or renewing their teeth, is to chip or cut them with a hammer and chissel; and the method of making and constructing what are commonly called steel mills for the purpose of grinding malt, &c. are chiefly made of malleable iron, case hardened, the teeth of which are cut, or raised out of the solid, by means of chissels and files, and are kept sharp by the same method. But in order to avoid these difficulties, and make them more durable and lasting, and that the user of such mills or machines may be able to sharpen his own mill or machine, and keep the same in repair without sending them to the maker, he has constructed them with loose or moveable teeth, which may be taken out at any time, and by grinding them on a common grinding stone, may be sharpened and kept in order; or by replacing the teeth, should they wear out, the machine will then be as good as new. *Figure* 2, plate VI. represents the different parts of a mill or machine for grinding bark, corn, &c. and the manner in which it is constructed. A, is a hopper made of wood, tin, or sheet iron, which receives the corn, or any thing that is to be ground. B, is the axis of the ball, or inner part of the mill, which may be made of wrought or cast-iron. C, is a conical covering, which prevents the materials to be ground from lodging on the cap, which may be made of wood, tin, or sheet-iron. D D, is a loose cap which fastens and secures the loose teeth of the ball, or inner part of the mill, by means of four screws represented by h. E, represents one side of the ball or inner part of the mill, filled with teeth. G, shews one-half of the inner part of the mill without teeth, wherein may be seen the manner in which the teeth are kept in their places. d d, shews the substance of the metal, which is of cast-iron. H H, shews the bottom flang that holds the teeth, and is cast with the body part of the cone. a a a, shews the outer cylinder, which is cast altogether, and shews in what manner the loose teeth, F F, are fixed in it. I I, is a flang which fastens or holds the loose teeth of the outer part of the mill and by means of six screws, as shewn by *figure* 4th. K K, is the bridge which carries the inner part of the mill, and is fastened to the outer cylinder by means of two screws c c. L, is the lower part of the axis. M, is the brass step on which the axis works. N, is a place in which the regulating screw works, and is made of wrought-iron. O, the regulating screw. *Figure* 3d, represents the under side of the outer cylinder with the bridge K, and the box which contains the brass step M. *Figure* 5th, represents one of the loose teeth on the outer part of the mill. *Figure* 6th, represents one of the teeth on the inner part of the mill. These teeth may be made of cast-iron, wrought iron, or steel, or any metal or materials that may be thought most proper. These mills or machines are not confined to any precise form or shape, and may be made of any metal or materials, and they may be worked either as hand-mills, or horse-mills, or by any other power that can be applied to them."

Mill-*Dams*, the basons which contain the water for supplying mills.

Mill-*Holms*, a term applied to the low meadows, and other fields in the vicinity of mills, or watery places about mill-dams.

Mill-*Stones*, the stones made use of in grinding grain or other substances. They are of different kinds, according to the purposes for which they are employed, but those chiefly used in grinding wheat into flour, were formerly imported from France and termed burrs. Lately however stones proper for this use have been discovered in different parts of this kingdom, as in Wales and Scotland. In the first of these places they were found by Mr. Bowes, in a quarry which is "situated within the corporation liberties of Conway: the stone, he says, appears within a quarter of a mile of that town, and extends from east to west for the distance of two miles, appearing in most places upon the surface within that distance. Such an immense body of the stone has been left bare and exposed to view, that the industry of ages would scarcely lessen it. A deep chasm intervenes at the end of two miles; and, on examining the same line across this valley, he found the stone mixed up with various other fossil substances, to which it seems to bear no relation. In the next rise of mountains it resumes its quality, and takes a southerly direction, passing through a range of hills to the distance of two miles more, where the vein disappears. It is every where the highest stratum; and when disengaged from the quarry where now worked, it tumbles down the side of the mountain to the plain within five hundred yards of the shipping-place, where small vessels may lie safely in all weathers at a natural quay, completely calculated for this business." And it is added that "the quarry lies on the decline of a hill: the vein now is about eight yards wide; but he has reason to suppose it is wider below. At the depth he has sunk, which is at least twenty-five feet, the stone mends in quality. When first taken from the quarry it is much softer, and easier wrought into shape, than when exposed to the air; even a day makes a difference. The vein appears to him quite inexhaustible, and contains every variety of the stone, cellular, close, hard, or soft. The right in this tract of country has been presented to him, by Mr. Sneyd of Staffordshire, under the hope that he might be able to make this discovery, and carry it vigorously into effect, in which he has not been disappointed."

From the evidence sent to the Society for the Encouragement of Arts, &c. the stones raised from this quarry are capable of being employed in most cases where those imported from France have been in use.

The stone from its external appearance seems to be constituted of quartz and cherts.

In the latter situation stones fit for this use were discovered by James Brownhill, miller, "who when the late unfortunate war had rendered the getting of the French burr extremely difficult, as he was passing by the great basaltic rock of the Abbey Craig, near

Stirling, examined the texture of several masses of the stones; and found one species, which appeared to him fit for the grinding of wheat, and brought home a sample of them, which he shewed to Mr. Alexander Bald, agent of the Alloa Mills, who agreed to make trial of a pair. They were built under his direction in the same manner as the French burr; and, on their being put to work, gave such satisfaction to the customers of the mills, as induced the Alloa Mill Company to have another pair built, and totally lay aside the French burr millstones." It is observed that, "the French burr stones are so porous, as to make it necessary to fill up the cavities with a preparation of alum: this considerable expense is saved by the uniform texture of the basaltes; and their superior excellence is so apparent, that upwards of 60 pair are now at work in several parts of the kingdom, and the demand for them is daily increasing." In addition it is stated that "the basaltes millstones are not only excellent for manufacturing of flour, but for all kind of grist. The distillers give them a decided preference, and they grind oats in a very complete style, as the meal is returned quite free of sand, which is a great desideratum for those places where oat bread is in use. The discoverer of this use of the basaltes, builds millstones of all sizes upon moderate terms, and is careful, from his experience as a miller, to build them of such a grain as is most suitable for the particular purposes for which they are intended.

According to Mr. Ferguson, the diameter of the upper stone is generally about six feet, the lower stone about an inch more; and the upper stone, when new, contains about 22½ cubic feet, which weighs somewhat more than 19,000 pounds. A stone of this diameter ought never to go more than 60 times round in a minute; for if it turns faster, it will heat the meal. But according to Mr. Imison, the millstone should turn twice round in a second of time, and should only be four feet and a half in diameter. It may probably be imagined, he says, that the meal will be much heated by such a rapid motion as he has recommended, but the effect is counteracted by diminishing the size of the millstone from six feet to four and a half. The velocity of the circumference of the small mill-stone moving twice round in a second, is only one third greater than the velocity of the large millstone moving one round in a second.

The modes of preparing mill-stones for the purpose of grinding have been described above.

In the former of the above quarries mill-stones are raised which are of much larger sizes than the French burrs, which may probably be an advantage in some cases.

Fig. 3, in Plate IX, represents the surface of the under grinding mill-stone the way of laying out the wads or channels: the wooden bush fixed into the hole in the middle, in which the upper end of the iron spindle turns round; and the case or hoops that surround the upper one, which ought to be two inches clear of the stone all round its circumference. *Fig.* 4. The upper grinding mill-stone, and iron cross or rind in its middle, in the centre of which is a square hole that takes in a square on the top of the iron spindle, to carry the mill-stone round: when the working sides or faces of the mill-stones are laid uppermost, the wads must lie in the same direction in both, that when the upper stone is turned over, and its surface laid on the under one, then the channels cross each other, which assists in grinding and throwing out the flour; the wads are also laid out according to the way that the upper stone revolves. In these the running millstone is supposed to turn *sunways*, or what is called a right-handed mill; but if the stone revolves the other way, the channels must be cut the reverse of this, and then it is termed a left-handed mill.

Flood-*Mill*, such a mill as is contrived for the purpose of raising water in order to discharge it from fens, marshes, and other similar kinds of land. See *Draining-Mill.*

Threshing-*Mill*, such machine as is contrived for the purpose of threshing grain or other sorts of crops. See *Threshing Machine.*

MISLEN, the same with meslin, or maslin-corn. See *Meslin-Corn.*

MIST, a foggy appearance produced by thick vapours floating near the surface of the earth.

Mists of all sorts are often highly destructive to many sorts of vegetable crops.

MIXEN, a term applied to a compost dung-hill. See *Compost.*

MIZZY, a term sometimes applied to a bog, or a quagmire.

MOAR-LOVRE, a term made use of to express a peculiar distemperature of corn, a sort of blight. In this case the earth is said to sink away from the roots of the corn, and to leave the plants standing in a great part above the ground with naked roots; which are too weak to support the stalks: the plants of course fall down and the ears become light. It is a distemper peculiar to corn growing on light and loose lands, which Mr. Tull has mentioned in his Horse-hoeing Husbandry.

The best remedy is to bring up mould against the rows, when they are strong enough to bear it, and it is fine and dry; the motion of the stalks with the wind draws in this loose powdery mould, and it spreads equally, settles about the roots, and covers them so as to produce fresh nourishment.

MOLE, a small well known subterraneous animal, which often does great mischief in the fields, by loosening the earth, raising hills, and destroying the roots of corn, grass, and other vegetable productions.

With respect to the natural history of the mole, it has been observed by M. Aurignac, that it lives under ground. Its health is liable to be injured by too free access of the air: yet that it sometimes leaves one subterraneous habitation, and passes on the surface, in search of a better. It lives on the roots of plants, on insects and on worms. Hence, it is commonly found in lands of soft, fertile soil. It never fixes its abode in miry, nor in gravelly grounds. If surprized in its subterraneous recesses by water, it springs in great haste to the surface. And that in winter, and during rain, it betakes itself to the upper grounds, which are the least humid and the least liable to be inundated. But in spring, the mole comes down from its winter-residence to the meadows where

it finds a soft mould capable of being easily penetrated, and containing plenty of roots. And after suffering long drought, it flees to ditches, to the brink of the first stream, or to shelter under hedges. In the months of February, March, April, and May, the female produces its young; bringing commonly four or five at a birth. These animals prepare beforehand, for this occasion, an arched recess under ground in a situation somewhat elevated, and generally under the cover of a bush or hedge. To the number of four or five mole-hills may be observed very near to the upper side of this recess. It cannot live without being at work. Being obliged to search under ground for its food, it forms there, long tunnels or subterraneous passages named, in French, *boyaux*. These tunnels are, usually, parallel to the surface of the earth, and vary in depth according to the changes of seasons, from four to six inches. And as the moles are almost equally afraid of cold and of heat, they make their passages the deepest, and work at the greatest distance under the surface, in summer and in winter. They are extremely timid when they perceive themselves to be in danger. They then penetrate by a perpendicular opening, to the depth of a foot and a half below the level of their ordinary residence. And in forming their passages they throw back the mould, which they remove towards the surface. It is thus the mole-hills are raised. Upon every new change of place a mole raises three, four, six, or even nine of these hills, according to its age. Consequently, all the mole-hills formed by any one mole, communicate, by subterraneous passages, with one another. When with any instrument, a tunnel, or passage, recently formed by a mole is opened, the mole will, in a few minutes, come to close up the aperture, in order to secure herself from danger, and from the access of the external air. It constructs, for this purpose, over the aperture, an arch of loose mould, having, externally, the appearance of an oblong mole-hill, and mending up the tunnel much in the same manner in which a plumber might mend a leaden pipe, by clumsily applying, on the outside, a piece of lead to cover any hole in it. And should this new mole-hill likewise be broken down, the mole will again return to repair it. These two capital facts, he says, constitute the fundamental principles of the art of the mole catcher. The mole works in all seasons; because it cannot otherwise, have subsistence. That it sleeps, as some naturalists have affirmed, all winter,—is not, he says, true. It is, however, languid in this season; working, now, much less than in summer. That about the beginning of spring, it is, when the mole sets to work with the greatest activity, and raises the greatest number of mole-hills.—It is, then, obliged to find food for its young; as spring is its season for parturition. The ground is, now, easier wrought than at other times. The animal, too, in itself becomes more vigorous, by the diminution of the cold, and the return of the genial temperature of spring. These are the causes of its increased activity in toil. The male is much stronger than the female, and raises a greater number of mole-hills, and those larger. The female works less than the male, throws up fewer mole-hills, and those smaller. And the young moles form only long covered ways, at the surface; the mould raised over which, is scarce sufficient to hide them. When they begin to make mole-hills, these are small without any regular shape, and arranged zig-zag. The hours of working, for moles, are at sun-rise, at the hour of nine in the morning, at noon, at three in the afternoon, and at sun-set. But, it is at sun rise, and at sun setting, that they ply their work with the greatest briskness. And in times of drought, they do not throw up mole-hills, except at sun setting. In winter their moments of working are when the earth is somewhat heated by gleams of sun-shine. The sense of seeing is exceedingly obtuse in the mole; but its hearing is exquisitely delicate and acute.

In regard to the principles of destroying these animals, it is remarked that it is difficult to take moles unless when they are at work. That the most favourable time for the mole-catcher, is in the beginning of spring. And that it is in the meadows, that they should be, in this season, the most earnestly attacked. They are to be attacked at sun-rise, at the hour of nine in the morning, at noon, at three in the afternoon, or at sun-set. That it is better to commence an attack upon them at sun-rise, than at any other time in the day. And that, the next most convenient hour is nine in the morning; because, if all the moles which one wishes to destroy cannot be then taken, the operations may be renewed at those other hours in the day at which these animals are known to resume their work. In watching for a single mole, care must be taken to make no noise, and especially, not to stamp nor beat upon the ground. One may, at any time, force a mole to come above ground, by pouring a sufficient quantity of water into its subterraneous recesses. And should a person happen to be near a mole-hill, when the mole happens to betray its presence by stirring the mould; let him, then, with his hoe, break into the tunnelled passage between that and the next mole-hill; and let him with a little earth, close up the passage at the aperture made with his hoe. The mole is now imprisoned between the mole-hill and the place where its passage is broken into, and stopped up. If the earth of a mole-hill be fresh and newly raised, you may conclude, that there is a mole within it. The same thing may be inferred of any number of fresh mole-hills within small distances of one another. Yet, however fresh the earth of any mole-hill, if there be in its centre a perpendicular hole of about two inches diameter; you may be sure that the mole is not within, but has left this residence, in search of a better. And when you find an assemblage of mole-hills together, of which the earth is quite fresh; then, upon removing them all with the hoe, and laying open the passages communicating among them, you cannot fail to find the mole that works within. This labour might prove too tedious and troublesome. But it will become very simple, if the mole can be confined between two points not remote from each other. Nothing more will then remain to be done, but to open with the hoe, the intermediate passage between these two points. And a mole may be reduced to confinement between two

such points, by making a few slight openings in the length of the tunnelled passage in which you desire to confine her. These openings interrupt her course; for, she will not pass, till she shall have first repaired them. But when you break into the tunnelled passage of a mole, close the passage slightly with a little loose earth, at both ends of the hole you have made.

In the practice of mole-catching on these principles, it is added that "the only instrument absolutely necessary to the mole-catcher, is a hoe. But that it will be convenient that he have, likewise, at hand a few chips of straw, a few bits of paper, and a pitcher of water."

It is stated that "the first thing a mole-catcher should do on a farm or estate which he goes to free from moles, is, to examine how those moles may be so confined that he shall be able to attack them all at once: for, by thus attacking them, he will the soonest accomplish his whole task."

In the plate is a representation of a meadow covered with mole-hills, as at *figs.* 1, 2, 3, 4, 5, 6, 7. And by surveying this meadow, as a mole-catcher, he perceives a detached mole-hill as *fig.* 1; and perceiving the earth composing it to be fresh, or newly thrown up, he concludes, then, that there is a mole beneath. The mole-hill is large; he thence knows the mole within it to be a male. And with respect to the two mole-hills, *fig.* 2, they are at no great distance one from another: of course he knows them to be the work of a single mole. They appear fresh: and he concludes the mole to be still busy within. They are small: he, on this account, supposes it to be a female that has made them.

The three mole-hills, *fig.* 3, are near to one another; and consequently, the work of a single mole. They are fresh: he of course knows the mole to be now at work within. They are large: and have therefore been thrown up by a male. The six mole-hills *fig.* 4 are not distant from one another: they must have been all thrown up by one mole. They are fresh: the mole is still at work. They are small: and, therefore, raised by a female. The zig-zag covered ways, or imperfect mole-hills as at *fig.* 5, are fresh: a young mole is beneath.

The five mole-hills as at *fig.* 6, are dry: they have been deserted. And the seven mole-hills at *fig.* 7, are yet fresh; but one of them, M, has a perpendicular hole opening at the top. The mole by which it was thrown up, is hence known to be but just gone. By these observations he knows that there are in this meadow, two male moles, two females, and a young one. And it is of consequence, to know whether the moles be males or females; young or old. The males work quicker than the females; and are therefore, to be more narrowly watched. The young ones, raising but a very little mould to cover them, as they move along at the surface, go, also, very quick; and should therefore, be kept constantly in view, after they have, once, been discovered.

In the operations for destroying them in the first case, as where a mole makes but one mole-hill, *fig.* 1. he removes this mole-hill with the hoe; and ascertains whether it has a communication with any of the mole-hills adjacent. For this last purpose, he hems or makes a slight noise, at the aperture, or mouth of the internal passage from the demolished mole-hill. He at the same time, applies his ear to listen what ensues within. If the mole-hill be without communication with any other; the mole being nigh is frightened by the noise; he hears it stir; and it cannot escape him.

With his hoe he lays open the tunnelled passage, *a*, *b*; and, at *b*, he finds the mole.

But, the creature, aware of its danger, may possibly, he says, have had time to descend deeper into the earth by the perpendicular passage, *b*, *c*; he has then, two methods for taking her: he either digs to *c*, and there finds his prey; or he pours in water at *b*, and the mole comes out of herself.

On the other hand, if upon hemming, he could not hear her stir; he concludes that this mole-hill communicates with others near it; and he proceeds as follows:

In the second case, where a mole has thrown up two mole-hills A, B, *fig.* 2. he makes in this case, an opening, *d*, *e*, more than nine inches long, in the direction of the tunnel which runs between the two mole-hills. With a little earth he closes the two ends *d*, *e*, of the tunnel. Within a few seconds, the mole, disagreeably affected by the air, and fearful of danger, comes to repair the breach, and is discovered by its working at *d*, or *e*. If it come to *d*, he knows that he shall find it between that point and the mole-hill A. And when it comes to *e*, he is sure of finding it between *e* and the mole-hill B. In either instance, he proceeds as was indicated in the first case; and lays open either that part of the tunnel which terminates at the mole-hill, or that which ends at B.

In the third case, where the mole has thrown up three hillocks, C, D E, *fig.* 3. he now makes the four apertures, *f*, *g*, *h*, *i*.

The mole will be soon discovered by its stirring the mould at *f*, at *g*, at *h*, or at *i*.

If it work at *f*; it is confined between that point, and the hillock C.

If it be perceived to work at *i*, it is confined between the point *i*, and the hillock E.

If it work at *g* or *h*; it is in the space between these two points.

In these three suppositions, he operates as in the first case, by laying open that part of the passage, within which the mole is confined.

If the mole be shut up between *g* and *h*; and he does not choose to take the trouble of laying all that space open; he then removes the mole-hill, D, and makes a third cut like the others. He watches for the working of the mole; and he then knows by the side this appears on, whether he shall find the animal between the third cut and the point *g*, or between that third cut and the point *h*.

In the fourth case, where a mole has made four or more mole-hills, *fig.* 4. he takes for example, the six mole-hills, F, G, H, I, K, L.

He makes the cut *k*, *l*.

If the mole come to work at *k*, it is confined between that point and the mole-hill F.

If, on the contrary, she come to *l*, she is confined between *l* and the mole-hill L.

In either of these suppositions, he makes from K to F, or from *l* to L, the same means of operation as in the third case; that is, he proceeds just as if there were but three mole-hills.

A different mode of operating in the 2d, 3d, and 4th cases, is this: he supposes that, when he has made the cut *d*, *e*, *fig.* 2. the mole comes to work, at *d*, and he observes it the moment it comes there. He knows that it must travel along *d*, *e*, to repair the breach in its tunnel by an arch of earth which it must raise from the bottom of the place laid open. If he remain there, without making a noise, he shall see it come to work. Then, to take this mole, he has only to put the end of his hoe behind it, before it comes to the point *e*. The earth which he had before put at the aperture *d*, will hinder it to advance: the end of the hoe will prevent it from retiring: and he shall easily take it, by removing with his fingers that small portion of loose earth with which it is covered.

Is it possible, he asks, even without waiting beside an aperture, to know the moment a mole comes to work at it? Nothing more is, for this end, necessary, than to place there a chip of straw, bearing a bit of paper at its upper end. This small standard will be subverted, or at least shaken, by the very first movement the mole shall make at the place where it stands. The shaking or fall of the chip of straw calls the mole-catcher to watch and take the animal within.

In the fifth case, where the mole comes not to work at the cuts made first by the mole-catcher, he supposes, that, if after making the aperture *k*, *l*, he finds that the mole continues to work at the mole-hill L. he is now sure, that it is between the point *l* and the mole-hill L. and his subsequent operations are the same as in the third case; that is, he must act as if there were but three mole-hills, J, K, L.

To know, whether a mole shall come, during his absence, to work under a mole-hill, he softly flattens the mole hill with his foot; and if, on his return, he perceives a small eminence to have been raised on the level, he can, then, have no doubt but the mole has been working there.

In the sixth case, is a different manner of operating from cases 2d, 3d, 4th, and 5th, where a person happens to be near a mole-hill at the moment when the mole breathes or blows at it. Should he be beside the mole-hill L, *fig.* 4, at the moment when the mole comes to work there; he does not use the uncertain method of the gardeners, who remove the mole-hill with the spade; but he cuts at *m*, *n*, the tunnel communicating between that mole-hill and the next one, K. This is a certain means of confining the mole between the mole-hill and the point *m*, *n*. When the mole is thus inclosed, he proceeds, as in the first case, and lays open the space within which it is confined.

In the seventh case as when several fresh mole-hills are found near to some other mole-hills, old and dry, as *fig.* 4 and 6. In this case, which is more troublesome than any other to the mole-catcher, it is doubtful whether the fresh mole-hills do or do not communicate by tunnels, with the old and dry ones. It is necessary to begin by making cuts between the old and the new hillocks, that the mole, when attacked in the new, may not be able to escape to the old. One may then proceed, according to circumstances, as in the foregoing cases.

When this happens to be the case, too many cuts cannot be made, unless anxious to spare the surface of the ground. It is good, for instance, as in *fig.* 4 and 6, to make a cut in the direction from H to N, and another in the direction from H to O; as there may be a tunnel in either, or tunnels in both of these directions.

On this, it is observed, that "if one were constantly to watch a single mole, and not to proceed against any other, till after the first were taken; only a very few could be destroyed in one day. But when a farm is surveyed to discover the moles, all the fresh hillocks should be gently flattened with the foot, and all the necessary cuts made,—as of these too many cannot be made, unless afraid of breaking the surface too much. Set up little standards of straw with paper streamers. Then pass about from one mole-hill to another, and proceed as directed above. If you thus proceed against several moles at once, you must exercise great vigilance: otherwise, while you are busy with one mole, others may make a good passage across the cuts; and, then, you will have to begin with them anew. A mole will be longer in repairing and crossing one of the cuts, if a lump of hardened earth is put at the bottom. This precaution should be always taken."

This is considered by Mr. Dralet the translator of the above, as "of all the means hitherto employed for the extermination of moles, the easiest and the surest." But a writer in the sixth volume of the Agricultural Magazine proposes a more simple, easy, and effectual practice, and which is less troublesome and expensive. It is the invention of a common labourer who clears nearly one half of the county of Glamorgan. His contrivance is composed entirely of oak, deal, or elm, but the first is the best, and common nails, and may be made by any carpenter or wheel-wright, and set to work by any common labourer.

In the same plate, at *fig.* 8.—A and B are two boards of oak, forming the sides of the trap, eighteen inches long, five inches wide, and half an inch thick.—C the bottom of the trap, more fully explained in *fig.* 9.—E a piece of oak board, five inches long, two inches wide, half an inch thick, nailed on the top edges of the boards A and B, both to strengthen the trap, and to keep the sides at a proper distance. At *fig.* 9. is the trap with its bottom upwards.—CC, two pieces of oak board, five inches wide, four inches and a half long, half an inch thick.—D, an aperture, nine inches long, four inches wide, made to receive the fall of the trap—L An hole for a common clout-nail (forming the pivot of the fall) to turn in. And at *fig.* 10. is D the fall of the trap, nine inches long from F to H, three quarters of an inch thick (the distance

from F to G two inches and an half, or three inches) from G to H half an inch thick, and four inches wide.—G shows the hole for the clout-nail forming the pivot.—M, the dotted lines, shew the manner in which the upper part of the fall D must be bevelled, to prevent its falling both ways.

At *fig.* 11. is seen "the mole-pot, the uses of which will be more fully explained afterwards, composed of four pieces of oak board, each five inches wide at the top, nine inches wide at the bottom, twelve inches long, one inch thick, or thereabouts, having two ears as at K K, with an hole in each large enough to carry a piece of small rope or spun-yarn."

And at *fig.* 12, is shown a mole trap set in the side of a ditch.

In order to find the runs or tunnels, "the farmer or his servant must, he says, carefully examine the ditches of each field, in order to discover where the moles have made their main tracks; which having once found, and the trap set thereon, he may rest assured that every one passing through it will be inevitably destroyed; neither are their runs at all difficult to be found, as the only thing necessary to observe is, whereabouts they have broken out most on that part of the field the nearest to the ditch, in the side of which he must then make an opening with a small common spade, opposite to the nearest place where they are observed to work most, in order to open the run. Should the first endeavour to strike upon it prove unsuccessful, he will not fail to find it by searching thereabouts, either a little higher or lower. In common fields and uninclosed lands a different method must be pursued; and as, of course, there are no ditches, the higher grounds and banks will be the certain and proper place to search for their runs, which having once found, the workman must proceed in the following manner: First, an hole must be cut out the length of the trap, as represented in *fig.* 12, in such a manner that when it is inserted, the run may enter each of its ends, as shown by the dotted lines; and also an hole or well of such a size that the mole-pot may be easily suspended therein. Secondly, a small clout-nail, of which he should take several in his pocket; or should he have forgotten to do so, a thorn out of the hedge must be thrust into the hole *n*, *fig.* 9, which also communicates with the hole *n*, *fig.* 10, and will effectually prevent the fall from acting. Thirdly, a small handful of fine earth, like that usually thrown up by moles whilst working, and which may be taken from one of their heaps, must be scattered all over the bottom of the traps, so as to cover it, as well as both ends communicating with the run. Fourthly, a turf, something longer and wider than the traps, must be cut of the headland, both to serve as a cover to it, as is seen at P PPP, *fig.* 12, and as a certain mark by which it may be found with the greatest ease: and lastly, two pieces of spun-yarn must be fastened, one to each ear of the mole-pot 11. *fig.* 4, by which it must be tied on the trap in such a manner, that any weight put upon the fall D at H may be thrown to the bottom; the carpenter having previously taken care that the weight of the fall from F to G shall more than counterbalance that from G to H, so that no sooner shall a mole be thrown into the pot, than it will spontaneously resume its former situation, and be on a level with the rest of the bottom."

It is supposed that after "the trap with the fall fastened up by the clout-nail at *n*, the fine earth strewn over the bottom, the turf covered over the top, and the mole-pot properly suspended, by being tied over the whole; nothing further will be required to be done to it for three or four days, (for the moles must be allowed to pass freely along it for that time, as it will induce them to use their run without fear, and be the means of taking them with the greater certainty). The workman must now carefully examine his traps, and on gently lifting up the turf, will plainly perceive their marks, (taking care, however, not to leave any opening for the light to enter), and pulling out the clout-nail at *n*, the trap will then be set fit for working, and the fall will throw them into the mole-pot, out of which it is impossible for them ever to escape."

It is further observed that "should the farmer have strictly followed the above instructions, and notwithstanding the moles still continue to work about his land, he may be certain they have forsaken the run on which he has set his trap, and he must therefore search for their new one." And it is concluded that "the advantages arising from using traps on the above construction are, that the materials are to be procured every where; they can be made by any common mechanic at a very small expense, (the wood being used rough as it comes from the saw,) are very durable if made of oak; are not liable to get out of repair, and if they should, can be mended most probably by a labourer; they catch the whole year, and do not require looking after more than three or four times in that period, and that will comparatively require so short a time, that a workman may with ease look over all the traps on a very large farm; and supposing the fields to lie contiguous to each other, one trap for each ten acres would, on an average, be fully sufficient."

According to the first of the above writers, mole-traps are either simple or complex. The simple mole-trap is a hollow cylinder of wood, white-iron, or pottery, 13 or 14 inches long, and in diameter a little larger than the tunnels of the mole. This cylinder is closed at one end, and has at the other, a sucker or valve pressing against an exterior edging. When the mole comes to the extremity covered by the sucker or valve, she presses this back in order to continue her progress through the cylinder, and can return no more. Two of the traps may be united so as to form a double trap, having a valve at each end. By this, the mole may be taken as she enters, whatever side she approach. It is added that "the most remarkable of the complex traps used in Normandy, is a small piece of board fixed in the ground by four iron pins with cross points extending from them; and on these points the mole transfixes itself.

It is very seldom that those succeed who make

use of these and other mole-traps: for, they do not use the fit means to entice the creature to the snare. That means is, nevertheless, very simple. Nothing more is necessary than to make a few holes by which the air may enter the tunnel of the mole, and give her notice of the injury done to her work. It will be easy to him who has read the preceding information and directions, to employ such mole-traps, in certain cases, with infallible success. He supposes for instance the two mole-hills A B, *fig.* 2. he makes the aperture *d e*. If the mole stir the earth at *d;* he there presents the valve of either the simple or the double mole-trap; and he is sure of taking it. If, on the contrary, it present itself at *e;* he must, there, use the trap. He acts in the same way, in every one of the cases mentioned above. It may be easily believed, he says, that there are some of those cases, in which it will be convenient to use mole-traps. They are exceedingly useful when the mole-hills happen to be at considerable distances one from another, as in the end of winter. But, in time of drought, and when the weather is very cold, the hillocks are so very near to one another, that the traps can be of little use.

The common method of destroying moles is, however, by traps, made in the following manner:

Take a small board, about three inches and a half broad, and five inches long: on one side thereof raise two small round hoops or arches, one at each end, like the two hoops or bails of a carrier's waggon, capacious enough for a mole to creep through easily: in the middle of the board make a hole about the bigness of a goose-quill, and have in readiness to put into it a stick about two inches and a half long, fitted at one end to the hole, and a little forked at the other. Cut also a hazel or other stick, about a yard, or a yard and a half long, which will rise with pretty strong elasticity, when it is stuck into the ground; and to the end of this stick fasten a very strong noose of string or horse-hair, made so as to slip easily. Have likewise in readiness four small hooked sticks: then go to the furrow or passage of the mole, and after you have opened it, fit in the little board with the bended hoops downward, so that when the mole passes that way, it may go directly through the two semicircular hoops. But before you fix the board in this manner, put the hair string through the hole in the middle of it; place the noose in a circular form, so as to make it answer to the two hoops; put the small stick before mentioned gently into the hole in the middle of the board, so as just to stop the knot of the hair spring, without entering so far as absolutely to tighten it. Then fasten the board down with four hooked sticks, and cover it with earth. When the mole, passing in its furrow, comes into this trap, it will displace the small stick that hangs perpendicularly downward, the knot will then be drawn through the hole, and the noose instantly straightened by the rising of the end of the hazel stick to which it is fastened, which will catch the mole round the neck or body.

Poisoning of Moles. For this purpose there are several recipes; some propose to throw into their retreats, nuts which have been pierced on one side, and boiled in a strong lixivium. Others boil such nuts in water, with an handful of hemlock, and use them as above. In some countries, people take the root of white hellebore with the bark of dog's colewort pulverized and sifted; mix this with barley-meal: steep the mixture in wine and milk; cut it in small pieces; then throw it into the mole-hills. In other countries it is usual to take the green of a leek, or to put arsenic on the white; and bury this in the freshest mole-hill that can be discovered. These poisons, it is observed, are, in general, used injudiciously. The mole rarely seeks its food at the surface where its hillocks are placed. It pushes back the earth, as it works, to the extremity of its tunnel. That earth raises the layer next above it: and by the continual repetition of this process, the mole-hill is, at last, formed. The mole, while undisturbed, keeps always within its tunnel; and it is into the tunnel, therefore, that the poisoned bait ought always to be cast, instead of being left in the hillock. In order to destroy the mole which formed the mole-hills A B, *fig.* 2. make a cut, *d e*, in the tunnel which communicates between them. Put the poisoned aliment, then, into it, at either *d* or *e*, or even between them. The animal will come, of course, to repair the breach, will find the aliment, eat it, and be destroyed.

Fumigating of Moles. In order "to suffocate the mole in its retreat, some advise to take a nut-shell, or any little vase, solid and of small capacity, and in it, to burn cedar root, or wax and sulphur, with a portion of straw; then to stop up every hole by which the smoke might issue out.—The success of this method, the first of the above writers says, is very uncertain, and indeed none at all in the hands of any person not well acquainted with the artifices and haunts of the mole. Sometimes, all the mole-hills in a garden or a meadow, whether fresh or dry, communicate by many different passages, with one another, as shown above. In this case, all these mole-hills must be pressed down, and closed up. But, doing this, you will yourself preserve the mole from the threatened suffocation. Suppose for instance, that the mole which made the hillocks, *fig.* 4. is to be suffocated; and that you put the combustible matters in at H. If the mole be at I or L; the smoak will be hindered from penetrating beyond I, by your shutting up the passage there: and your precaution to ensure the death of the mole, will prove the very means of its escape. It is only by cuts in the passages, that fumigation can be made effectual. To suffocate the mole of the hillocks, *fig.* 4. make the breach *l k:* close up its extremities; put in your combustible matters between *k* and F, and between *l* and L, after levelling the hillocks L F. But you must, first, ascertain whether the mole-hill, H, *fig.* 4. have no communication with those of *fig.* 6; and if it have, cut off that communication by other breaches," as shown above.

There are other modes proposed for the destruction of this animal, but they are much less certain than the above.

Mole-*catcher*, a person whose employment is chiefly the destruction of moles.

Mole-*catching*, the art of destroying moles. See *Mole*.

Mole-*hill*, a small mouldy heap of earth thrown up by the mole on grass or other lands. It has been observed by a late writer, that "in the more rich and fertile soils, hills of this sort are frequently thrown up in great numbers, from their abounding more with the food of the subterraneous animals that produce them. Meadows are often extensively and seriously injured by it, on account of their depth of soft humid soil; moles usually reside, destroy, and render useless the grass, not only of the very spot where the hills are raised, but likewise to some extent immediately around them; as well as impeding the free course of the scythe; for these reasons, the extermination of moles becomes an object of great consequence to grass husbandry.

"In the early spring months, when such hills are in a tolerably dry and powdery state, no time should, he says, be lost in spreading them out and dispersing them in as even and regular a manner as possible over the surface of the sward that adjoins them; as when they remain long without being scaled they do considerable injury to the grass plants underneath them by blanching and rendering them tender. This business may be very conveniently performed by a common iron toothed garden rake.

"But it is invariably the best method, he observes, never to suffer the animals to remain in the land, but to procure an expert mole-catcher to destroy them, and thus wholly prevent the hills being thrown up." As soon as the hills have been dispersed over the land in the manner directed above, the operator should be careful in raking up all the small stones that may have been thrown out with the mould; as when left upon the ground, especially where it is to be mown, they prove a very disagreeable impediment to the scythe."

Mole-*Traps*, such traps as are contrived for the purpose of taking and destroying moles. See *Mole-Catching*.

Mole-*Plough*, an implement intended for the purpose of draining land.

It was invented by Mr. Adam Scott, and as improved and made use of in the midland counties, is an implement which, in suitable soils and situations, as in pleasure-grounds, and where much regard is had to the surface-appearance of the land, may be of considerable benefit in forming temporary drains. It makes a drain without opening the surface any more than merely for the passage of a thin coulter, the mark of which soon disappears. This instrument is chiefly employed in such grass-lands as have a declination of surface, and where there are not many obstructions to contend with; but it may be used in other kinds of land, as on turnip-grounds that are too wet for the sheep to feed them off, or where on account of the wetness the seed cannot be put into the earth. With this plough the drains should be made at the distance of ten or fifteen feet in straight lines, and also contrived so as to discharge themselves into one large open furrow, or grip, at the bottom of the field. As it requires great strength to draw this implement, it can only be used where a good team is kept. It is suggested by an intelligent practical farmer, that in deep clayey soils it may be highly useful, but that where there are beds of gravel or sand intervening, it cannot be employed with advantage.

It is represented at *fig.* 1. in Plate XII. in which *a* is the beam; *b* the coulter, and *c* the cone which forms the drain. It has been lately improved so as to require much less force of draught, by having wheels placed before and a roller behind.

A great and important improvement has lately been made on this tool by Mr. Lumbert.

It is observed by Mr. A. Young, that "in a communication from his son, inserted in the thirty-sixth volume of the Annals of Agriculture, mention is made of this plough having been greatly altered by Mr. Lumbert of Risington Wick, near Stow on the Wolds of Gloucestershire, who worked it by 8 men turning windlasses. This he takes to be the first public notice of any such invention. Thomas Estcourt, Esq. M. P. for Cricklade, and a member of the Board of Agriculture, had, he says, since that period several times mentioned the same object to him. In March 1804, he had the goodness to inform him that the plough was then working at Cricklade; and, upon his expressing a wish to see it, obligingly proposed to write to Mr. Wells, surgeon at Cricklade, informing him of his intention, and requesting his writing to Mr. Lumbert, the inventor, to desire his presence at the same time. These necessary previous steps being taken, he arrived at Cricklade, March 21st, and had the satisfaction to find that the plough was then at work within a mile of the town, whither he repaired with Mr. Wells and Mr. Lumbert. The field in which the machine was working, belongs to Mr. Champernoun of Cricklade: the soil a very rich surface loam upon a clay bottom, which made it wet, and demanded the operation of draining; the state of the surface (though grass) was such as would have been very materially injured by so many horses as must have been necessary to draw the mole at the depth he found it working, which was from 17 to 18 inches.—Eight women work it: and in respect to the labour exerted, it is sufficient, he says, to note that Mr. Lumbert contracts for the work at three halfpence per perch, lug, or rod, of $5\frac{1}{2}$ yards: his foreman contracting with him for doing it at three farthings, the machine being found by the master—the man paying himself and the women out of that sum. The plough does, according to soil and circumstances, from 150 to 200 perches a day: 300 have been done. At 200, three farthings a perch are 12*s.* 6*d.* per diem; the 8 women at 8*d.* are 5*s.* 4*d.* leaving 7*s.* 2*d.* for the foreman's pay and the reparation of the chain, the chief object in the repairs, as it breaks often, and wants the addition of a false link whenever that accident happens. He timed the motion of the plough for some rods, and found the average 5 yards in a minute. At this speed, 490 perch would, he says, be done in 9 hours; but the time of moving the windlass, frame, and anchor, is a large

deduction, though he should have conceived not sufficient to reduce the performance to 200 perch. He could not but much admire the efficacy of the anchor and *scorts*, in quickly fixing and preserving the steadiness of the machinery in resistance of so great a force as is necessary to move the mole deep buried in clay."

It is added, that "the present construction of the machine was the result of many experiments in making them under divers variations. Mr. Lumbert speaks, he observes, of two circumstances particularly, which cost him much attention and many trials; the line of traction, and the due elevation of the beam. He has not comprehended why the beam should be elevated (other circumstances remaining the same); why any elevation further than parallel to the horizon should be necessary; the parts connected forming one piece in either case. This question, which, he says, is intimately connected with the structure of all wheel ploughs, and is found under great variations, from the elevated beam of the Norfolk plough to the very depressed position of the beam of the Hertford one, deserves more attention than it has commonly met with. The line of surface being 1. 2. and the tendency of the share into the ground 1. 3. should the elevation of the beam be proportioned as 1. 4? The line of traction in Mr. Lumbert's plough being to a little above 1, suppose his mole working at 5, he seems to have proportioned the elevation of his beam somewhat to the same angle above ground at 6, that is at 22½ degrees. He found it necessary that the line of traction should cut the centre of the front roller—but not drawing by it. If a line be drawn from the horses' shoulder while drawing to the heel of the Norfolk plough, he has often found, when the ploughs *are said* to go well, that such line passes by the centre of the wheels; but the Norfolk plough is truly a wheel machine, the draught being to the carriage, and not to the plough itself: whereas Mr. Lumbert draws from the heel of his beam. The line of traction, however, in Mr. Lumbert's machine, is always varying; the angle is very acute when the women begin to turn, but necessarily becomes less and less so till the mole arrives at the windlass frame. The elevation of his beam throws a great weight on it by counteracting the tendency of the mole into the ground. Quere, If his line of traction be not to the centre of the compound resistance? If so, it explains, he says, the reason for his greater ease of draught; but it does not explain why he should not have availed himself of high wheels in front instead of a low roller, converting his machine into a true wheel plough, and drawing from the carriage, the chain from the plough heel being fixed to the carriage, as that from the coulter (or near it) is in the common wheel plough."

It is further stated, that "Mr. Lumbert has made this great improvement of the mole plough about 7 or 8 years, and the success attending it has been considerable. Mr. Poulton of Cricklade, and Mr. Wells, have used it as well as Mr. Champernoun. Mr. Coxe at Water Eaton has drained, as he was informed, some hundred of acres with it. Many have used it at Perton; nor had Mr. Adams heard of any failures. All known here have been on clay—but they have heard of its answering on less stiff bottoms. The drains run well after three years."

He adds, that "Mr. Lumbert, in their examination of the machine, desired him to observe that the bottom of the mole was not at all bright, there being no wear there, while the upper parts were worn quite bright; and from this circumstance he concludes that any attention to keep frosts out of the slit made by the coulter and standard is unnecessary. He conceives that the force of pressure and consequent plastering is all on the upper side of the pipe, insomuch that he is firmly persuaded that the operation is chiefly at the bottom of the pipe, where the soil is left porous, on comparison with the top of it: and he is so much of this opinion, that he conceives the water which runs down by the slit, is more likely to be conducted over the pipe than to get into it." Mr. Young says, "he merely reports his remarks without a comment."

It is remarked further, that "the improver goes to any part of the kingdom with his machine for draining of 1½*d.* per rod; but if to a distance, must have ensured work in the proportion of 200 rods for every mile he travels going out: at any considerable distance this amounts to so large a quantity, that in many cases it would be advisable for several neighbours to join for providing sufficient employment. He sells the tool complete at 50 guineas, having a patent. He can go 24 inches deep; and he has on his own farm drains that have stood well seven years. When the ditch of a field is not in such a direction as suits for the conveyance of the water from the pipes made by the mole, or other circumstances render it necessary to have a bottom main drain to take the water, his mode of making these *clay drains*, as he calls them, is by digging to a certain depth with common spades; and at the bottom of the trench so opened, he takes a spit with a narrow spade that has a cutting edge; this tool opens a trench, which just receives a jointed wooden frame with a chain at the end, by which it is drawn on by the application of a lever: this frame, fitting the space left by the narrow spade, is covered with clay rammed close and firmly to it, being first wetted, that it may slide from this clay vault when drawn on by the lever: and from much experience he finds these drains perfectly safe and durable. Over the rammed clay mould enough to fill to the surface is thrown in."

Mr. Young further mentions that in discoursing "with him on other applications of the power he exerts in drawing the mole, he informed him that Mr. Barker of Fairford, has a water that was so choked up with mud and weeds, that a duck could scarcely swim in it. He applied the windlass, frame, and chain, to drag out all; and with such success, that no other method would have cleansed the water at so cheap a rate: some drag, scraper, or other contrivance, must of course be necessary for taking and retaining the mud, &c." And Mr. Young supposes, that "a very useful application of this power would be to the purpose of drawing turnips or cabbages from off wet land, which by common carting is attended with so much mischief: he has seen temporary

sheds roughly erected on the borders of turnip-fields in Suffolk, for stall-feeding beasts: the addition of the windlasses to draw the turnips to such sheds would, he thinks, be extremely important. Another application of this force well-deserving attention is, for drawing the machine, which he has seen in the maritime part of Essex, wherewith cross-roads are levelled. Where ruts are deep, and combs and quarters high, with other inequalities, this tool, a sort of harrow, might, he says, be very cheaply used for effectively smoothing the whole, and improving the roads at a very small expense."

And as "much the most œconomical system in which the thrashing-mill can be applied, is that of a circular iron rail way, whereon to draw the stacks to the mill, as he has fully explained in the thirty-third volume of the Annals; instead of the application of the power of wind or horses to draw the stacks, the windlass and anchor of the mole-plough might be most cheaply applied. Another application of this power which he shall mention is, for the draught of ploughs and other machines when comparatively tried: the force exerted would be more regular and steady than that of horses or even oxen; and the only attention particularly demanded would be to keep the chain parallel to the furrow, and at the right distance from it."

Mr. Young says, that "in the operation of hollow draining itself, a most important desideratum yet remains, and that is the drawing a plough that shall cut an open trench for filling up with straw, wood, or stone. Two such ploughs have been invented—Mr. Arbuthnot's, a plate and explanation of which are to be seen in his *Eastern Tour*; and Mr. Makin's, which is kept in the Society's Repository in the Adelphi Buildings. The trampling of so many horses as these ploughs required, was, he says, the great objection to their use: this serious evil is done away in the windlass scheme: and he cannot but recommend to Mr. Lumbert's attention, the improvement of one of those ploughs, or the invention of another for executing these drains by means of his windlasses. He says, that "in all sorts of hollow-draining, Mr. Lumbert is decidedly of opinion that the cuts should be in the direction of, and with the slope of the land: not diagonally across it, which is the common practice. In the latter method the drains operate but on one side: cutting off the course of the water as it descends, it drains the land only below the cuts; but if made with the slope, they operate equally on either side; and as he supposes the veins or pores of the soil which conduct the water to act in every direction, provided the water itself is taken away, his cuts in the direction of the slope receive it laterally from every portion of the land between the drains, the descent from which to the bottom of the drain is greater than the angle of the descent of the natural surface of the field. It would not, he says, be easy to bring this opinion to the test of exact experiment: but a very ingenious farmer in Suffolk, Mr. Simpson of Witnesham, near Ipswich, has the same conviction, and has drained some hundreds of acres very successfully upon this plan."

This description may, however, be better understood from plate XII. *fig.* 2. in which

1. The beam.
2. The mole, to which segments for lengthening it screw on at 3.
4. The roller at heel on which it presses.
5. The chain, 50 to 60 yards long, which winds on to the two cylinders 7. 7.
6. A pulley, around which the chain 5. plays.
8. 8. 8. 8. Windlasses turned each by two women.
9. Stays, which entering the ground assist in keeping the machine steady.
10. The anchor.

The proportion and respective angles of all the parts may be measured by the scale.

MOLTEN-GREASE, in *Farriery*, a disease in horses marked by a sort of fat oily discharge in the dung, and supposed to proceed from a colliquation, or melting down of the fat of the horses body, by violent exercise in very hot weather, or other similar causes.

According to Taplin it "is produced by too great, sudden, or powerful exertions, when a horse is not in proper condition: as in strong and severe hunting, long and speedy journeys, or hard driving in carriages, when the animal has been just taken from grass loaded with impurities; just out of a dealer's possession, full of light flatulent food; or when naturally too full of flesh for violent exercise. In such cases," he supposes, "from the internal heat, increased circulation, and temporary inflammation, the fat seated upon the membranes in various parts of the body undergoes rarefaction and rapid solution, making distinct efforts for discharge by the different emunctories. The proportion nearest the vessels becomes absorbed, and there is produced some degree of fever; another part makes its appearance in the excrements; a third portion fixes upon the lungs, and obstructs respiration; to these a laxation of the intestinal contents succeeds; and, lastly, a looseness, or scouring."

This forcibly "points out to every humane master and faithful servant the great danger of over-riding, driving, or fatiguing any horse whatever beyond what is prudent and necessary; especially when not in high condition for the service he may be engaged in, whether on the turf, field, or road. Let it be constantly held in remembrance, more horses are ruined and destroyed by cruelty and neglect than by chance or accident. The subject we now treat on, proves, more than any other, the absolute necessity of insuring condition previous to a course of constant business."

He further states that "the symptoms are in different subjects more or less violent, according to their state and condition at the time of attack; varying in all, in proportion to the parts most affected by the original cause. 'Wherever the solution has proved most partial, the effect will become most predominant; as for instance, upon the bowels, lungs, or circulation of the blood by absorption. In the first, great pain attends the laxation or looseness;

in the second, great difficulty of breathing from the expansion of the lungs may produce symptoms of inflammation there. And when the mass of blood is generally affected, and preter-naturally loaded, fever must consequently ensue. These symptoms, as just observed, all vary in different subjects; but one is *pathognomonic* or *invariable* in all, which is the general incorporation of a greasy substance with the excrements, nearly similar to the separated particles of congealed oil in frosty weather; previous to the entire solution of the intestinal contents, and so long as the dung retains its usual form, the greasy hue appears only upon the surface, but as it advances in disease it becomes more intimately united."

He advises, that "as soon as ever these symptoms are perceived, proper methods should be taken to relieve nature from the threatened oppression, by such evacuations as the predominant circumstances direct; at any rate let plentiful bleeding be the first step to reduce present, or prevent approaching, inflammation. If fever has not come on too rapidly, give, so soon as circumstances will permit, the following mild laxative drink:

Take of Senna, two ounces;
Boil it a few minutes in three quarters of a pint of water, with three drachms of ginger bruised; then strain and dissolve in the liquid
Lenitive electuary, four ounces;
Soluble tartar, three ounces; add
Tincture of senna, six drachms;
Tincture of jalap, one ounce. Mix.

When the disease is in its primary stage, and the horse is strong and powerful, he advises without delay the following purging drink, repeating it in three or four days, if found proper.

Take of Senna, two ounces;
Infuse it in a pint of boiling water with
Salt of tartar, two drachms; add
Vitriolated magnesia (Glauber's salt), four ounces;
Cream of tartar, two or three drachms.
Dissolve and make the drink.

And when the horse is greatly depressed, with palpable fever, disquietude, loss of appetite, and internal painful sensations, he recommends the use of the following glyster.

Take of Water gruel, two quarts;
Coarse sugar, half a pound;
Common salt, a handful;
Olive oil, four ounces.
Mix and inject tolerably warm.

"With the view of attenuating the blood, relieving the lungs, and taking off the load from the circulation, as well as to mitigate all symptoms of fever when present, he inculcates a cooling plan of treatment, with the assistance of bran water or pectoral decoction, especially if the lungs are much oppressed, or the approach of inflammation apprehended. The appetite must, he thinks, also be attended to, and solicited in every stage of the disease by comfortable mashes. And as soon as the predominant symptoms subside, he suggests the having recourse to a course of mild purging balls, going regularly through three doses, at such periods as are best adapted to the strength of the horse. And in a few days, after working off the last dose to begin upon the following warm diuretics, well guarded with aromatics, giving one every morning till the whole are taken.

Take of Castile or pure white soap, ten ounces;
Nitre,
Rosin, of each six ounces;
Anniseeds in powder, four ounces,
Camphor,
Ginger in powder, of each, one ounce;
Oil of juniper, six drachms.
Honey sufficient to form the mass; which divide into balls of two ounces each."

This disease has been little attended to by late writers. In regard to the real nature of the discharge, instead of fat, it is probably the *coagulab le lymph* of the blood, transuded through the coats of the intestines, or a superabundance of their natural mucus.

MOLTER, the toll taken at a mill. See *Moulter*.

MOON-EYES, a disease in the eyes of horses, in which the weakness is supposed to increase or decrease according to the course of the moon; so that in the wane of the moon their eyes are muddy and troubled, and at new moon they clear up; but still they are in danger of quite losing their eye-sight.

MOOR, an extensive common or other uninclosed land which is covered with heath.

Moory-*Earth*, that sort of earth or soil that is prevalent on moors. It is in general a very fine black mould, sometimes found under a pretty thick sward of grass, but more frequently under moss, or straggling plants of heath. It differs from peat, in that it does not stick together, nor has the fibrous roots, or bituminous adhesive quality of it; peat, when dry, become hard and firm: this falls into powder. It is of a spongy nature, and ready to imbibe moisture, which adds considerably to its weight. There is commonly underneath it, as under most earths of this kind, a bed of clay, or some substance impervious to water: so that the particles of bodies decayed on their surface, not being admitted into the soil, remain upon that surface, dry, and increase its thickness, according to the continuance of the cause.

Where this kind of soil is collected in a place where running water in rainy seasons, brings with it loam or other rich soils, from the neighbouring grounds, it then acquires a greater degree of cohesion, hardens when dry, and resembles the cleansing of ponds more than the former.

The most considerable soil of this kind is the sort called peat. This is usually full of roots of weeds, and even of trunks and branches of trees and other plants. It always contains a bituminous oil, which renders it very inflammable when dry; at which time it also becomes very hard, though it is quite soft when in the bed in which it lies; being easily cut. It is observed by Mr. Maxwell, "that the whole mass and body of this soil is a dunghill made up of rotten timber, grass, weeds, and often mud washed from the higher

grounds about it, by the land-floods; than which there are few richer composts."

He believes the qualities of moory grounds, especially the mossy kind, differ very little from one another in any other respect, than with regard to the better or worse quality of the earthy material which makes a part of their composition, and the difference of their depths. They are more or less spongy, in proportion as this rich material fills up the cavities of the component vegetables, which are preserved from putrefaction by the acid in the water. The less spongy, and the more rotten the earthy matter is, the fitter it is for the vegetation of any thing planted in, or sown on them."

Moory *Land*, such sort of land as is principally constituted of earth or soil of the moory or mossy kind. They are of different sorts according as the earthy stratum is of greater or less depth. Mr. Marshall has observed, that "the soil of the Highlands of Scotland compared with that of the moorlands of Yorkshire has a decided preference; unless upon the summits of the higher mountains, and where the rock breaks out at the surface, or where this is encumbered with loose stones or fragments of rock; the hills of the Highlands enjoying some portion of soil or earthy stratum between a thin coat of moor; while on the Yorkshire hills, the moory earth, generally of greater thickness, lies on a dead sand, or an infertile rubble, without any intervening soil." And "from the sort of general knowledge, which he must necessarily have of both districts, he is of opinion, that the Highland hills (apart from the summits of the higher mountains) are of three or four fold the value of the eastern moor lands of Yorkshire; more especially of the central and southern swells: the narrow tract which hangs to the north between Guisborough and Whitby, is of a better quality: very similar, in soil, to the lower hills of the Highlands."

The improvement of moory lands must obviously be effected in different methods according to their particular natures, situations, and circumstances.

The first thing to be done, in order to the improvement of moory lands, is to divide them into proper inclosures; not only to secure their future produce, but also to be a means of procuring rich earth to cover the otherwise insipid useless mould on the surface, and give root to the plants which may afterwards be cultivated on them. Then, as the natural produce of this earth is of no value, its surface should be pared off, in order to be burnt.

If the depth of the moory earth be not very considerable, the surrounding ditches, which make the inclosure, will afford a rich strong soil, which should be spread about three or four inches thick all over the surface. When the clods are burnt, their ashes should be mixed with this new soil. If no proper earth can be got from the ditches, sand or gravel may be used with success. Gravel is singularly beneficial to such lands.

The Berne Society, who recommended this method of improvement as founded on repeated experience, very properly observe, that the good effects of the sand and gravel will be considerably increased by a moderate mixture of dung, and that, especially if the ground be intended for ploughing, this covering should be at least a hand's breadth in thickness. Dung alone would undoubtedly be extremely efficacious on all such soils, in which it is remarked to be of longer service than in any other; but the farmer can seldom spare a sufficient quantity of it to go far enough unmixed, or indeed for mixing. In this case, other ingredients must be recurred to; though the sand, or gravel, will generally do great things without any mixture. Well preserved ashes will be of excellent service, and so will the rubbish of old buildings, or any other similar substance, when mixed with sand or gravel, even of the coarser kind, and incorporated with this naturally rich earth, which, were its real value known, and the proper method of managing it understood, might claim a preference to any other soil. Loam is still better than either sand or gravel. This should be brought on before the fires are lighted to burn the surface of the moor, and should remain in heaps till it can be equally mixed with the ashes. Lime, where it can be had, will also contribute to the meliorating of mossy grounds. The moory earth, thus covered, is fitted for various kinds of crops.

It has been observed by a late practical writer, in respect to the thinner sorts of lands of this description, that "heath, which is a sort of plant that for the most part infests those soils that are of a moory nature, and in which there is but a small proportion of vegetable matter, on account of there being few leaves or other vegetable products, except the heath itself, to be converted into mould; the recrements of this plant are not found to afford improvements to the soil on which it grows, in the way that is experienced to take place from the decay of many other more saccharine, mucilaginous, and juicy plants. Hence it probably is, he says, that the heathy soils are mostly so poor and unfriendly to the growth of useful crops, whether of the grain, leguminous, or grass kinds." In bringing this sort of land into the state of cultivation—"as it has been found from repeated trials, that where the heath is turned down without being removed or completely destroyed, it keeps the furrow slices from coming into intimate contact with each other, so as that by confining and retaining a due degree of moisture, the decomposition and decay of the heath may be quickly effected, and the soil of course in too open and loose a state for the growth of almost any crop—it should be cut as close to the surface of the ground as it can be conveniently done; or, what is probably a better practice, removed, by paring off a very thin slice of the surface ground with it, and then either consumed by means of fire, or applied to such other purposes as may be necessary.

It is well remarked by Mr. Headrick, in a paper in the second volume of Communications to the Board of Agriculture, that "long heath makes a most excellent thatch for houses, far more durable than straw of any kind; it also makes excellent rinces for scrubbing milk vessels. From

its extreme durability, it is also the best of all shrubs for making concealed drains. In the dry spring months it is indeed capable, in many cases, where it grows high and of considerable closeness, of being burned without the labour and expense of either of the above operations. But in all cases where fire is employed, as the staple of soils of this kind is seldom deep, care should be taken that the combustion be not carried to too great a height, so as to prove injurious by consuming the small portion of vegetable material that may be present. The operation of cutting the heath may, he says, be most conveniently performed by an implement of the scythe kind, only made much shorter and of greater strength, so as not to give way or break by the stiffness of the stems of the plants." And that "the heath having been removed in some of these ways, lime in its caustic or most active state is to be applied in large proportions, either over the whole of the surface before the ground is ploughed, or upon the soil when turned up. The former method is, however, he thinks, to be preferred, as coming more intimately in contact with the plants, where lime is scarce, and cannot be laid on in large quantities; but where it is plentiful, the employing it in both ways might be more beneficial, by its thus tending more readily to the destruction of the roots as well as the stems of the plants. Where it can be procured, lime should, however, always be put on in large proportions on first bringing heathy or moory soils into the state of cultivation, as little savings in this respect in the first instance, may often prove highly disadvantageous in the end. It has been observed by an able writer, that experience has proved that the addition of lime to the ashes of the pared surface operates greatly more beneficially than if spread in any other manner: and that the larger the quantity the greater the effect, and probably the greater the proportional effect; that is, six chaldrons an acre will do more than twice the good of three chaldrons; the chemical effect both in neutralising the acids found in all these soils, and also in destroying the roots left of the spontaneous growth, depending in some measure on the effect taking place suddenly."

It has been known, according to a writer in the twentieth volume of the Annals of Agriculture, that "eight chaldrons an acre, laid on at once, have converted a moor into meadow worth twenty-five shillings an acre; but the same moor, under one chaldron per acre per annum for eight years, has not been worth seven shillings and six-pence an acre. The effect of lime on all soils long in cultivation, is, he thinks, problematical, and does not answer the expense in one case in ten; but in new moor lands the effect is prodigious and hardly credible: laid on ling mountains without tillage, without paring, or other operation than merely cutting the ling and spreading the lime, such moors have been changed from one shilling to twenty shillings per acre; but the quantity has been fifteen or twenty chaldrons per acre." It is however observed that "the application must always be regulated by the circumstances of the case. Where the expense per acre is forty or fifty shillings, the improvement will ultimately come high. And in order that the calcareous matter may be as intimately as possible blended with the particles of the soil, and thereby exert its effects most extensively, it should be applied over the land in the most perfect state of pulverization, and as equally as it is possible to spread it out. Where the lime is applied with sufficient attention to these circumstances, it generally destroys the heath in a short time, probably in some measure by its powers of attracting moisture from the soils, and combining with the acid astringent juices of the heath plant, and rendering them incapable of affording that kind of support which is requisite for its healthy growth, as well as by the alteration of texture that is produced in the land, and the caustic destructive action that may take place in consequence of its coming into contact with the roots in that state. This is probable, he says, from its being found to be the most effectual when laid on such lands in the state of quick lime, though something may no doubt depend on the eagerness with which moisture is attracted by it in such cases. After the lime has been applied, especially where the surface has been pared off and consumed by fire, the ploughing should only be slight, so as to blend it and the ashes with the soil, but not to place them at a great depth below the surface."

But in cases, "where heathy or moory land has a higher degree of surface wetness, and is not so much overrun with the plant as to prevent its being employed as pasture, it may sometimes, it is observed, be brought into cultivation by merely removing the superabundant moisture by proper drains, burning the heath in the spring months when suitably dry, and afterwards pasturing it closely with sheep so as to keep it from seeding; as in this way, in time, it in some cases becomes wholly removed."

It is added, that "when this sort of ground has been broken down and pulverised as much as possible by the operations of ploughing and harrowing, it should always, where not too stiff, be sown with some sort of close luxuriant green crop, such as turnips, peas, and tares, that may be fed off by sheep; but where it has a sour quality, and is more stiff, clayey, and adhesive, those plants that strike more deeply into the soil, as beans, Swedish turnips, buck-wheat, rye, and oats of the grey kind. In many cases too, rape, peas, clover, and vetches, will succeed in a very beneficial manner. But as the principal intention in most cases of breaking up this sort of land, is that of bringing it in a cheap and expeditious manner to a suitable condition, after a grain crop or two for growing grass, the green crops, of whatever description they may be, should be consumed by animals upon the ground, especially where the soil is such as to admit them without injury; as in this method a high degree of fertilization and improvement may speedily be obtained at little or no expense, from the great benefit the animals receive. If it can be conveniently done, two or more of this sort of crops may be consumed on the land in the same season

with still more beneficial consequences. Where the soil is too wet, stiff, and poachy, to admit of this practice, the crops may be drawn or cut, and converted to the feeding of cattle in the house. It has been well observed in the Annals of Agriculture, that proper cropping "is the key-stone of the arch;" and that if it be not attended to with great care, the whole of the improvement may turn out disadvantageous.

It has been stated, "that there is, however, another method of improving these soils by such crops, which is that of turning them down, when in their most succulent states, by the plough. This may be a judicious and useful mode on the drier and more sandy descriptions of these soils, where they may readily undergo putrefaction and decay, but in the more tenacious sorts, and where there is a sour disposition that would greatly retard the process, it would seem to be much less beneficial than that of feeding them off by some sort of live stock.", On the whole it is concluded that, "in whatever method they may be brought into the state of cultivation, the processes of tillage should not be carried further than the destruction of the heathy or other coarse plants, and the removal of the sour and unfriendly disposition of such soils for the growth of useful vegetable productions. They should be then restored as soon as possible to the state of grass or pasture."

It is observed in the Perthshire Agricultural Report, that some practical improvers on these thin moory soils pare and burn, then spread the ashes with a little lime, sow turnips, to be fed off the first year by sheep, the second year plough again for turnips, and feed them off in the same manner, then lay the lands down with barley and grass seeds. This is, the writer says, the practice on the Nairn estate betwixt Perth and Dunkeld. On the opposite side of the Tay it is, he adds, the practice of another improver to plough the moor in the winter, letting it lie in this state all the next summer, ploughing it from three to five times in the following summer as may be necessary: then to lime and sow oats the third spring, laying down with a crop of barley and grass seeds in the fourth year. Some, with the intention of being more expeditious, begin by trenching through the winter, at the expense of four pounds the acre, for a crop the succeeding spring. This is, he says, the practice in the district between Perth and Coupar. Some suppose that paring and burning should be practised on the thinnest soils of this sort when the sub soil is gravel or sand, under the idea that all moory lands should be treated in the same way, and that not a particle of earth can be destroyed by the process, which puts the able writer in mind of boys, who white a stick for a certain purpose, until it be so worn down that it become useless for any purpose whatever." And an opinion of other improvers of moor is, he says, "that the land ought to be ploughed and lie in that furrow for one year; that against the succeeding spring and summer, it ought to be cross-ploughed and harrowed, till the clods are reduced, limed the next autumn, drawn in ridges and ploughed for the seed furrow in spring. This method of reclaiming moors is, he says, recommended by a gentleman's factor in Strathearn, and is very similar to the practice betwixt Perth and Coupar. Both have this to recommend them, that the quantity of soil is not diminished, where there seems to be so little to spare." And Mr. Buchanan of Camsmore in the neighbourhood of Perth, who has improved upwards of five hundred, and fifty acres of new ground of this kind, (which is as much perhaps as any other person in Perthshire has done,) lays lime on the surface in the summer or autumn, and leaves it generally for two or three seasons, spread in this manner, that it may sink into the ground and mix intimately with the soil. If the land has been well limed, the first crop will be tolerably good; the second heavy; and the land is by this time so well pulverized, that it is easily made for barley and grass seeds, the following year. In some cases, he interposes a fallow crop of potatoes or turnips, between the second crop of oats and the barley crop. By this management he has seen on his new ground the two first crops of oats remarkably good: the second especially, which exceeded six bolls an acre. His moors cultivated in this manner, where the ground was high, the heath as tall as a person's knee, and the soil not worth one shilling an acre in its former state, have continued to carry grass crops and let at between nine and ten shillings of yearly rent, for the space of twenty years, without any future dressing, and without any symptoms of the heath attempting to arise. Farmers may, he says, grudge to lose the interest of money laid out in lime, for the two or three years before the land be in crop: but this is a fallacy; the interest is not really lost. The soil is meliorated to such a degree, by the top-dressing of lime, that the grass raised thereby does more than repay the interest of the lime. Much expense is also saved by ploughing only once for every crop of oats." The able writer further remarks, that "there is a certain barrenness of soil, in which the heath delights; and whenever that barrenness is removed, it does not thrive; neither does it thrive in the other extreme of the poorest soil and most exposed situation. To every plant there is, he says, a particular quality of soil, a certain degree of moisture, of warmth, and exposure, which is natural. Different plants, as well as different animals, have peculiar climates, which are accommodated to their constitution: and even in the same country, one species of plants is found in the vallies and another in the hills; nay, in the same field and soil, if its nature and qualities be changed by cultivation, its productions will change of course. Allow your drains to stop in a field which had once been properly dressed; let it become sour, spouty ground, it becomes instantly filled with *sprits*, rushes, and other aquatics." But, says he, "drain and cultivate the same field again; these coarse grasses disappear, and others which are peculiar to dry land, succeed in their place. Fold sheep, lead rivulets, or lay enriching manure on the most barren ground, which is not overcharged with water, and the richest carpet of close fine grass will spring up spontaneously. Remove these before it be fully saturated, and it will gradually return to its former sterility. Were all plants

fitted by nature to thrive only in the same circumstances, we would have, he adds, at least the half of the globe, without any plants at all; what might therefore appear, by superficial observation, to be a niggardness in nature, or a defect in the bounty of heaven, is, upon a closer inspection, recognized to be the effect of consummate wisdom and of goodness without bounds. From the frozen tops of the highest mountains down to the bottom of the warmest vallies, every degree of heat and cold, of barrenness and fertility, of wetness and dryness of soil, Providence has, he says, adapted to the nature of particular plants, which come to perfection where another species could not live; and these various plants are the food of different animals, that no creature might be deprived of nourishment peculiar to its kind." In short, he says, "without entering on that polemical point in agriculture, the food of plants, (which has been long a problem, and will probably remain to be solved by future ages,) we may safely remark, that whatever is their food, they are taught by nature to seek after that food which suits their kind. They uniformly reject other food; and, when forced, by the unskilfulness of man, to accept of food unsuitable to their constitution, they soon decay. It is therefore probable, that the food of all plants is not the same; but that some of them prefer one kind of food, and some another, and these in various degrees. At any rate, whatever their natural aliment is, or when the earth is brought by industry to have that aliment, there we uniformly see them making their appearance; and yet we cannot rightly tell how."

Vast improvements on different sorts of moory lands have been made in Yorkshire, where there are immense tracts of moors. It is stated in the Agricultural Report of the North Riding of Yorkshire, that an improvement was made "upon Lockton moor, about six years since, on a quantity of land of about seventy acres, which would not let for more than 1s. per acre, before it was inclosed. Of this, forty-eight acres were pared and burnt, and sown with rape, except about an acre sown with rye; the produce about sixty quarters. The rye grew very strong, and in height not less than six feet, and was sold, while standing, for five guineas the acre. The land was only once ploughed, otherwise the crop of rape would probably have been much better. One hundred and twenty chaldrons (each thirty-two bushels) of lime were ploughed into the field; which, for want of more frequent ploughing, probably was not of the service it otherwise might have been. Part of the land was afterwards sown down with oats and seeds; the former of which afforded but a moderate crop, the latter a very good one, and has since produced two loads, 120 stones each, per acre. The seeds sown were rye-grass, rib-grass, white clover, and trefoil; of these, the first succeeded amazingly, the others not so well; potatoes throve very well; turnips not equal to them. A farm-house has been built upon it, which now, along with five acres more of the same kind of land, is let on lease, at 30l. per annum. The soil consisted, in general, of benty peat, upon red-grit stone, with a mixture of clay upon limestone; this last is, in some places, at a considerable depth, in others, sufficiently near the surface for lime to be burnt upon the premises."

It is however remarked "that the greatest and most profitable improvement he has met with, is one made by Richard Simpson, at Samtoft, upon Pickering moors, of which he has given the following circumstantial account.

The land was allotted to him on the inclosure of the common of Pickering and Newton.

"The allotment, he says, contained 315 acres, and was situated on the northern verge of those limestone heights which border the valley in an east and west direction for above thirty miles, from near Helmsley to Scarborough. To the north of this tract of limestone, which, in most places, rises with a gentle slope from the plain of the vale, and bears a breadth of two or three miles, lies the wild, and chiefly uncultivated tract, called Black-moor, which cannot contain less than 300 square miles, not one-tenth part of which is in a state of cultivation. The soil of the farm might, he says, be classed thus:

"*Class I.*—One hundred acres pretty strong loam, of a moderate depth, upon limestone.

"*Class II.*—Seventy acres of a deep sandy soil, with more or less of a red-stone earth intermixed. These two classes were over-run with heath, or ling, in patches, with brakens (fern), and a tough mossy herbage intermixed.

"*Class III.*—One hundred and forty-five acres of a black moory soil, covered with an uniform coat of heath, with a few brakens, and here and there a few tufts of bent grass intermixed.

"But although the upper soil of this last class was nearly alike, consisting of half-putrified heath, intermixed, like all the upper soil of the dry part of the moors, with black and grey gritty (chiefly siliceous) sand, and had occasionally, while common, been pared for turf for fuel, yet the sub-soil, in different parts, varied materially; and on that difference of sub-soil he founded his hopes of improvement, and he was not, he says, deceived in the event.

"About 100 acres of this (class III.), although the upper soil was uniformly black, and in some places two, in others, from that to six inches thick, yet the soil beneath had every appearance of what, had it been on the surface, he should have called a light sandy loam intermixed with a freestone-gravel, and had undoubtedly once formed the upper soil, before the ling or heath had encroached upon and destroyed the other grasses, which in all probability existed there: this is a process which is going on every day, and has undoubtedly taken place on most of the borders of the moors, to a considerable breadth; for ling will thrive on almost any soil, and remarkably well on a light sandy loam; and being a perennial, and, he may add, a permanent plant, retaining its stem and branches all winter, and its stems generally rising above the surface of snows, its seeds are carried thereon by the winds to considerable distances, where being lodged, on the melting of the snows, and vegetating, the ling produced gradually destroys the more tender grasses growing in its shade: add to this, the soil produced by the gradual decay of the ling, becomes continually more

fit for its propagation, and more unfit for the produce of almost every other species of vegetables.

"The remaining forty-five or fifty acres had an upper soil, similar to the last described, and a sub-soil of a hard-cemented grey sand, of a most unpromising appearance, as impenetrable to water as the closest grained stone, and almost as hard; and, what was worse, this stratum was too thick for the plough to penetrate through it. This is the worst species of land he has seen upon any part of the moors; for the produce of any kind of corn, even rye (except in patches), going off before it shoots into ear, although remarkably healthy and vigorous until the period immediately preceding its shooting, which, he supposes, must be owing to its then sending forth roots to derive nutriment, from a greater depth, and meeting with this sub-soil totally unfit to afford that nutriment, it withers and dies. This happens alike, he says, in a wet or a dry season; and yet even this land, where lime may be had at a moderate rate, may be appropriated to some purposes with benefit to the proprietor; for, when pared and burnt, and well limed, both white clover and rye-grass thrive on it remarkably well.

"He has been thus particular, because being well convinced that there are some thousands of acres on the borders of Black-moor, and in patches adjoining several of the small cultivated vallies that run through it, of a soil and sub-soil similar to the hundred acres of class III. above described; and as this land, where lime can be had at any reasonable price (as from 3d. to 6d. per bushel), will pay very well for cultivation, being most of it fit for the produce of either rye, turnips, or oats, at the first, and what is not so, being sown with rye, and laid down two or three years with grass-seeds, will then produce turnips and oats; and on all of it, white clover and rye-grass will succeed remarkably well, particularly the former; he thinks, if the owners of such lands could be induced, by a more minute examination of the soil, and more particularly of the sub-soil, to bring them into a state of cultivation, it would not only be a benefit to themselves, but of public utility; for in their present state, they are worth a mere nothing, not 6d. an acre."

"On entering on the above farm in the year 1787, it was, he says, evident, that the nature of the mossy herbage, intermixed with patches of ling, on even the best of the limestone and sandy soils, indicated paring thin, and burning, as the best husbandry; so indeed he thought, and so in general acted; but being a young farmer, and having frequently heard it asserted, 'that to burn soil was to destroy it,' he ploughed out ten acres of the best herbage, and the most free from ling, on the limestone soil, without paring; he may add, he says, that he had sufficient cause to repent of it, for he has not even had one middling crop from it since; and although laid down with seeds, they have by no means so good an appearance as those sown the same year on similar soils, although he has expended as much lime and manure on this as on any part of the farm.

"It appeared to him likewise, that paring and burning the black moory soil on a good sub-soil, would answer a doubly good purpose; for by paring olerably thick and burning, he not only changed the worst and least putrified part of the soil into good ashes, rich in alkaline salts, but, by so doing, he brought the sub-soil within the reach of the plough, and could at pleasure mix it with the remaining black soil, and expose it to the influence of the air.

"He kept likewise, he says, another object in view, and that was, to begin with a larger proportion of the best and most productive land, and a smaller of the worst, that, by so doing, it might not only pay for its own cultivation and improvement as he proceeded, but that he might get into a better stock of manure. The first year, he pared and burnt 120 acres, viz. eighty of the classes I. and II. and forty of class III. On most of this he laid, he says, three chaldrons (of thirty-two bushels each) of lime on each acre, but on part of it only two: he was induced to do this, because although our present chemical knowledge of the properties and component principles of lime is very confined, and we are utterly ignorant of its mode of acting as a manure, yet it is known that lime and alkaline ashes mutually assist each other's action, as manures, in a very eminent degree, and that if lime is intended to be used at all in a succession of crops, it is always best to lay it on with the ashes. On such part of these eighty acres that were got burnt, &c. previous to the beginning of May (about fourteen acres), he sowed oats, with once ploughing, and had a tolerable crop, viz. near seven quarters per acre. He sowed forty acres with rape, with once ploughing—produce, in 1788, 160 quarters, four quarters per acre: the remaining twenty-six acres he sowed with turnips, ploughing once, and had a very good crop, which was eaten on the land with sheep, and was succeeded in 1788, with oats, above seven quarters per acre.

"The ten acres he had this year ploughed out without paring and burning, were a similar soil to the above eighty acres, most of it class I. He sowed this with grey peas—produce not a quarter per acre.

"The forty acres of class III. he pared thick, burnt, and laid on about three chaldrons of lime per acre. Such part of it as had the best sub-soil, he ploughed in May, and harrowed and cross-ploughed the latter end of June, and sowed with turnips, which being a tolerably good half crop, were eaten upon the land with sheep, and succeeded in 1788 by a crop of oats of from five to six quarters per acre. Being in want of herbage for sheep, he sowed down this field, about fourteen acres, with seeds, along with the oats, viz. white clover, about five pounds per acre, and the common hay-seeds of the country, about five bushels per acre: they came remarkably well: and the year following, this field was almost an entire sheet of white clover. One thing in this field, he says, deserves remark: about an acre of it, of as good a soil as any of the rest, was not limed; the consequence of which was, that although not perceptible in the turnip crop, it was very much so in the oats, and still more in the grass-seeds; very little white clover was to be seen: and now, although the other parts of the field have a tolerably good herbage, with a few thinly-scattered small branches of ling coming amongst it (owing, he supposes, to its not having been long enough in tillage to destroy all the roots of this hardy plant), yet

that *part* of the field *unlimed*, is nearly *destitute* of *herbage*, and *covered* with *heath*.

"About sixteen acres, the other part of this forty, being of a somewhat inferior sub-soil, and the black moory soil of a greater depth, he sowed with turnips, with once ploughing. These were a very poor crop, the bottoms in general not larger than the common hedge crab: they were eat with sheep in the autumn, and the land sown with rye, which produced about two quarters per acre. Grass-seeds were sown amongst the rye, in the spring of 1788, in the proportions last mentioned: they came remarkably well; and the herbage the two following years was almost entirely composed of white clover.

"The remaining ten acres was of the cemented sandy sub-soil above described. A little turnip seed was, he says, likewise thrown upon it, after once ploughing, which produced a few dwarf tops, but no roots that were eatable. These tops, or leaves, were eat with sheep in the autumn, and the land then sown with rye, and with grass-seeds in the spring following, in the same quantities as the last mentioned. Produce of rye, six to eight bushels per acre, and these of inferior quality. The grass seeds came remarkably well; and even on this soil the white clover, for the first two years, was in far greater quantity than all the other grasses put together. The herbage of these forty acres, being adjacent to the farm-stead, is yet of tolerable quality: but here and there a sprig of young heath. He intends, therefore, to plough it out the next spring, and re-lay it with grass-seeds, after another succession of crops.

"He proceeded in this manner in 1788, 1789, 1790, and 1791, in which year he had gone over all his farm, except a few acres situated on hill sides, the declivities of which were too steep for ploughing. He constantly pared, burnt, and limed, as above, but varied occasionally the crops. What, after the experience he has had, he would recommend as the best course for a black moory soil, is to pare, burn, and lime, plough twice, and sow rye in the autumn of the first year; to fallow for turnips for the next crop. If a little manure can be had for the fallow, there is a greater probability of the turnips succeeding; and if manure is not to be had, the lime and ashes, with the melioration of the air, the soil has already received, will, he says, render it much fitter for a crop of turnips than it was when newly opened. On these dry light moory soils, the turnips should, he says, be constantly eaten upon the land with sheep, and may be succeeded with oats or rye, according to the better or worse quality of the subsoil. With this first crop after turnips, the land ought to be sown with seeds, in which white clover and rye-grass ought to be in the greatest proportion: in grass, it should lay three, four, or five years, as pasture-ground; when on being ploughed out again for another succession of crops, as,

"Oats,
"Turnips.
"Oats, with grass seeds; or
"Oats,
"Turnips
"Rye, with grass-seeds;

and on the worst sub-soil, grey peas or rye, then turnips to be followed with rye with grass-seeds—it will be generally found, he observes, that the soil will be in a much fitter state for the production of these crops, than in the first succession, always remembering to lime for the turnip crop, and, if to be had, to lay on a little manure likewise.

"As no more than two crops ought to be taken for one fallow on any light upland-soil, perhaps the best mode of opening out-lands of the description of class I. and II. is to pare, burn, and lay on three or four chaldrons of lime per acre with the ashes, to plough twice for turnips, to eat them on the land with sheep, and to follow with oats, &c.; and after one or two successions of crops, the land ought to be laid down with grass-seeds, always remembering, whatever the succession, to lay down the first year after a fallow, when, after a few years rest, it may be ploughed out again with advantage.

"As the lands of class I. and II. and the better sorts of class III. are brought to an immediate state of improvement, and the profits arising therefrom are evident from the bare inspection of the crops, it will, he says, be only necessary to compare the expense and improvement on the worst species of land in class III." This he states to be as follows:

	£.	s.	d.
"Paring and burning one acre and spreading the ashes,	0	18	0
Three chaldrons of lime, at 7s.	1	1	0
Leading and spreading ditto,	0	6	0
Six ploughings for a succession of crops, as rye, turnips, rye,	1	10	0
Six harrowings for ditto,	0	12	0
Rye-seed and turnip-seed,	0	16	0
White clover and grass-seeds,	0	10	0
Harvesting two crops of rye,	0	10	0
	£.6	3	0
Firs tcrop of rye, eight bushels; second crop, twelve bushels, at 3s. 9d. per bushel,	3	15	0
Eatage of the turnip crop, about	0	5	0
	£.4	0	0

So that there will be a loss, he says, of 2l. 3s. per acre; but then it is to be considered, that the herbage of the first three years is worth more than 10s. per annum, and that the soil, by the operation of the lime, is in a continual state of improvement, and has every appearance of being permanently worth 5s. per acre to farm. He owns he should not have attempted to cultivate land of the last description, had it not unavoidably fallen within the ring-fence of the farm; and being already inclosed, there was a greater probability of its paying for the improvement.

"The great error into which many, in his recollection, have fallen, in opening out-land for the first time, is, he says, the *ploughing* out the *tough mossy sward without paring* and *burning*; the consequence is, that for the first four or five years, there is an almost total failure of crop, and, of course, a want of manure for the next succession. This is done, he adds, under the mistaken idea

that by burning, so much of the soil is almost totally dissipated and lost. Now, although we are in want of experiments to make it evident, what greater proportion of vegetable matter is dissipated in suffering combustion with a slow fire, and in contact with earthy matter, than would be dissipated in the same undergoing putrefaction; yet we know, that as all vegetable-soils contain more or less of calcareous earth, in its mild state, the subjecting this to the action of fire, must increase its activity as a manure, by bringing it nearer to the state of quick-lime, and that the siliceous and argillacious parts of the soil are not dissipated in burning. Modern chemistry will throw much light on this subject." It has been observed however, by others, that "paring and burning have very different effects, according to surface and soil: it is an expensive operation, and can only be repaid by one or two succeeding good crops. In good soils, no doubt of the propriety; but where ling abounds on a thin soil, with gritty pebbles, they are confident, as much may be done by burning the ling, ploughing, and letting it lie six or twelve months, than harrowing, liming, and taking two or three turnip crops, grass-seeds, and no corn: this should be done by the land-owner; no tenant will be at the expense. When land falls into their hands, it is exhausted by crops of grain, and then the land is condemned, as having been good for nothing; whereas, these lands are grateful, when properly laid to grass, and will, by sheep grazing, arrive, at a future time, to afford profit, and some improvement, under the plough."

It is added by the first writer, that he is "far from asserting, that a soil will not become thinner by repeated burnings; but he is of opinion, that it will not become so in the degree generally imagined; and he is an advocate for only the first paring and burning of very old sward, or heath." By others, however, it has been observed, that "much depends on the situation of the improver of this land: it must be supposed he has a farm of old land, and this new falls by a division of common. In this case, the rent of the new is of no consideration: he can, in September or October, easily spare his ploughs, when he feels little expense in ploughing fifty acres; if it lies even twelve months, where is his loss? It is gaining from the seasons. Cross-plough and harrow well; the spring following, plough, lime at the rate of two or three chaldrons per acre, not more; turnip, eat with sheep, then break the tough sod; turnip again, without lime: your sod is now acting in part as manure. In the spring, use the same quantity of lime, and sow grass-seeds. Here is no advantage in having oats; the land is hurt by it. If paring such land was abolished, it would prevent such crops. Ploughing up is slow; but the land is meliorating, and the sod adds to the soil; and it will be found, in future, grass. He has a proof of this management on a turfy thin soil, within a few inches of sand sub-strata: had this been followed up with oats, he should have got into the sand." On this it is suggested, that the above writer "seems to conclude, that if land be pared and burnt, corn must be grown thereon. This is not a necessary consequence. If he is going to improve any of these moor lands, the first considerations are, what does he want to obtain? —Improvement of the land.—By what means can he best obtain that?—By producing the largest quantity of food for sheep.—How is this to be obtained?—By paring and burning, and the use of lime; and by those means, a larger crop of either turnips or rape may be obtained, than by lime without paring and burning; and the better crop of turnips that is obtained the first year, the better the second year; and the better the crops of turnips are, the better will the grass be afterwards."

And, "the following is the mode of improvement that has been practised on the moors which were inclosed a few years since, situated on the east side of Rosedale and Hartoftdale" in the same riding, as detailed in the same Report.

"The land being ploughed, is allowed to lie in that state one year, before the expiration of which it is limed and well ploughed, and then sown with rye if on a gravelly, and wheat if on a clay bottom. This mode of management is there thought to be more advantageous than any other."

And it is further stated, that "some improvements have been made upon the western moor lands, that have answered very well, every part of those moors being well situated for obtaining lime of the first quality: this, it is remarked, renders improvements easier and more beneficial, than on the generality of the eastern. William Head, of Gailes, had an allotment of 300 acres, on the inclosure of a part of those moorlands; the particulars of whose improvements are these. About twenty years since, most of the commons, he means the high black mountains in this neighbourhood, were divided by act of parliament: an allotment, of about 300 acres, fell to his share, which, when inclosed by a ring-fence, was not worth 10l. a year."

On this it is remarked, that "three hundred acres of this moor land would be a sufficient quantity for three tenants, who might, in order to relieve their home-pastures, send up their holding-stock, viz. young horses, young cattle, and perhaps a few sheep, in the month of May, and allow them to continue till the latter end of August."

He sub-divided this allotment into fields of about fifteen acres, and undertook the cultivation himself; and having now improved more than 200 acres of it, he has let the whole at an easy rent, for 120l. a year, clear, to a good tenant. Its ancient occupiers were, he says, plenty of moor-game, and, perhaps, 100 Scotch sheep, worth about 10s. a piece after being there two years. Of late years, it has well maintained about 250 long-woolled sheep, forty Scotch bullocks, and ten horses; the ewes, with their lambs, and the year-old sheep, went to that high situation in April; the year-old sheep were brought off at Martinmas, and put to turnips; the ewes and lambs continued there till near January, when they were brought into a more sheltered situation, and remained there till April following, and then returned, with their increase, to the cultivated mountains. In March, the wethers, when only once shorn, were sold for about 44s. a piece; the forty Scotch bullocks, on an average, paid him for a year's keeping there, about 50s. a piece; the horses, in the breed of which the

country, he thinks, shews more taste than judgment, frequently left him nothing. The produce of this tract, when he began with it, was ling, the soil chiefly a black peat-earth, six or eight inches deep: this soil, if it had more substance, would not be unfertile. He burnt the ling, and had no ashes. He then ploughed, and harrowed in about five chaldrons of lime per acre, with turnip-seed; had turnips worth to him forty shillings per acre, which were eaten where they grew, with sheep. In June, the following year, he harrowed in about five chaldrons more, and sowed grass-seeds; and to secure a succession of pasture grasses during the whole summer, he mixed rye-grass, which came up first, with red clover and trefoil; the second, white clover; the third, and last of all, feather-grass, *(holcus canatus)* hardy on all soils, and by no means unprofitable, if properly managed.

Suppose, says a writer, "moorland was ploughed once in autumn, and, in the spring following, was ploughed twice more, harrowing in five chaldrons of lime per acre, with turnip-seed; these to be eaten where they grew, with sheep; in the spring following, ploughing it three times, harrowing in five chaldrons more lime per acre, with turnip-seed; these also to be eaten where they grew, with sheep; in the spring following ploughing it once, and harrowing in plenty of grass-seeds. A crop of oats, or any other kind of corn, requires more nourishment than this kind of land can afford to give it.

"Limestone being on the spot, and coals cheap, the lime, the first writer says, stood him in no more than 5s. a chaldron, of thirty-two bushels. Lime is the great instrument for binding, sweetening, and invigorating the soils in the situations alluded to, which, on trial, he found would not produce corn of any kind."

It is remarked, that "the high moorland ought to be improved for pasture; if it would give a crop of corn, the harvesting of it would be extremely hazardous; and as it will not effectually fatten stock, the tenant, who has no other ground of a superior quality, is obliged to sell at a bad market. This kind of land pays best, when depastured with holding stock in the summer months. By decreasing the quantity of pasture land at home, by the summer assistance of the high lands, you greatly increase the quantity of arable."

The man who improves moor land should not, it is observed, attempt to rob it of its newly-acquired capital, by laying on such a crop as would extract the very soul of his improvement: he should sink his improvement, and be satisfied with a fair interest. One disadvantage in not paring and burning, is, that you have a tough sod either to lead off or burn (even after you have had some crops, particularly turnip crops), at some expense.

Another "very capital improvement was, it is said by the author of the same Report, made about twenty years since, under the direction of William Dinsdale, on a large tract of the moors betwixt Hawkswell and Richmond; the soil a black turf earth." In this case, "the ling being first burnt off, the land was ploughed in summer, and cross-ploughed in autumn. In spring following, it was limed, and after one more ploughing, sown with turnips, which were eaten off with sheep: these were succeeded by oats; they, by a whole year's fallow; after which, turnips were again sown, which, being eaten with sheep, were succeeded by oats and grass-seeds: this new ley continued to be pastured with sheep for two years, and was then ploughed out again for oats."

Since the above improvement was made, several hundred acres of the same tract of moor land has been inclosed and improved in a similar manner. And it is stated, that "a gentleman of Bowes tried, with good success, a method of improving the pasturage of barren moor land. Impressed with the idea, that the poverty of the soil would not repay the expense of cultivating by the plough, he pared and burnt the ling and bent, and mixed the ashes with an equal quantity of lime; these being spread upon the land, he harrowed it sufficiently to be mixed with the soil nearest the surface. Upon the land thus prepared, were sown hay-seeds, clover, rib-grass, &c.; these being again harrowed, the produce was equal to his expectation, and afforded useful and good herbage for some years.

After observing that "many parts of the western moorlands might be advantageously stocked with rabbits, after the vegetable produce had been improved by the use of lime;" it is concluded, that "the primary object of the cultivation of such moors should not be corn, but food for sheep: the former might sometimes be taken without disadvantage; but two green crops, exclusive of temporary leys, for two or three years, ought to intervene between each crop of corn. By this mode of culture, and the use of large quantities of lime, the land would be in a constant state of improvement, and would be found much more profitable, than when kept exhausted by repeated crops of corn." And, that "the stock of the improved lands should be principally sheep, as the growth of winter food for them, and their consumption of it upon the ground, are the most certain and expeditious means of improving them."

In the deep kinds of moory lands, or those of a morassy nature, Mr. Marshall observes, after freeing them from superabundant moisture by proper draining, the proper means of bringing them into a state of cultivation, so as to be let, at their full value, to ordinary tenants, are the following:

"The first work, in a large undertaking, is to divide the site of improvement into fields, suitable to the farm or farms to which they are intended to be laid, with ditches running in such directions as will lead off surface waters, without the expense and encumbrance of deep open drains within their areas:—then to adjust the surface of each field in such a manner as will shoot off rain water into the intersecting ditches:—in order that, should a fall of rain happen, during any stage of the process of culture, the work may not, for any length of time, be impeded." And that "as the surfaces of lands of this nature are mostly rugged, uneven, and of a loose spongy texture; this generally renders them unfit for the operations of tillage, without some previous assistance of manual labour. And, when the moory earth, or vegetable mould, is deep, and rises to the surface without any

covering of fossil substances, it requires some length of time to bring it to a texture sufficiently firm for the ordinary purposes of aration. Hence, the general principle of improving deep moory lands, which have not been supplied by nature or art with fossil coverings, evidently appears to be that of converting them to the state of profitable herbage, before the production of corn crops be attempted." In effecting which, "the process will, he says, ever be the best directed, by the existing state of the site to be improved. If the inequalities of its surface are large and abrupt, the first business is to adjust it, so far as to admit of the operations of tillage, whenever they may be required, and can be properly performed; as well as to convey off surface waters in the way already suggested. And this done, to pare off the minor protuberances (the tufts and hassocks formed by particular plants in its watery state)—and more or less of its surface in general, so as to cut off the plants and stale mould which occupy it; and thus to give a degree of freshness to the whole." And "if, in a dry season, the surface is found to be firm enough to bear the tread of cattle or horses, the latter operation may be done with a paring plough; if not, with a paring spade, or breast plough."

When, "after the surface has been thus cut over, and the state of dryness of the soil can be ascertained by its colour, any particular parts appear to be insufficiently freed from moisture, covered drains may generally be made, at a small expense, with the fibrous tufts which grew on the surface (as with hard materials), and which will lie a length of time in the land, before they decay." And "the remainder of the roots and mould, pared off, require to be burnt,—their ashes to be spread evenly over the surface,—and to be immediately harrowed, or raked, into the fresh mould; to prevent their being displaced by the wind." When, "in this stage of the process, a fossil substance, of almost any kind, can be spread over the ashes, at a moderate expense, grass seeds may be immediately harrowed, or raked, into this covering; and the surface be left to acquire a sward; without further trouble:—continuing to keep the young herbage closely pastured, when the season will permit; first, with sheep, and afterward, with heavier stock; until the surface be rendered firm, and the soil be sufficiently bound together, with the fibrous roots of herbage, to bear a succession of corn-crops;—if such should become advisable." He adds that "an objection to this summary way of bringing the ground into the state of herbage, lies in there being no immediate gross return for the money expended in draining and cultivation. But, says he, to attempt to raise corn on a raw morass—or a black peat moss—namely, on spongy vegetable mould—would only be increasing the expenditure, without any certainty of return. Let us therefore look for a productive and marketable crop, that may be raised with more certainty." It is observed that "in the southwest quarter of Scotland, potatoes have lately been raised, even in deep spongy peat mosses, with good effect. The practice is to plant them in beds, divided by deep trenches: more or less dung being used in their cultivation. Without this it is considered to be in vain to expect a crop." And "to a certain extent, in a populous country, where dung and labour are plentiful (the whole being done by manual labour) this practice is, he thinks, very eligible, and does great credit to whoever struck it out. For, after one or perhaps two crops of potatoes have been taken, a crop of oats is obtained. But every thing is still effected by manual labour. And, even with this, a very wet spring, or a cold moist summer, succeeded by early frosts, may frustrate the planter's hopes." Of course "what is most desirable, in this case, is a crop which is sown and reaped in the summer months; and which requires neither labour nor attendance during the moist seasons of autumn, winter, and spring. And, fortunately, such a crop is, he observes, natural, or has been long enured to the climature of this island; and is, moreover, one of the most profitable crops in English agriculture. This crop is rape seed: which is not only sown, but reaped, in the very height of summer. And a soil in which it is known to delight is that of reclaimed watery lands,—in a state of herbage." It is added, that he "had not, however, known it to be raised on crude moory ground, as a first crop after draining, until he tried it a few years ago, in the south of Scotland:—where a considerable extent of ground of this nature had been drained, levelled, pared, and burnt, and the ashes ploughed under (by a young improver, without a proper plan for carrying on the improvement. He directed part of it to be sown with rape seed; though the season of sowing was then getting too late; namely, the latter end of July, or the beginning of August." And, that "the result,—notwithstanding this and another unfavourable circumstance which it was too late to avoid—(the land having been laid much too flat for a winter crop)—was such as to prove, sufficiently, that rape seed may be raised with profit, as a first crop, on drained moory soil. And it is highly probable, that many extensive tracts of lands, which now lie entirely waste, and as nuisances in their neighbourhoods, may through its means be improved, with immense profit to their proprietors. The experiment may be tried at a small expense. The cost of the labour and seed required, for a sufficient trial ground, is, he says, inconsiderable. The proof is not whether rape will thrive, as herbage, but whether it will mature its seed, on the given soil, in the given situation. Having received a recompense for the previous expences, in one or more rape crops (for there is no danger, *in this case*, of exhausting the soil—of impoverishing ten feet deep, perhaps, of vegetable mould) it remains to lay the foundation of more permanent profits." And "this may be done, in his opinion, by sowing grass seeds, either with, or over, the rape crop, or after the stalks have been drawn, as seasons and circumstances may require; continuing to stock the ground, in the manner already recommended, until the surface be sufficiently firm, and the soil has acquired a proper texture, for mixed cultivation:—a period which may be shortened, by fossil substances, especially such as are calcareous, spread over the surface during any stage of the improvement of this sort of land."

It is finally remarked, by the same writer, "that there are situations in which low-lying flat lands, such as are now under consideration, ought not, when they are brought to a productive state of herbage,—to meadow or rich pasture ground,—to be hastily changed from so profitable a condition; whether they be viewed in a private, or in a public light."

Besides the advantages of shelter, great improvement and benefit may be derived from planting lands of the more mountainous and poorer kinds of these descriptions with trees of the timber kind.

It is remarked by the writer of the Perthshire Report, that "there is a great tract of moor or waste land, unfit for any useful purpose, except planting, betwixt Auchterarder and Tullybardin, and westward to the military road or farther. A few half-starved sheep may be seen in some places on its skirts, but the great body of the moor in its present state is useful neither to man nor beast. A small plantation of Scotch firs has grown several years in one place of this moor, to a considerable size; and many other spots are planted by different proprietors, which are generally in a thriving condition, and show that it is a proper soil for firs. As the moor is already divided, if the co-terminous heritors would put in permanent land-marks on their respective limits, and be at the joint expence of a bounding fence round the whole, each paying in proportion to the number of acres of his property inclosed, this great plantation would raise such a forest, he says, as would shelter the bleak country round it and be productive of a vast return. And although pine woods are not esteemed beautiful objects, yet they certainly are, he thinks, as pleasant to the eye, as gloomy heath." It is added, that "at present every acre of heath is at an average scarcely worth a sixpence of rent; but let it, says he, be called one shilling, which is more than the value. If it were planted, we may reasonably suppose every tree grown to timber would in eighty years be at least worth five shillings. There are firs in this part of the country, planted between sixty-five and seventy years ago, which are, he observes, selling at present from ten to fifteen shillings; and some of them bring twenty shillings: but allow eighty years for any difference which may be in soil or climate, and take only one half of the lowest price. Suppose what might be planted of the moor in question, to be seven miles long and three miles broad, at an average. If the inclosure were a regular figure, having seven miles on two sides, and three on the other two, the bounding fence would be twenty miles long; but on the supposition that the figure be somewhat irregular, having exterior and interior angles, let the fence be called thirty miles in length, which is a large allowance. The area of this moor, seven miles by three, is twenty-one square miles, which are nearly equal to ten thousand seven hundred acres. Every acre will plant three thousand four hundred and twenty-two trees, allowing sixteen square feet to each. At an early period, which depends on the strength of the soil, and the progress of the young trees, one third should be taken out, when they begin to interfere; and each of the remaining trees will occupy twenty-four square feet. At a second weeding, when it appears necessary, another third of the original number may be cut down; and the remainder, being one thousand one hundred and forty, which are left to grow to timber, will each of them occupy a space of forty-eight square feet; which is sufficient for any ordinary fir. Many large firs grow vigorously in less room." It is called the moor of Orchill, and the following is a calculation of the expense and profit of covering it with trees:

Plantation Dr.

	£.	s.	d.
To rent of 10,000 acres, at 1 for 80 years, at 5 per cent. compound interest	519,607	13	10¼
An earthen fence of 30 miles, 6 feet high, at 4d. per yard, with compound interest for 80 years, at 5 per cent.	43,614	1	6
36,615,400 fir plants, at 1s. 6d. the 1000 of three years old, with compound interest at 5 per cent.	136,103	8	0
Planting ditto, done by 6 men to an acre, at 1s. 3d. each per day, with compound interest, at 5 per cent. for 80 years	198,865	6	8
Two foresters, at £20 each of yearly wages, for keeping the fence in repair, weeding, &c. with ditto interest, at 5 per cent, for 80 years	38,849	3	3¾
£.	937,839	13	4½

Plantation Contra Cr.

	£.	s.	d.
By 12,205,133 trees, 80 years old, being one third of the number planted, and valued at 5s. each	3,051,283	5	0
Ditto number of weedings, taken out before 20 years, and valued at one halfpenny each, with compound interest at 5 per cent. for 60 years, amounting to	474,955	12	0
Ditto number of weedings taken out before 30 years, valued at one penny each, for 50 years, at 5 per cent. compound interest	583,163	5	4¼
Balance in favour of planting £.	2,114,243	11	7½

It is added by the able writer, that "after allowing the value of the weedings to go for back-gone trees, and other contingent expences, not adverted to, which is surely enough, the profit is beyond conception. And were this plan to be adopted by the proprietors of this or other large moors, larches might be planted in some places, especially along the boundaries of different properties; and wherever the soil or the bleakness of the exposure is thought unfriendly, larches might thrive better than common firs, being the hardiest and the most valuable plan of the two. If there happen to be rivulets, ash

would thrive, he says, on their banks, and elms, oaks, or beeches on any dry spots of green ground. This variety would remove the dull sameness of the plantation and enliven the prospect. Eight or ten rows of spruces, as having of all trees the best shelter, by continuing to any age, feathered to the ground, might be planted next the fence, to defend the whole plantation from sudden gusts or streams of wind. The expense on the plants might be, in a great measure, saved, and the trees rendered more congenial to the climate, by having the seed sown in the country; and three boys would, he says, suffice for three of the men, which would save one fourth of the expense of putting down the plants."

"The prime cost of the fir-plants would, he says, be £.2,746 3s. which might in a great measure be saved; and of planting £.4,012 10s. of which one fourth may be saved. After the first 15 or 20 years, the foresters will pay themselves out of the sale of weedings; and their wages may be saved entirely after the last weeding at 30 years."

It is afterwards observed, that "whoever has beheld, the astonishing plantations at Cullen-house in the county of Bamf and at Monymusk in Aberdeenshire, by the late proprietors of these places, and also by other heritors in different parts of the kingdom, who had a taste for improvement and understood their interest, will see the propriety of turning such moors as this, to account. It is not, says our author, a mere experiment; it is not without precedent; it is no chimera. They have many patterns before their eyes."

In order to show the expense of this system of improvement on a small scale, it is stated that "One acre of land at one shilling of yearly rent, by compound interest at five per cent. for the space of eighty years, is worth £.48 10s. 11½d. The same acre planted with common firs, and weeded down by various thinnings to one thousand one hundred and forty, and sold at the end of eighty years for five shillings each, would amount to £.285. And if more valuable timber were planted, it would fetch more. Whenever the land will not let at more than one shilling, or one shilling and sixpence, the acre, and is unfriendly to cultivation by the plough, it is by far, he thinks, the best method of turning it to account, to plant it full of trees suited to its nature. Even common firs in this way, will bring a sum equal to six shillings an acre of yearly rent; and moreover, it is of no small consideration, that the most barren and bleak moor, by this management, will be rendered perfectly green; and if depastured by sheep when the trees are cut down, it will, he says, remain green, and continue to let at a decent rent." He further observes, that, "were gentlemen of fortune to allot a small sum annually, perhaps from £.10 to £.50, according to their income, for raising plantations on different parts of their estates, the advantage to their heirs and to the public would be incalculable in every point of view. Nor does he see any solid objection against it. It is in vain to reason with those, who will do nothing for posterity, because posterity has done nothing for them; as Swift expresses the argument of the slothfully selfish. The most plausible objection to this reasoning is, he says, "that if all the low moors and other places not of the value of one shilling an acre yearly, and unfavourable for tillage, were planted, the country would be so much overstocked with timber, that it would give no price." This objection might, he says, be got rid of by answering that so long as the value of an acre in planting was superior to one shilling of yearly rent, even the desire of *profit* ought to recommend planting; nor ought a generous man to regret that the public were served in timber at a more moderate price.—But this subject claims attention; and the following considerations are submitted to the reader: If, says he, the premises in the objection do not exist, the conclusion, being only hypothetical, must fall to the ground. There is little hope that all proprietors will plant their moors in any one generation, and therefore little danger that the country will be overstocked with timber. Their views, their taste, their mode of expenditure and many of their other habits are so extremely various, that there is no period in which all or even a considerable number of them will adopt this mode of improvement.

It is added, that "the fir-woods on the shores of the Baltic are decreasing so fast, by the continual and growing demand upon them, that they have retired far to the inland parts of these countries; and the necessary land carriage, together with the freight, insurance, and duty, has raised the price 50 per cent. within these few years; and if this goes on, it is difficult to say to what amount the expense of foreign timber may arise. If the price become excessive, and that there be no supply of native fir, the improvement of the country, in the article of building, which is so ornamental to it, will become stationary; none being able to afford the expense of lodging themselves comfortably, except the affluent and great." And "in countries at a distance from water carriage, where there is no pit-coal, and where the mosses are altogether or nearly exhausted, the inhabitants must feel the inconvenience of being in want of an article which is so very necessary to their comfort, unless they have wood to burn. Some counties in England and many parts of the continent are in a deplorable condition in this respect. A supply of wood for fuel can, he supposes, never in these circumstances be plentiful, without extensive plantations on land which is unfit for grass or corn." He also thinks, "that it is a presumptive proof that this country was warmer, and the temperature of the air more mild, than at present, when our very mountains produced grain. This mildness of the climate was, he conceives, occasioned by nothing else than the woodiness of the country at that æra. Restore, says he, the cause, and the effect will follow. The more wood there is in a country, in northern latitudes, the more temperate the climate, and the more genial the influence of the air. Add to this, that in point of beauty, there is no comparison between a bleak moor covered with stunted heath, and a waving forest clad with the livery of nature."

The author of the same Report further observes, that "on the skirts of the moor of Orchill, there is a belt of sand on which broom and furze are

growing, particularly on the east, towards Auchterarder. The soil in which furze is found, invites, he says, the industry of the husbandman, with an assured prospect of an immediate and abundant return. Where broom grows the soil is lighter, and has, for the most part, a gravelly or sandy bottom. The former is a good mould, and fitted for most crops. The latter is well adapted for turnips and red clover; and after resting a few years, will bear plentiful crops of grain; but having a weaker body than the former, it requires to be tenderly dealt with in cropping. Let not the husbandman be surprised to see these plants rise, even at the interval of fifty years or more, after they seemed to have been extirpated; for the seeds of some plants remain long in the ground, without being deprived of the germ, or vegetative principle. Marle, he observes, abounds in the country around this moor, and is well calculated to stimulate such soils. Nature has indeed provided, in most situations, some manure that will increase the fertility of the earth. Lime is now carried to that part of the country; and the numberless little rills, which descend from the moor in all directions, after rain, would enrich the grass in many places, as may be seen in every little hollow between the hills. All these act indeed as a stimulus alone, which is mostly the case with every species of calcareous earth, of which they are entirely composed: but when argillaceous earth can be had at hand, it adds to the quantity of soil, strengthens the stamina, binding together the loose particles of such land as this, and thereby enables it to stand more frequent tillage." It is further stated by the same writer, that, "from behind Culross, all the way to Blairingone, there are several tracts of waste and barren moor. The Earl of Dundonald has, it is observed, planted much in this district; but more, he thinks, ought to be planted. In the moor between Gask and Maderty, and all the way from Dollary on the west to the vicinity of Perth on the east, there are large tracts of stunted heath that might be planted; and the stately plantations growing on some parts of this moor, ought to induce the proprietors of other parts to follow the example. There is ground fit only for being planted, between Invermay and Newtown; and on the verge of the bank east from Aberdalgie to the great road. In the two places last mentioned, trees of hard wood, which are more valuable than firs, would, he thinks, thrive and come to perfection."

It is well remarked that, "in plantations of fir, where the soil is tolerably good, young trees of hard wood, especially oaks and elms, may be put in among the firs, which protect them and do not much retard their growth by exhausting the soil: but care must be taken to cut down occasionally such of the fir trees as interfere with their tops, by first lopping off the branches, and then laying down the trunk; which practice may be continued until all the firs, thought necessary to be taken away, are felled. In this manner, he supposes, one may have the benefit of almost two plantations on the same ground at once; the young trees being well advanced before the older ones are taken out of their way. This practice is, he says, becoming more general every day. In other cases a belt of firs is planted round, to protect other trees in the middle of a plantation, without which precaution the interior trees, in certain situations, would be too much exposed: but this management is, he thinks, less to be depended on, unless the ground be level, and the firs somewhat tall before the other trees are planted."

It is added that, "on the higher parts of the Sherif moor, near Dumblane, there are near seven thousand acres, calculated only for being planted. The lower parts of this moor are, in some places, cultivated; and the soil being deep, if it were drained, pared and burnt, might be improved still farther up, on the west side of the moor. The higher parts being planted with trees, and the skirts being reclaimed by tillage and grass, would be an ornament to a country which is naturally cold and bare."

It is here remarked, that "the vast fir woods already mentioned, which are growing naturally in Rannoch, besides others in Strathspey and elsewhere in the north of Scotland, are raised much farther above the level of the sea, than any of those places here recommended for plantations of fir. The plantations of Lord Dundonald behind Culross, and those on the Knock of Crieff, are thriving on a soil as poor. These instances, and the fine plantation lately cut down at Turleum, behind Drummond Castle, a higher spot than any of them, may, he supposes, open the eyes of men to see what might be done on the Sherif moor, on that of Orchill, and in similar places, which, at present, are of very little value."

It is added in conclusion, that, "besides the moors that have been mentioned, there are some other *low-lying* wastes, covered with a thin stratum of moss, on a bed of gravel, which produce nothing but heath; one at Comrie, one at Dunira, one at Doune, one near Callander, and in other places. Mr. Drummond of Comrie, who lately purchased Dalganross, has boldly lined off streets and a market-place through the very heart of the moor, fued out part of the ground, and the new settlers are going on with spirit, to lay on new soil and otherways to improve one of the most barren spots in the country; and men will, he says, be enabled to live where, a few years ago, scarcely a sparrow could find subsistence. Such are the effects of industry under the direction of good sense!"

And "the moor in the vicinity of the house of Dunira has been reclaimed, he says, some years ago. Mr. Dundas has planted the most barren spots, with a variety of trees suited to the soil; and, wherever there was any depth of earth, the expense of cultivation has, he says, been rewarded by extensive and rich fields of grass. The plantations on the flat below will soon vie with the waving oak woods on the declivity of the winding hills and in the face of rocks, with which this singular place is surrounded."

Also, "in the vallies of the Seedlaw hills there are several spots of short heath, he says, which are planted; but there are others of a better quality, which ought to be top-dressed with lime or marle, to raise

a sward of grass. The climate in general is too unfavourable for raising much grain; but potatoes and turnips, succeeded by a crop of barley and grass seeds, might grow in many places, which, at present, are totally neglected."

These facts are sufficient to shew the vast advantages that may be derived from this sort of improvement in many sorts of moory lands; and many others may be seen in the excellent report from which these have been taken. See *Waste Lands*.

Moory Soils, such soils as are chiefly constituted of earthy matters of the moory kind. This sort of soil occupies large tracts in some districts as has been sufficiently seen in the preceding article. See *Moory Land* and *Soil*.

MORASS, a boggy sort of land. See *Bog* and *Swamp*.

MORTAR, a sort of coarse substance constituted of lime and sand well wrought together so as to form a cement for the construction of buildings, &c. It is of importance in the making of it that the materials be well mixed and blended with each other, as upon this and the lime being of a proper kind, its goodness in a great measure depends.

Mortar *Mill*, a machine contrived by Mr. Supple, for the purpose of saving labour in the making up of mortar, as well as doing the business more effectually and at a trifling expense.

The method of doing it is thus described by the inventor: "A pit is dug in the ground, which is bricked at the bottom and sides, into which the operator puts the lime. He has the command of a small stream of water, which is conveyed at pleasure into the pit, and in a few days the lime is sufficiently slacked; he then puts the lime and sand, or gravel, into the mill, which not only mixes both together, but incorporates them in a very effectual manner; and, as the lime is sufficiently moist when taken out of the pit, no more water is required for the mortar. If for present use, the quantity he makes at a time is six bushels, as he finds when more is put in, it is apt to strain the cogs, if not made very strong. If the mortar is made with sand alone, the space between the cogs need not be made so wide as three inches. He has a second shaft, with closer cogs, in order to give the mortar another working; the space between these cogs is but two inches; but it does not answer well till after the first shaft has been used, nor is it necessary, unless for very nice work." He adds, that he "made 200 barrels of lime into mortar last summer, and has now the like quantity of lime in the pit for the same purpose. He made six barrels of mortar in a day, with ease; a boy of seven years old drives the horse, and the most indifferent one is good enough for the purpose, the draught being so easy."

The plan of the machine is seen at *fig.* 7. in Plate VI. in which A is the plan of the boarded floor, raised eight inches from the ground, four feet two inches in diameter, and surrounded by a fourteen-inch wall, whose outside height is two feet. B, a sliding door, two feet wide. C, plan of the shaft, with its cogs, or teeth; its length eleven feet eight inches, breadth eight inches, depth five inches. D, plan of the post, or axis, on which the shaft turns round; diameter seven inches, height twenty inches. EE, plan and upright of one of the cogs as it stands in the mill. The plan is a rhombus, the longest diagonal is three inches, the shortest but two, in order to make the angles of the cogs more acute, by which means they will pass through the mortar with the greater ease. F, elevation and section of the mill in perspective.

It is observed, that the space between the cogs is three inches, except the first to the left of the post, which is but half an inch distant from it, in order to give the cogs to the left a different direction from those on the right; and its use will, by inspection, readily appear. There must be a space of two inches between the end of the cogs and the floor, in order to give the gravel a free passage, which would otherwise strain the cogs, and stop the course of the mill."

MOSS, a vegetable substance or plant, that sometimes spreads over the surface of old grass lands.

This is a sort of plant or vegetable which is apt to fix itself upon the surface of old grass lands of both the meadow and pasture kinds, and produce much injury to them by drawing away the nourishment of the grass plants, and of course lessening in a high degree the grassy herbage. It affects such as are of the clayey moist description, in cold exposed situations, the most frequently, choaking the grass by spreading closely over it. It is observed by a late practical writer, that "various means have been proposed by writers on husbandry, for the removal of this most destructive vegetable. But as it requires a considerable proportion of superficial moisture to promote its growth and extension on the soils which it infests, it is probable, that the application of such substances as have a tendency to absorb, and take up the superabundant degree of wetness by which it is supported, must be of great utility and advantage. In this view lime has been applied evenly over the surface, in such cases, with much benefit. He has, however, experienced superior advantage, by covering mossy grass-lands with a thin even coat of attenuated calcareous matter, in union with a sandy material, such as is scraped up from roads, when formed into a compost with about one fourth part of well-rotted farm-yard dung; as by this application a new, and more vigorous description of grasses is brought up, which soon overpowers the moss plants, and thus wholly destroys them. For the same purpose, and at the same time promoting the improvement of the lands, as well as bringing the herbage into a finer state, the penning or folding of sheep has been advised by Mr. Kent. This method may probably, he thinks, be had recourse to with the most success either in the close of the summer season, or early in the spring months; the latter is, however, to be preferred, as from the grass immediately covering the surface, more effect may be produced in smothering and destroying the mossy vegetation. In this practice, advantage is, he says, obtained in different ways, as by the effect which the treading has in opening and removing the close netted texture of the moss, and that of the urine and dung in promoting the more strong growth of the grass plants. Harrowing with short, sharp-tinned, light harrows, is likewise a practice that may, he supposes, be found useful in some cases, especially previous to the application of such substances or com-

posts as have been just mentioned, as by such means the matted nature of the moss is broken down, and rendered more open and fit for admitting the manure to the roots of the grass plants, and exerting its full influence in promoting their vigorous growth, and at the same time the spreading of the moss in some measure prevented. After such harrowings have been performed, some have recommended it as an advantageous practice to sow grass seeds and especially white clover over the surface. Different sorts of implements have been contrived for dressing the swards of grass lands, when in this condition: such as the above and different sorts of scarifiers and sward cutters; but it may be very conveniently performed by a sward dresser lately invented by Mr. Amos, and represented in his Minutes on Agriculture and Planting. See *Sward-dresser*.

Old grass lands when much overrun with moss should be broken up for the purpose of tillage, in order to their being laid down again to grass after a proper course of crops; as it is probably impossible to render them good grass lands again in any other method.

Moss is likewise a term frequently made use of to signify a particular sort of earthy material, found in some low situations in different parts of the kingdom, but particularly in the more northern districts. This earthy material is of different natures in different situations, as wood moss, black peat moss, flow moss or red bog, &c. The first, which is principally composed of ligneous substances, is probably the best for manure; and the black peat, which is chiefly composed of heath, decayed *sphagnum*, and the roots of the *eriophora* is the next in the goodness of its properties. The third which is chiefly derived from the *sphagnum* in a more fresh state, is the least useful. See *Mossy Land* and *Peat-moss*.

Mossy *Land*, a name given to boggy peaty grounds, in many parts of the kingdom. These sorts of land consist of a turfy surface, below which is a black, moist, spongy earth, which being dug up with spades, almost in the form of bricks, and dried, is what is called peat, and which is used as fuel in several districts.

The shortest method for the improvement of moss, if the ground be designed only for grass, and its situation be such as admits of it, is this: first drain the moss, and if there be heath upon it, burn that off, and make the surface even. Then make a dam at the lowest part, and a sluice, and work the water upon it through the winter. The mud which comes with the land-flood will bring a fine sward upon it in two or three years, and be afterwards a yearly manure: so that it will bear annual cutting, and, besides, be good pasture for cattle, after the sward is become strong enough to bear them.

Mr. Græme found that the improvement of moss may be endangered by draining it too much; for his crops were best where the surface of the water in the surrounding ditches was not above three feet lower than the level of the moss.

The nature and origin of the soil of mossy land, has been lately much inquired into and examined by different writers. It is remarked by Mr. Hadrick, in his very able paper in the second volume of Communications to the Board of Agriculture, that "Dr. Anderson, in a late treatise, advances an opinion which appears to him somewhat paradoxical. He asserts, he says, that moss is a vegetable, or congeries of vegetables, which are *growing*, or *living* below; while he distinguishes the top, where we frequently see vegetables actually growing, by the epithet of *dead moss*. Thus, says he, according to him, there are two species of moss, *viz.* 1st. *Quick moss*, from which peats are dug, on which no vegetables are ever known to grow, and in which no animals are ever known to exist; that this, before it is cut out of its natural situation, is composed of a congeries of growing, or living plants. 2d. *Dead moss*, which frequently covers the former at the surface, on which heath, and fog, and coarse grasses, are seen in a growing state, while insects, and other animals, frequently nestle in it." He conceives "the idea to have been suggested to the Doctor by the vulgar dialect of some parts of the country, where deep moss, fit for making peats, is often distinguished by the appellation of *quick moss*. But, he apprehends, that this term, in the vulgar dialect of Scotland, no where indicates life in the sense affixed to it by the Doctor, and he knows of no term used among the vulgar that ascribes life to vegetables of any kind. By the term *quick*, when applied to mosses, he supposes they mean only to express their miring property, just as *quick sands* mean sands in which a passenger is in danger of sinking. *Dead moss*, he conceives to be synonymous with *firm moss*; those parts of peat bogs which are covered with herbage being the only parts on which a passenger can walk, when the moss is wet, as his feet are supported by the matted roots of plants." It is further remarked that "whatever may be the strict meaning of these terms in common language, the Doctor must admit that, according to his hypothesis, this vegetable, during the whole period of its growth, is excluded from the influence of sun and air. No vegetable he ever heard of forms ligneous fibres, or acquires inflammability, without contact of air and of the sun's rays during the period of its growth. Now, he asks, how comes it that a vegetable growing in such extraordinary circumstances, acquires the very high degree of inflammability ascribed to it by the Doctor? Inflammability it cannot acquire from the action of the sun's rays, because it is soaked in water, and frequently covered with a thick coat of what the Doctor calls *dead moss*. However ingenious, therefore, the hypothesis may be, this obstacle to its admission seems to him insurmountable." And further, "what seems, he says, decisive of the utter deadness, and partial dissolution of that species of moss, to which the Doctor imputes life and vegetation, is, that such moss emits light when kicked and tossed about in a very dark night. This is well known to those who live contiguous to peat bogs, and is the cause of frequent terrors, which are ascribed to *Will of the wisp*, &c. It is really owing to the slow inflammation of the ligneous, or carbonic fibres, of which the moss is chiefly composed, in consequence of contact with atmospheric air in a moist state. No plant, as far as he knows, is capable of this spontaneous inflammation while it continues in a growing, or living state; and most plants require all their mucilages, and other soluble

parts, to be extracted by long soaking in water, before they are capable of exhibiting this phenomenon. If a piece of wood be well dried and seasoned, it cannot afterwards be rotted except very slowly; but if it be sunk in a green state, among moist earth, its soluble parts are extracted in the course of a few years. Its ligneous fibres become soft, and may be separated in every direction; each species of wood breaking in a way peculiar to itself, both laterally and perpendicularly, similar to the crystallization of salts. If this wood be suddenly exposed to the air, in a dark place, while moist, it will shine with great brilliancy; if it be dried, it will be found much more inflammable than fresh wood of the same species, which has been seasoned; as it consists almost wholly of carbon. The property of shining in the dark is common also to leaves of trees, and to all vegetables, whose carbonic fibres have been laid open in consequence of long soaking in moisture, when they are first exposed to the action of atmospheric oxygen. By frequent repetition of soaking, and exposure to the air, such bodies become entirely calcined, and they leave an uninflammable earth, such as is produced by burning them in a common fire. No living vegetable, however, and no vegetable whose solution is not pretty far advanced, is ever, he says, seen to undergo this spontaneous inflammation; but moss, adapted for making peats, certainly undergoes this process, and therefore such moss, instead of being alive, must, he thinks, be dead." And "this may, he supposes, help us to explain a fact, which is ably illustrated by Dr. Anderson, that moss, if frequently turned up to the air, and kept uniformly in a moist state, though not absolutely soaked, is gradually changed into a fertile soil. None of the succulent, or nutritious vegetables, are known to grow upon other vegetables, unless the putrefaction of the latter be pretty far advanced. Frequent turning of moss, in the given circumstances, exposes it, he says, to slow inflammation or putrefaction; both of these processes being of the same nature. Which may also help to account for some facts which seem to have puzzled Dr. Anderson, as appears from his treatise: that oak, which is never found to rot when sunk in moist clay, or moisture of any kind, should be found reduced almost to a pulp in moss; but the Doctor may observe that the oak found in moss was never seasoned; it fell where it grew, and was inclosed by moss with all its natural juices, while a vast quantity of additional juices, retained in the moss, soon invested it on every part. The trees in this situation were in time robbed of all mucilage, and soluble parts, which became food for the moss plants that invested them; of course nothing at last remained but the carbon, or ligneous fibres, saturated with the moss juices. Though the cohesion of these fibres be destroyed, they are insoluble in water, and do not easily rot in it; in other words, they do not readily decompose water." But he adds, that "another difficulty still occurs to the Doctor. How come these ligneous fibres to retain their inflammability, or even to have it considerably increased?—A few facts will, he says, be afterwards stated, which may help to account for this; at present it is only necessary to observe, that wood will retain its inflammability a very long time, if buried green in any moist substance, which effectually excludes it from the action of atmospheric air, provided it does not petrify, or change into stone. Its soluble parts may be extracted, and diffused through the water; but they rather impede, than increase the inflammable power of wood. The ligneous fibres, however, remain, and are not rotted, except by the joint action of air and moisture. It has often been observed, that the part of a stake fixed in the ground, which soonest rots, is a ring from the surface downwards, which is between the wet and the dry; that is, the part which is exposed to the joint action of the earth's moisture and of atmospheric air. Now, says he, trees that are buried deep in moss are soaked in perpetual moisture; but are excluded from the action of air; they cannot therefore be said to rot, though their parts should be softened, and their soluble mucilages be extracted, and dissolved in the water; but any one who examines the large trees found at the bottom of mosses, must be convinced that they had undergone a partial rotting before they were completely covered by the moss. The upper part of these trees is uniformly flat, or eat out into hollows, while the under part retains its natural rotundity. This shews that after these trees had fallen, the under part was immediately invested, or sunk in moss, while the upper part continued a long time between the wet and the dry, before the moss grew up and excluded the action of the air. If then, continues he, the ligneous fibres of wood sunk in moss remain undecomposed, their being softened, and reduced to a pulpy state by long maceration in water, affords no reason why they should lose their inflammability, but rather that this quality should be increased. Inflammability can only be lost in consequence of the carbon contained in a body having combined with oxygen; a combination which, in this situation, cannot take place; nor does there seem sufficient reason to conclude, that the plants, of which moss is composed, grow in a different manner from other plants, or that they acquire a high degree of inflammability without the action of the sun and air; a supposition which is contrary to universal experience. But, he says, without entering into any controversy upon the subject, he may be allowed to state his own opinion, with the reasons on which it is founded. Far from laying claim to infallibility, the reader, he says, is requested to withhold his assent, unless the facts adduced may seem to him convincing" and well founded.

He observes, first, that "there is one opinion in which he cordially agrees with Dr. Anderson, that moss grows, or receives a gradual accumulation from vegetation. The only point in which he differs with him, is respecting the place where this vegetative accumulation is made: the Doctor says it takes place below, while he apprehends it takes place at the surface." It is added, that "with regard to the general fact, that moss grows, many proofs are adduced by Dr. Anderson and other writers; and he will only superadd two, which appear satisfactory. In a moss, he says, belonging to Robert Fulton, Esq. of Hartfield, near Paisley, the people in casting peats, came upon a causey formed of broad stones upon moss: this causey had been very substantially finished with

stones, brought from a distance, in the Roman manner, and was probably constructed by them while they occupied a fortified camp at Paisley. Though it had been originally laid upon moss, a new covering of moss had grown over it, to the depth of several feet. There is a moss at Swindridge Muir, from which peats had been dug at some very remote period; the old pots from which the peats had been taken, are grown up to the level of the surrounding moss; but on leading up a main drain which passed through several of these holes, they were found to be filled with moss of a more soft and spongy texture than the old moss, which never had been dug. Indeed, the new moss no where coalesced with the old, the sides of the pots remaining perpendicular and entire. The new moss could not have been accumulated from any thing blown into the pots by the wind, as the whole surface of the surrounding mosses were covered with heath and coarse herbage; it must therefore have been caused by a new vegetation of moss in the holes from which the peats had been taken." It is further remarked, that "were a naked rock suddenly thrown up from the sea, or from the bowels of the earth, the first plants which nature would place upon it would be the various species of lichens, and such as can subsist wholly upon what they imbibe from the air, without needing a soil in which to push their roots. These plants serve the double purpose of clothing the rock, and thus preventing the fine particles that are dissolved by air and moisture from being washed away, and, from their growth and dissolution, of accumulating vegetable soil for the sustenance of more succulent plants. The rock is thus gradually made to acquire such a depth of soil, that it becomes able to sustain, not only grasses and shrubs, but may become a receptacle for the oak itself. But, says he, if we suppose this rock to be so situated, that moisture cannot easily run off from its surface, a great variety of the moss plants will begin to grow upon it. As these accumulate, the moisture will rise along with them; for they retain it like a sponge, and obstruct its passage from the rock. Thus, as long as the moss plants can accumulate moisture, they will continue to grow, until the rock comes to be covered with a deep moss." And "the same effect will, he thinks, be produced upon a bottom of gravel, or limestone, which does not easily admit the moisture to pass through it. Upon a bottom of aluminous, or pyritical schistus, none but the most hardy plants, such as those which compose moss, can, he asserts, exist; and such plants will therefore, he says, accumulate upon such a soil, if not checked, even though it should have a considerable declivity." It is added, that upon flat clay land, and in hollows, that had been formerly covered with wood, we uniformly find mosses which have grown in consequence of the wood having been felled, or allowed to fall down. This is owing, he thinks, to the water having been obstructed by the trees, after they had been strewed upon the ground, and which consequently caused the production of aquatic plants. But such trees as we find in the bottom of mosses, being steeped in water, throw out a considerable portion of the tanning principle: this is of such a nature, that no other but the hardy moss plants can grow in a soil affected by it; such plants, therefore, rapidly grow in such situations, and accumulate as long as they can cause the moisture to rise as they rise. In the bottom of mosses that had been originally caused by the fall of woods, we find all those grasses and plants which commonly grow in woods, in a state of preservation; we also find the leaves and other exuviæ of the trees, which having been dropped during a course of ages, seem not only to have increased the dampness of the soil, but by their astringent juices to have predisposed the soil for the growth of moss plants; thus the moss seems to have advanced a considerable way before the trees fell, and by the moisture which it retained, it seems to have chilled their roots, and rendered it easy for the winds to overthrow them."

It is further stated, that "mosses in flat situations are generally highest in the centre, that being the point where the water finds most obstruction to its running off. The limit to the farther accumulation of these mosses is the point to which the water can be drawn up as the moss increases, and they have been known to grow until the column of water, sustained in the moss, has burst its barriers, and conveyed the moss that retained it over the neighbouring fields. Many examples of this might be specified, but he will only mention that of the Solway moss, the facts relative to which are well known to the public. To this cause also moss hags are, he conceives, to be imputed, or those dangerous chasms which frequently occur in deep mosses; these are produced by a part of the moss shifting its position, from the column of water sustained in it acquiring greater pressure than the lateral resistance. Thus moss may, he thinks, be considered as a fresh water sponge, which grows as long as it can draw up and sustain water to nourish it." From these facts it is concluded, that "the predisposing causes of the growth of moss appear to be an extreme degree of dampness, or of astringency, in the soil, which render it an unfit receptacle for any other, but the moss plants. He uniformly proceeds upon the supposition that the sperm, the seeds, or the suckers of the moss plants are at hand, where a soil is thus predisposed for their production; for it would be absurd to suppose, that these plants would begin to grow even in the most favourable situations, if there were neither seeds nor roots from which they were to spring. We are told, he says, that in America and several other countries, peat bogs are unknown: this he would account for in two ways; either the moss plants are there, but never accumulate into a bog, from want of a proper receptacle; or supposing situations favourable for their accumulation, there are neither seeds nor plants of mosses to occupy these situations. We know not, he adds, all the causes which induced the Supreme Being to diversify the productions of different climates; but we know, that they are exceedingly diversified, and that this operates as a powerful motive upon remote nations to cultivate a friendly intercourse with each other."

It is remarked, in addition, that "the moss plants grow

at the surface, with their roots and stems immersed in moisture; but their leaves and branches are exposed to the air, and the sun's rays. Those mosses, he says, which discover no vegetation upon their surface, are either arrived at the utmost height at which they can sustain water, and have hence become dry and are frequently blown about by the winds, or there are large spaces perpetually washed by the rains which fall, which are hence converted into water-courses. In such ruts every new accumulation of moss is washed away, if what was formerly accumulated be not also carried off to a considerable depth. In flat places, where the moisture does not readily get off, the genuine moss plants may be seen growing somewhat similar to the green vegetation which arises in pure water, when exposed to the sun's rays. When a moss is intersected by numerous water-courses, it appears to be divided into islands, on which heath and coarse grasses, with *lichens* and other moss plants, are growing. When a moss has grown so high that it no longer retains a sufficiency of water to cause its further accumulation, the upper part, being between the wet and the dry, is partially rotted or decomposed into vegetable earth; hence the upper stratum of moss is never so inflammable as the parts below, having already, in some degree, suffered the slow inflammation which converts it into soil."

The same author farther observes, that "the moss plants seem almost wholly composed of carbonic fibres, and are so hardy that they continue to grow above, while their stems and roots are mouldering below. He has traced many of them to a considerable depth. Thus the yellow, or white fog, of which there are several varieties, is commonly fresh and vigorous at the surface; about a foot lower, it may exhibit marks of decomposition, though its organization remains entire. It may be frequently traced almost to the bottom of a deep moss, though its organization becomes constantly less distinct, until it is entirely lost. In the same way he has been able to trace the heath plant almost to the bottom of a peat moss; below it becomes soft, and is frequently bruised by the incumbent pressure, but its organization is seldom destroyed." He says, "the plants, which compose moss, are doubtless exceedingly various. Botanists have enumerated more than 300 species of them, of the *cryptogamia* class; but it is probable, he thinks, that many species of these plants are invisible to the naked eye; and that there are many others, whose form and organization it is difficult to ascertain."

He conceives, that "while the moss plants are growing at the surface, they are not rotting below: they are only steeped, or macerated in water, which extracts their soluble ingredients, and reduces them to a soft and pulpy state, in the same way as was mentioned respecting wood. As the water cannot get off except by evaporation, in the lower parts, it is never changed, but the same water must continue for ever in the place which it occupies. Were it otherwise, that is, were the water frequently shifted, the moss would, he thinks, gradually rot, and moulder into earth: hence the effect of watering mosses, which, by accumulating vegetable mould, causes the moss to throw up sweet herbage." Dr. Anderson, he says, thinks "that mosses could never accumulate to their present extent, by growing above, while they are rotting below: he thinks that even an acre of the best grass could never accumulate hay sufficient to cover the surface on which it grew, to such a depth as many mosses have attained, by the residuum left after it was rotted. But it is well known, that by the rotting of hay, and other succulent vegetables, by far the greatest part of their substance is conveyed away in those gasses which are emitted during the process, and there is nothing finally left but a light earth, together with some salts that are formed in the product. In moss, no such rotting process, he says, takes place, for we never find that any of those gasses emitted by rotting vegetables are emitted by moss; on the contrary, moss will preserve succulent vegetable, and even animal substances. It is said, that in the Ards moss, in Airshire, bodies of persons have been found by the people who were casting peats, which have remained in a perfect state of preservation ever since the persecution of the covenanters by Charles II. The covenanters frequently held their conventicles, or field preachings, on the borders of this moss: when surprised by the king's troops, they fled into the centre of the moss, where cavalry could not pursue them. As these meetings were generally held in the night, it appears that some of these people had dropped into holes, where they could not afterwards be found. It is therefore evident, he thinks, that moss, so far from being itself in a state of putrefaction, is a styptic, whose juices are capable of preserving even those bodies which are naturally most liable to putrefaction; the two cases are therefore altogether dissimilar, and the argument inconclusive. But if we were to suppose the grass, like the moss plants, growing as thick as it could stand, and every season macerated, but not rotted, in water which fills up every interstice, he apprehends it would soon accumulate upon the soil that produced it, to a much greater depth than any moss now in existence: it may be further observed, that scarcely one half of the densest moss is filled with vegetable matter. When peats are first cut out, they are nearly double the size they retain after they are dried; and when they are squeezed while wet, by a press, they go into a much smaller form."

It is next asked, "how it comes that water only macerates the moss plants, that is, extracts their soluble ingredients, and destroys the adhesion of their parts, without rotting them, as happens with succulent plants?—He apprehends this must be partly imputed to the hardy nature of the moss plants; for being chiefly composed of ligneous or carbonic fibres, the water does not readily act upon them, or more properly, is not easily decomposed by them. Those plants are easiest rotted which abound most in mucilages, and parts that are soluble in water; even mucilaginous plants do not easily rot, if they be wholly immersed in water, and excluded from the action of the air, which is precisely the situation of peat moss. But independent of this consideration, we shall see, he says, that the water which resides in mosses is impregnated with a portion of the tanning principle, which

effectually prevents the rotting of the plants, in the proper sense of that word. Moss plants, therefore, are macerated, or infused like tea in water, but not rotted: the organic texture may be destroyed, and the soluble parts diffused in water, without suffering any chemical change: as the same water always resides in the moss, unless it be evaporated, there can be little or no loss of vegetable substance. As this maceration in water does not oxygenate the plants, it should, he conceives, render them more inflammable than when in their organic state, as was suggested respecting wood."

He afterwards remarks, that "the trees and shrubs he has found at the bottom of mosses are the following, and they are perhaps the only indigenous trees and shrubs of this country. Of trees, 1, the oak; 2, the elm; 3, the birch; 4, the willow; 5, the aller; 6, the fir. Of shrubs, 1, the hazel; 2, the dwarf willow; 3, the gall-plant; 4, the heath plant: this last frequently continues to grow upon the moss during the whole period of its existence. The 2d and 3d shrubs also frequently continue growing upon mosses in the western parts of Scotland: they are very hardy shrubs, and seem to prefer those situations where their roots are immersed in the tanning principle, and the plants themselves abound in this principle. The shrubs which grow in mosses are, he says, always partially decomposed, if they have not entirely lost their organic form, when traced downwards to a certain depth; but he has also observed certain tubular roots, resembling large threads, which are evidently in a living state from the top to the bottom. These roots belong to plants which are growing at the surface, and which do not seem to decay below, with the mass of other plants. In the commencement of many mosses, it would appear, that the falling of leaves and decayed branches, together with the undergrowth of shrubs and coarse grasses, had obstructed the water, and caused the moss plants to grow and advance before the trees fell down. The moss, by its retention of moisture, and by creeping up the stems, seems to have chilled the trees, and brought on their decay, before they fell down: thus we frequently, he observes, find a considerable depth of moss below the trees, which are often broken over a considerable way above the root, and they generally lie in one direction, owing to the prevailing current of the winds having first bent and afterwards caused them to fall in that direction. Mr. Smith shewed the writer, mosses, where oak and elm trees were lying near the bottom, and above them hazel and other shrubs had grown, which, in their turn, had been destroyed and closed round by moss." It is added, that "as a proof that moss is composed of a congeries of plants, which had successively grown and decayed, though they had not rotted, we may observe that it is always composed of thin layers, or strata, piled above each other, and the lower strata much more compressed than those above. This may be distinctly seen in many species of dried peat, and may also be observed in the face of a peat bank, or wall, from which peat had been cut. The moss plants, therefore, seem to be more analogous to wood, than to any other species of plants: they are parasitical, and can grow either upon wood, or upon the wrecks and particles of their own substance. But so far from being in a state of putrefaction below, they will not, he says, grow in any soil where the putrefactive fermentation is excited."

With respect to the difference of moss, it is observed that there are two species or kinds, *viz.* black moss, which is of a mahogany colour in its original state, but soon becomes black by exposure to the air, and whitish yellow, or foggy moss, which is much less compact than the former, and retains a white or yellow colour after it is dried; the latter, he says, does not seem to be in such a perfect state of maceration as the former, as the fog of which it is composed still retains its organized form; and there does not seem to be such a great variety of the moss plants present in this species of peat as in the black. The predisposing cause of these variations seems, in his opinion, to be either the soil, or species of wood on which the moss at first commenced its growth, or the climate in which it is situated. Thus mosses growing on fir woods, are generally of the soft and spongy kind, and the trees themselves may be split into slices, which are used, in many parts of the country, in place of candles: mosses growing upon oaks, and other astringent trees, commonly produce a black and compact species of peat. Mosses in cold and elevated situations, as they grow very slowly, commonly produce a hard and compact peat. In this respect, moss resembles wood, which is always hard and compact in proportion to the coldness of the climate, or rather to the length of time it takes to grow; moss again, in low and warm situations, as it grows rapidly, is commonly soft and porous. These several causes often, he thinks, act separately, and often co-operate; and thus moss, considered as a soil, is found to possess the same varieties of quality which distinguish other soils." It is concluded that, "if these observations be well founded, it would appear that moss is not a plant which grows by a law peculiar to itself, and in direct opposition to the established laws of vegetation in other cases; but that it is a congeries of vegetables, of various species, which are adapted to grow in soils and situations, where the more delicate succulent plants cannot subsist; that they are mostly of the parasitical kind, and grow either upon rocks and damp clays where they receive little from the soil, or they can grow upon other plants, or even upon the particles that are formed from their own dissolution; that the predisposing causes of the growth of moss, are dampness and astringency in the soil; that while these plants are growing at the surface, they are dissolving below, not indeed by a process at all analogous to putrefaction, but by the simple diffusion of their parts in water, where they remain without any chemical change" or alteration.

After this, the ingenious writer gives an analysis of the mossy material, as made by himself and Mr. Smith.

At Swinridge Muir, August, 1797, they attempted, he says, to analyse a small portion of Berkshire peat,

which he had got from Dr. Coventry, professor of Agriculture in Edinburgh, the statement of which is as follows:

"1. This peat was of uncommon density, approaching to pit-coal, and contained no marks of organic matter; therefore the vegetables of which it was composed, had been completely macerated, and reduced to a pulp.

"2. In some parts it exhibited the astringent taste of alum, in others of sulphate of iron.

"3. Part of this peat being pounded in a mortar, infused in pure warm water, and filtered, the liquor discovered slight marks of acidity by test paper.

"4. Muriate of barytes being dropped in, produced a copious precipitate, which proves that the acid was sulphuric.

"5. Saccharine, or oxalic acid, carried down from another portion of the liquor a very slight precipitation of lime, which proves that a portion of gypsum existed in the mass.

"6. Lime water carried down a portion of magnesia, proving the existence of sulphate of magnesia, or Epsom salt; indeed this was evident from a slight efflorescence which had formed upon the peat while in his possession.

"7. Purified pot-ash produced a copious precipitation of various substances.

"8. Another portion of the same peat being burnt, emitted, towards the close of the operation, a sulphureous smell, and exhibited a sulphureous flame. The small particles which had been formerly washed, being also burnt, were powerfully attracted by the magnet. This demonstrated the presence of iron, and was an additional proof that one of the salts contained in the mass was sulphate of iron.

"9. What was burnt in the mass left a large proportion of white ash, which, on exposure to the air for several days, acquired a rusty colour, owing to iron.

"10. On washing, filtering, and precipitating the liquor obtained from this ash, in the way already described, it appeared to contain the same salts that existed in the unburnt peat, though in much greater proportion, *viz.* sulphate of lime, of magnesia, of alumine, and of iron. These are the salts which are commonly found in beds of schistus; and since the ashes of Berkshire peat are in such high request as a manure, he apprehends that many beds of schistus, which he could point out, would answer the purpose much better. He is disposed to think that the chief benefit, so far as saline matter is concerned, arises from the sulphate of magnesia, or Epsom salt; and if beds of schistus be resorted to, those should be selected which abound most in this salt, and contain little or no alum, or sulphate of iron.

The liquor extracted from the ashes exhibited no mark of uncombined acid; and it is probable that the acid mentioned, No. 3. which was scarcely perceptible, might be neutralized by a small portion of alkali formed in burning the peat.

"The saline matter being washed off, there remained a residuum consisting of a light earth, mixed with particles of iron, which obeyed the magnet."

And in regard to the peat of Swinridge Muir, the following are the results:—"11. The black hard peat taken from the bottom of a moss being burnt, yielded a considerable proportion of ashes, though not such a quantity as the Berkshire peat. The ashes were of a brown colour, like rust of iron, and were attracted by the magnet.

"12. Being infused in warm water, and the liquor passed through a filter, it discovered no mark of acid, or of alkali, by test paper.

"13. Oxalic acid carried down a small precipitate of lime; hence the ashes contained gypsum, or sulphate of lime.

"14. Muriate of barytes caused a very considerable precipitate; hence the acid that entered into the composition of the salts contained in the ashes, was the sulphuric.

"15. Infusion of camomile flowers produced a dark precipitate; hence sulphate of iron.

"16. After the lime was carried to the bottom by the oxalic acid, volatile alkali caused a minute precipitate of magnesia in the liquor that was left clear; hence the ashes contained a small portion of sulphate of magnesia, or Epsom salt. It appears therefore, he says, that this peat-ash contained the same saline ingredients with the former, though not in such proportion. A much greater proportion of uncombined iron was left in the residuum."

It is observed that, "17. *The foggy, or yellow peat*, being burnt, did not yield so large a proportion of ashes as the former; they were white, and did not obey the magnet: a filtered solution discovered no mark either of acid or of alkali, but was found to contain a minute portion of gypsum, or sulphate of lime. No iron could be found.

"18. *Subsoil of moss*, being examined, was found to consist of a bluish white clay. This being made into balls, and dried in the air, was afterwards burnt in a kitchen fire, where it became white, and very hard; being afterwards exposed to the air during nearly three weeks, it became rusty, shewing that it contained iron.

"19. The balls being pounded in a mortar, infused in warm water and filtered, the infusion tasted of alum, but exhibited no mark of acidity by test paper.

"20. Muriate of barytes produced a very copious precipitate, proving that sulphuric acid entered into the composition of its salts.

"21. Decoction of camomile flowers produced a dark precipitate, proving that sulphate of iron existed in the liquor.

"22. Oxalic acid produced no precipitate; hence no lime, nor any combination of lime, existed in this mossy subsoil.

"23. Volatile alkali threw down a very slight precipitation of magnesia; hence a small portion of Epsom salt." The writer concludes that "it appears therefore that this subsoil contained the same saline ingredients which are found in those beds of schistus called till. These are naturally the most sterile of all soils; and to distinguish them from schisti of an opposite character, he has called them the aluminous and pyritical schisti." It is further stated,

that "by these experiments they did not find what they were in quest of, *viz.* alkali, in the ashes of peat. It is possible that pot-ash may be formed in the ashes of some species of peat, and that their effects as a manure may partly depend upon this salt, though we found none in the ashes we examined; indeed pot-ash, and the salts we actually found, could not co-exist in the same liquor." He afterwards puts the question, "How happens it that peat acquires the salts already described?" To this he replies, that "on the one hand it appears that iron, magnesia and sulphur, are evolved in the ultimate dissolution of all animal and vegetable substances, at the time when they pass into an earthy residuum. Now the Berkshire peat was evidently in this state, and resembled a petrifaction: the lime and part of the sulphur might have been produced by those tribes of fresh-water shell-fishes, which cause shell marle in the bottoms of lakes and ponds, and are frequently afterwards covered over with moss. The various strata of schistus, and of pit-coal, seem to have been originally derived from mosses, and to have acquired their peculiar ingredients in this manner. On the other hand, Mr. Smith assures him he has frequently found the salts in question in mosses in Scotland; but was always able to trace their origin to springs, which either burst out, and ran over part of the moss, or oozed imperceptibly from some part of its bottom. The question is, he says, left to be decided by farther investigation."

It is remarked, that "the Berkshire peat is more dense, and yields a greater proportion of ashes, than any peat he has seen in this country (Scotland): perhaps its effect as a manure may, he thinks, depend as much upon its earthy residuum, as upon its saline matter." See *Ashes*.

It is observed in regard to the liquor, or *juice of peat*, that it "contains the gallic acid, or tanning principle, appears from various facts. He is told that the Highlanders use moss holes in place of tan-pits, aiding the moss water with the bark of oak, birch, willow, and mountain ash, and excluding all running water from getting into the pit. It is known that water, which runs through moss, is frequently employed to steep lint; but it is also known that stagnant moss water, that is, what oozes from the sides of the hole where it is collected, invests the lint with a dark skin, and prevents its putrefaction. This, by the people who live near mosses, is, he says, called *barking the lint*, and they are always careful to use water which runs through the moss from the neighbouring fields, as what oozes from the moss itself uniformly prevents, instead of promoting putrefaction.

"24. But what seems to put this matter beyond a doubt is, that the juice of moss uniformly gives a dark inky precipitate with the sulphate and other salts of iron. When the extract, or juice of moss, is much distended with water, it sometimes requires a great part of the superfluous moisture to be evaporated, in order to render this effect the more striking; but in the many trials he has made with the juice of moss, in various parts of this country, he never saw the experiment fail." It is added that "Mr. Smith has suggested some phenomena, which the preceding fact may enable us to explain. In some places it may be observed, that water which oozes from the side of a moss bank, where peats have been cast, destroys every succulent vegetable that lies in its road, though it does no harm to the moss plants: this water conveys with it the gallic acid, or tanning principle, which destroys succulent vegetables, unless it be neutralized. Again, a drain or rill of water, that passes through a moss, and which conveys water different from what it receives in its passage, causes a strong growth of succulent grass in those places where it is allowed to spread. This water soon washes away the gallic acid from the moss, and the brown feculent matter which it afterwards conveys, and deposits, is disposed to putrefaction, and promotes vegetation. Hence water that passes *through* a moss, though not that which comes *from* a moss, may be used for watering land. Hence also in converting moss into manure, it would be useful, he conceives, to steep it some time in a hollow, where a rill of water runs through it. Hence also, he supposes, part of the effect of water brought upon moss, when it is converted into a watered meadow, may arise from its washing out the gallic acid, and disposing the moss to putrefaction."

It is added that, "25. Three bottles of moss water were obtained, one squeezed from peat taken out from the bottom of a moss, another from peat near the top, and the third filled from a moss hole, where peats had been cast; this juice being boiled down to a small bulk over powdered chalk, and afterwards filtered. The oxalic acid being dropped into a portion of it, carried down a precipitation of lime. Hence juice of peat, or rather the gallic acid contained in it dissolves lime; and one effect of this manure, applied to moss, is to neutralize the gallic acid which resists the putrefaction of the moss. In very dry summers, he has frequently seen water taken from a moss hole, so situated that water was not apt to flow into it from the parts adjacent, produce a sensible effervescence with chalk, and with the mild alkalies. These facts he imputes to the gallic acid, which forms a soluble compound with lime and the alkalies, but becomes insoluble with iron.

"26. Small portions of moss were taken, part from the back of a furrow, part from the bottom of the furrow, part from a greater depth, and part as low down as could be reached. These several portions of moss, with all the moisture they contained, were placed in the bottom of a wooden dish; a few small pieces of dried peat, the largest not exceeding the size of a small egg, were placed here and there among the other wet parts of moss. The dried peat was of different species; some hard and brittle, which breaks with a smooth fracture; some that tears asunder like hair, owing to certain grasses, and other plants, of which it is chiefly composed. Over the moss and peat, thus placed, a few pieces of burnt lime were laid, and as much water added, as slaked the lime. The vessel was then filled with water to the brim, and allowed to remain more than six weeks. When examined, it was found that the water had partly

evaporated, and the mass was so far consolidated, that it dropped out of the dish like a cheese. On breaking it in pieces, no remnant of the wet moss could be found, except that it had incorporated with the lime, and imparted to its lower parts, a dark colour; but the threads of the dried peat remained unchanged, though invested with lime; while the bits of brittle peat, on being broken, shewed clearly that the moisture had only penetrated a short way within the surface, forming a nucleus around the centre, which was dry as before. Hence, he concludes, that, in reclaiming moss, it should not be permitted to get too dry at first, or the lime will never act upon it: dried peat, light seasoned oak, he says, resists the admission of moisture, and may remain a long time under water before it becomes wet to the centre. But it appeared that the lime, in this instance, had followed the moisture of the wet moss into every pore, and had completely destroyed its organic fibres; but as the moisture could not penetrate into the dried peat, the lime had produced no effect upon it.

"27. A little of the juice that remained in the compound of lime and moss, was squeezed out with the hand into a glass, and afterwards filtered. He remarked, that great quantities of gas escaped during the pressure; the water passed through the filter in a very limpid state, and conveyed with it none of the colour of the moss. A little of the filtered liquor being dropped into a solution of sulphate of iron, at first produced a brown colour, being the precipitate of iron with lime; but on the addition of more liquor, a very intense dark precipitate, resembling ink, was produced, though retaining a greenish tinge: the dark precipitate went to the bottom, while the brown remained suspended in the liquor. Lime water, being poured into ink, produced a greenish black precipitate, and left the liquor of a red colour; it produced upon it precisely the same effects that took place in this experiment; there can, therefore, he thinks, be no doubt, but the dark precipitate in this case was produced by the gallic acid, or tanning principle, acting upon, and rendering the iron insoluble." And "hence it appears evident, he thinks, that quick lime added to wet moss, extracts from it a much greater proportion of the gallic acid or tanning principle, than can be obtained by pressure, or other means; for though the galate of lime, in this case, was distended with much more water than was contained in the moss, the precipitate of iron was much more copious than in any of the former cases.

"28. The oxalic acid being dropped upon another portion of this filtered juice, carried down a very strong precipitate of lime, and wholly divested of that colour which accompanies precipitates of lime from moss water, afterwards mentioned." And "after this combination of oxalic acid and lime had dropped to the bottom of the glass, the liquor discovered evident marks of acidity by test paper, and when dropped upon sulphate of iron, produced a dark precipitate as before. Here then was obtained, he says, the gallic acid in an uncombined form, of sufficient strength to act upon test paper, and proving its character by its effects upon iron. The change of colour from a rusty brown to black, which Lord Dundonald calls oxygenation, when peat is cut from a moss and exposed to the air, appears to him to depend upon the particles of iron contained in the moss plants, acted upon by the gallic acid, or astringent juice. In the same way, when fishers prepare their nets in the juice of bark, the liquor is of a brown colour, but becomes black when the nets are exposed to the air. We may observe also, that common ink never becomes perfectly black until it has been frequently shook and exposed to the air some time after it is made. Whether the iron, or the astringent juice, imbibe oxygen in these cases, he is unable to affirm; but it would seem, that exposure to the air causes the gallic acid to unite more intimately with the iron; hence to render its particles less soluble in water and their blackness more intense. When every pore in the fragments of plants of which moss is composed is thus filled with the insoluble compound of iron and gallic acid, it is evident that water cannot easily penetrate into a mass of dried peat; it may get into the internal cavities, but cannot get into the pores of the plants. Hence lime does not operate so powerfully in reducing moss that has been dried, as that which has uniformly been kept wet; because the water, which operates as the vehicle to convey the lime, cannot get into the pores of the peat. We therefore, he says, see one great effect of lime in reclaiming moss, consists in seizing and neutralizing the gallic acid, which resists the decomposition of the moss plants. Perhaps this observation is, he says, also applicable to all soils that are covered with heath, or other astringent herbage.

"29. Lime-water being added to the filtered juice of peat, changes it to a dark brown colour, and soon causes all the feculent matter of the peat to drop to the bottom of the glass, though it appeared before to be in perfect solution. In the same way, when a sufficient quantity of lime-water is added to muddy moss-water, in which a vast quantity of mossy particles are suspended, but not dissolved, it soon causes all the moss to fall to the bottom, leaving the liquor clear. In these cases a thin pellicle of oil, resembling that which is obtained by distillation from pit-coal, rises and floats on the surface of the liquor." Here he puts the question, "how are we to account for this fact? Lord Dundonald says that sorreline, or oxalic acid, abounds in moss; and it occurred to him that this effect might be caused by this acid, which forms an insoluble compound with lime, and precipitates it from all its solutions, even from those that are made by means of the mineral acids.

"30. It was next proposed to try the effect which oxalic acid might produce upon moss-water. This acid, both prepared from sugar, and squeezed from the green leaves of sorrel, was dropped into filtered moss water, into the expressed juice of heath, and of various astringent plants; but it soon rendered these liquors perfectly limpid, throwing down at the same time, a small quantity of whitish precipitate: if, therefore, sorreline acid abounded in moss, the water which flowed from the moss would be perfectly transparent.

"31. But what appeared, he says, to satisfy him that oxalic acid had no concern in this precipitate, is, that after it was washed by repeated additions of water, until all the uncombined lime was completely extracted, the sulphuric, nitric, and muriatic acids dissolved the lime contained in the precipitate with considerable effervescence. Distilled vinegar indeed produced no effect upon it; and perhaps none of the vegetable acids are able to decompose the compound formed in such cases, between lime and moss. The solutions being again washed off, the oxalic acid produced a very clear and distinct precipitation of lime from each of them. The experiment was frequently repeated, with the same result. Now, says he, the precipitate of moss, by lime-water, could not be owing to oxalic acid contained in the moss, because the mineral acids again robbed the moss of the lime with which it had combined; whereas real oxalic acid robs the mineral acids themselves of lime. The combination in this case then must have been, not between lime and any acid, but between lime and the matter of the moss itself, forming a compound insoluble in water, and possessed of much more specific gravity than moss in its natural state.

"32. Three portions of moss, the first from a considerable depth, the second from a furrow thrown up with the spade, the third a piece of black dried peat, were, he says, digested in caustic pot-ash; at the same time similar pieces of moss were set to digest in caustic ammoniac, or volatile alkali. These preparations being allowed to remain more than two months, the result seemed to be the same in both. The two first pieces of peat were reduced into a black pulp, soluble in water, and had swelled considerably during the progress of combination with the alkalies. The dried peat was softened on the surface, though it had resisted the penetration of the liquor into its interior parts. These being alkaline composts in miniature, it seems, he thinks, to result, that moss should never be allowed to get fully dry, before it is mixed up in compost with alkaline, or perhaps with putrescent manures.

"33. About three quarters of a pound of pot-ash being rendered perfectly caustic with lime, the alkaline ley was, he says, poured upon genuine wet moss, immediately after it was taken from a considerable depth; this moss was of a mahogany colour when taken out, but its surface soon became black by exposure to the air. The moss was boiled among the alkaline ley in an iron pot during two days and a night. The liquor swelled much, and emitted much elastic vapour, so that it was necessary to boil it very gently.

The moss was soon reduced into a pulpy mass, and dissolved in the liquor. Being afterwards considerably diluted with water, it was passed through a searse, and left a small quantity of mossy fibres, which, being washed and dried, retained their inflammability. The filtered liquor was now boiled down to dryness, and was found to possess all the qualities of an alkaline solution of moss, extremely soluble in water, though not deliquescent. It was black like pitch.

"34. A portion of this alkaline solution of moss being dissolved in water, and lime-water added to it, the whole of the moss was soon carried down to the bottom, leaving the liquor clear. This, he conceives, clearly proves two things: first, that lime has a stronger attraction for the matter of moss than pot-ash, or indeed any of the alkalies, for it was tried with them all. In making alkaline composts with moss, therefore, he can see no propriety in what some recommend, to have a large quantity of quick lime mixed with the alkalies, to render them caustic. Such alkalies, however caustic they may be, never will combine with the moss, while lime is present to combine with it. If these alkaline composts be of any use, they should be made of alkaline ley drawn from quick lime. Secondly, This experiment proves that the precipitate mentioned, No. 29, and the one now under review, were really an alkaline solution of moss, insoluble in water, and indecomposable by the vegetable acids. He tried if lime would produce the same effects upon the oleaginous alkaline solutions that is exhibited upon the mossy alkaline solution; and found that it uniformly appropriated the oil, forming with it a white paint, or calcareous solution of moss, insoluble in water, while the alkali remained in the liquor in an uncombined state.

"35. After the lime had carried down all the moss from the alkaline mossy solution, and had left the alkali dissolved in the clear liquor: with a view to try if it had extracted any gallic acid from the moss, the clear liquor was decanted off, and sulphate of iron, in solution, added to it; a dark precipitation ensued, mixed however with a grassy green, owing to part of the precipitate being caused by the alkali, and not wholly by the gallic acid. This shews, he says, that pot-ash has a stronger affinity to the gallic acid than lime; for when the lime went down with the moss, the gallic acid remained combined with the potash.

"It also, he adds, appeared evident from this experiment, as well as from No. 27, that the alkalies and lime extract a much greater proportion of the gallic acid from the same quantity of moss, than can be procured by steeping, infusing, or pressing, the same moss; or by any other methods without the application of these agents.

"36. The various salts of lime, the carbonate and oxalate excepted, decompose, he says, the alkaline solution of moss by double elective attraction; for while the acid in these salts combines with the alkali, the moss is precipitated in union with the lime. Muriate of barytes, and all other earthy salts which the alkali can decompose, operate in the same manner upon the alkaline mossy solution. All the metallic salts that are decomposable by an alkali, are mutually decomposable by the alkaline mossy solution. The acid in these salts combines with the alkali in the alkaline solution of moss; while the moss combines with the metal, forming an insoluble compound: these compounds may, he thinks, be called calcareous, earthy, or metallic insoluble alkaline solutions of moss, according to the substance which enters into their composition. The same effects happen when these salts are applied in solution, to a solution of the oleaginous alkaline solutions of moss. It would

therefore appear evident, he supposes, that one great effect of adding lime to moss, is converting it into an insoluble alkaline solution of moss, of much greater density than the moss in its original state. Moss is naturally of less density than water, and is partly soluble in it. But the compound of moss and lime is of much greater density than water, and is insoluble. Moss does not allow water to filter, or to pass through it, but holds it like a sponge. The compound of lime and moss resembles friable loam, is of a dark brown colour when wet, and of a hazel colour when dry. It readily admits moisture to pass through it, and the water which flows from a moss that has been well limed, is limpid and pure, not being charged with any of the mossy matter, as this had been rendered insoluble by its union with lime." It is added that, " so great is the power of lime in reducing moss, and causing it to collapse, that he remembers several years, ago, Mr. Smith shewed him a moss, a great part of which had been reduced into cultivation, and well limed. What was cultivated had sunk more than three feet below the surface of what remained in its original state. This effect could not, he thinks, be imputed to draining alone, as the standing face of the natural moss was much more dry than the cultivated moss, which had sunk so far below it.

" 37. Powdered chalk being put into moss water, and into the alkaline solution of moss, and frequently stirred during several days, did not, he says, carry down one particle of the moss from the solution." He states that, " from No. 25, it appears, that carbonate of lime is capable of neutralizing the gallic acid contained in moss, and thus may produce one good effect, viz. bringing it into a state where it is capable of undergoing the putrid fermentation; but from the experiment just recited, it appears that carbonate of lime is incapable of forming that close union with moss, by which it is speedily converted into soil." On this ground he conceives that, " the more caustic lime is when applied to moss, the sooner will this purpose be effected. It appears also, he thinks, from the preceding experiments, that lime is a much more effectual manure for reducing moss into cultivation, than alkalies, or putrescent manures. Lime causes the moss to consolidate into an insoluble earthy compound, friable, and of proper specific gravity to sustain the roots of plants. Alkalies cause moss to swell into a larger volume than before, while they render it so soluble in water, that what has actually combined with them, is in danger of being soon washed away. However useful, therefore, it may be to apply alkaline composts of moss to other soils, it does not seem advisable to use alkalies for reducing the moss itself into a state of cultivation. The same observation seems, he says, applicable to putrescent manures: these may be applied with great effect in union with lime, or after lime has already reduced the moss into a soil; but when applied singly, in the first instance, they render the moss too blistery, enlarge its volume, and cause it to become more soluble in water than before; of course, though such manures may cause moss to throw up a luxuriant vegetation, they at the same time increase its inherent defects, want of solidity, and too great a retention of moisture, so that the moss is not able to bring to maturity the vegetables it sustains. We may also see good reasons, he conceives, for having all mossy composts drenched with as much water as they can hold, without running off, every time they are turned."

" 38. With a view to detect the nature of the matter of moss, or that principle in it, which combines with lime and alkalies, acids were, he says, added to the solution formerly described. The sulphuric acid raised a violent effervescence, and much gas escaped; while the moss was precipitated from the solution in the form of a yellowish, oily, or resinous matter. Being diluted, and passed through the filter, the colouring matter peculiar to moss-water went through in a state of solution, and there remained upon the filter a brown, greasy, and inflammable matter, arranged in small flakes. It is remarkable that all the precipitates of moss from solution, either in water or alkalies, constantly assumed this flaky appearance, somewhat similar to the figure of certain moss plants. From this and similar experiments, which were frequently repeated, he is at a loss to decide to what class the matter of moss, which combines with lime and alkalies, ought to be referred; whether to oils or resins; but it was highly inflammable. The calcareous and alkaline compounds with moss were also inflammable; though much less so than the flaky matter precipitated from them by means of acids. The same effects resulted from subjecting the calcareous compound of moss to the marine acid, and much gas escaped during the process.

" 39. The nitric acid acted, he says, with great violence upon the alkaline solution of moss; part combining with the alkali, and forming nitre, while part of the acid was decomposed and went off in red fumes, both when the alkaline solution of moss was in dry powder, and when it was diluted with a portion of water. In the first case it left a brown powder, which seemed to be the moss calcined; in the last case a brown liquor was left, which being evaporated some time in a heat approaching to boiling, and set aside to cool, threw up crystals of oxalic acid." And

" 40. That these crystals were really the oxalic acid, was proved in the following manner: a filtered solution of them being made, and dropped into lime-water, and into purified solutions of lime by means of acids, an immediate precipitation ensued; the lime being soon carried down to the bottom in union with this acid." It is therefore concluded that the moss contains no oxalic acid in its original state, (See No. 81.); but it seems to contain the basis of this acid; and the only question is, he says, what this basis may be? And Fourcroy, he asserts, says, that nitric acid, added to the gallic acid, produces the oxalic acid.

" 41. To ascertain this, he added nitric acid to a highly concentrated decoction of camomile flowers; a plant known to abound in the astringent principle or gallic acid. The result was oxalic acid, which carried down lime from lime-water, and from solution by means of other acids." He thinks that

"from these facts it should follow, that when putrefaction is excited in moss, or in mossy composts, by means of the ashes left after burning, by means of alkalies, or of putrescent manures, without the presence of lime, as the salts which operated in these cases to excite the putrefaction are soon washed away, or form new compounds, a portion of nitric acid should be generated from the nitrogen, which is evolved, forming an union with oxygen; that this nitric acid, so formed, uniting with the gallic acid in the soil, must produce oxalic acid, and thus dispose the moss, or mossy compost, to encourage the growth of sorrel; that part of this effect may doubtless be imputed to the puffy state to which such manures reduce mossy soils, and mossy composts, thereby rendering them more liable to be acted upon by the oxygen of the atmosphere, while they become more retentive of moisture to aid putrefaction; that the texture of a soil, as well as its ingredients, renders it a more fit receptacle for some species of plants than others; but where lime is applied, the texture of such a soil or compost is rendered much more solid, and permeable to water; while oxalic acid in moss, manured by lime, cannot encourage the growth of sorrel, as this acid forms with lime an insoluble compound, increasing the density of the soil, a compound not to be destroyed by any other solvent of lime: though, therefore, oxalic acid should be formed in moss manured with lime, or in calcareous composts of moss, it is plain it cannot encourage the growth of sorrel." And he observes that, "though these inferences are deduced merely from the preceding experiments, they correspond with practical observations; as, he says, Mr. Smith remarks, and indeed has demonstrated the fact by the most satisfactory experiments, that all limed mosses, and mossy composts in which lime is used, constantly throw up *chickweed*, or *arsewort* (a vegetable only to be found in putrid soils divested of astringency) after the lime has produced its effect; but all mosses that are burnt, and those which are manured with dung or alkalies, and all mossy composts that are formed with alkalies and putrescent manures, without the intervention of lime, constantly throw up the sorreline plant and yarr." He adds that "the same gentleman has a field of deep moss, part of which was dressed with lime, part with stable dung alone, part with dung and lime united, and these were applied in different proportions to different parts of the field. Part of it was pared and burnt in the usual manner, and to some parts of this last, lime was also applied. And that, when he saw the field several years ago, some time after it was thrown into pasture, the limed parts were easily distinguishable by a close sward of sweet herbage, in which white clover predominated; and it was easy to discriminate those parts which had received a large proportion of lime from those which had got a smaller dose, by the superior closeness and richness of the herbage. Those parts which had got both lime and dung, carried a ranker herbage than those which had got lime only, though of the same quality with the former. The parts which had got nothing but dung, and those which had been pared and burnt, appeared puffy and blistery, and carried only a tuft of grass here and there; but there were innumerable tufts, or rather patches of sorrel, and in some places this plant occupied the whole surface. Now, says he, this field was never sown with grass seeds; but was left to gather such plants as nature might produce." And, "at present, after laying more than seven years, the limed parts are, he says, covered with a rich close sward of natural grasses, abounding with white clover, and never were observed to throw up one sorreline plant, while the dunged and burnt parts are almost wholly occupied with heath, which has lately induced Mr. Smith to top-dress these parts with lime." On the whole, he concludes that, "if the inferences drawn from the preceding experiments be fairly deduced, it would appear that the putrefactive fermentation in these parts had ceased; of course the astringent plants have resumed their ancient empire. Such plants never grow where putrefaction is going on in mosses, or where lime is present."

And, "from a review of the preceding experiments it appears, he thinks, 1st, That lime is the most powerful agent that can be employed for reducing moss into soil. 2d, That quick lime is much more powerful than its carbonate in neutralizing the styptic juice of moss, because, being soluble in water, it insinuates itself through every pore of the plants, and while one part combines with the gallic acid, or styptic juice, the remainder unites with the mossy matter itself, forming it into an insoluble alkaline solution of moss, or soil of great fertility. 3d, That during the action of lime and alkalies on moss, gasses are generated. From No. 26, it would seem, he thinks, that these gasses are not chemically combined with the moss, but, like the carbonic acid in yeast, are separable by pressure or agitation, and hence part of them at least remain in an active state, ready to promote the growth of plants. Indeed the same conclusion was inferred from examining the alkaline solution of moss, though in a much higher degree." And "4th, that it appears that alkalies are much better calculated than lime to dissolve the moss plants, and to generate gasses in them beneficial to vegetation; but as they render the moss very soluble, and enlarge its volume, they produce no soil capable of sustaining the plants. The same observation is also applicable, in part, to putrescent manures."

"5th, The ingenious author has not ascertained the nature of the gasses generated in the cases mentioned above. 6th. The reasons will, he thinks, appear why mosses and other soils, in given circumstances, are more apt to produce one species of plants than others. 7th. What is here detailed concerning the action of lime and of alkalies upon mosses, together with that of putrescent manures, is also, he thinks, applicable to the action of these substances upon other soils, in so far as they act upon vegetable matters." 8th, He concludes by suggesting his admiration at the beneficence of Providence, in having provided the moss plants for the situations in which they grow: they

afford an immediate supply of fuel; are the source from which pit-coal derives its origin, though trees, and all the plants which abound in oils and carbon, also contribute to the supply of pit-coal. Were the places, says he, now occupied by mosses, divested of vegetables, or stored with vegetables of a different character, they would become noisome fens, which, by the emission of putrid gasses, would spread all around them pestilence and death. Mosses, he adds, emit no noxious gasses; but rather, by growing at the surface, where the plants are acted upon by the sun's rays, they perpetually throw out oxygen, and thus contribute to the salubrity of the atmosphere. The only defect with which they are chargeable is, forming magazines of moisture, which by its exhalation generates cold, and spreads rheumatism and intermitting fevers among all the animals within its reach. The perpetual evaporation of this moisture not only tends to chill the moss, but it descends in hoar frost and mildews, upon all the lands that are lower in point of situation. These last-mentioned disadvantages are more than amply compensated by the consideration that moss is not only an inexhaustible magazine of manure for other soils, but may be converted into a most fertile soil itself." And, "after it is so converted, none of the defects already stated are any longer applicable to it."

Having given this view of the nature and constituent properties of mossy lands, we may proceed to consider the methods most adapted to their improvement in different cases and under different circumstances.

It may be observed that these sorts of land are met with in different situations in different parts of the kingdom; and Dr. Robertson says, in his able Survey of Perthshire, that, "in every flat, and on some slopes of the higher hills, there are mosses of various dimensions, of various depths, and of various degrees of firmness, according to the time that has elapsed since the moss began to acquire solidity. In the Highlands, mosses are, he remarks, so frequent, that it would be tedious to enumerate them. Their formation is uniformly owing to the same cause—fallen trees, the deciduous parts of heath and of strong aquatic plants. The largest tract of moss, in a valley, any where in this county, and perhaps in Britain, is, he says, in *Monteath*, which has given its name to a whole stewarty. It is also called *Moss-Flanders*, from its flat appearance, and is most commonly known by that name. This whole tract of moss, from the bridge of Gartmore to the bridge of Drip, may be computed at 10,000 acres." As it has been frequently found that "a stratum of moss is buried several feet below the surface of soils, of the rich kind, with a variety of timber lying in it, the mode of its origin seems evident."

"If, says the above writer, the soil below *Moss-Flanders* and the other moss in Strathearn, have been formed by the agitation of the sea, which is very probable; whenever the waters retired, such a luxuriant soil could not long remain unproductive. It must have been sown without delay, by the hand of nature, with the seeds of the plants growing around it. Of these, the oaks and other forest trees, being the most vigorous, would, he thinks, in a few years, overtop and choak the rest. Time itself and the violence of winds, are sufficient to overturn any trees: and when trees are felled on flat land, where their leaves have been accumulating for ages, the leaves and branches dam the water; aquatic grasses grow; the place becomes a morass; and every morass composed of such substances, by acquiring solidity, becomes a moss. These are, he says, the outlines of the most probable opinion of the manner in which *Moss-Flanders* was generated. The roots of oaks are found at this day, sitting in the very manner they grew, and adhering firmly to the clay and trunks of immense size lying near the roots, at the depth of fifteen feet below the surface of this moss."

Where the mossy land is of considerable extent, and of the more deep kinds, different modes have been in practice for bringing them into a state of cultivation. Some have attempted to remove the whole of the mossy substance by means of water, and a proper machine for the purpose, while others have had recourse to lime in large proportions with clay or sand, and other similar matters. It is well remarked, by Mr. Headrick, in the paper mentioned above, that "mosses were considered solely applicable to the uses of fuel, until the late Lord Kaims set on foot a project for floating away an extensive moss on his estate near Sterling. The project has been followed to a much greater extent by his son, who has, he says, constructed a bucket wheel, of great power, for raising water out of the Teath, to float the moss: the water is raised somewhat higher than the top of the moss, passes some hundred yards in hooped wooden pipes of 18 inches diameter under ground, and then emerges upon a raised embankment of earth, by which it is conveyed to the moss. It is stated, by the author of the Report of Perthshire, that the expense of this machine and embankment was £.1000, but the people upon the spot informed Mr. Headrick that it cost £.1500. When the water arrives at the highest part of the moss, it is, he says, conveyed in a rut perpetually descending along the whole line of the uncleared moss; at every part of this line, the people are employed in throwing the moss into the stream with spades. Those at the part where the water first enters the moss, keep the stream upon the surface, and they lift and throw into it all the moss within their reach, until they uncover the clay below; they then cut out a new water-course, and throw into it the embankment of moss which sustained the water before; those lower down operate in the same way, only they preserve the current of water on a lower level than those above them; those at the lowest part keep the water running upon the clay, and shift its course occasionally, so as to have it running along the bank, or face, of uncleared moss; thus, at every point along this water-course, people may, he asserts, be employed in heaving in pieces of moss by the spade, and they constantly shift the position of the stream, in proportion as the moss is cleared away." On this it is observed, that the writer learnt that it required the labour of a man

nearly a whole year to clear one Scotch acre of moss, and reduce it into a condition to receive a crop. This labour cannot, he thinks, be estimated at less than £.25; to which, when the price of seed, compound interest upon the original erection of the machine and embankment, &c. is added, the expense of this mode of cultivation cannot appear trifling."

It is further stated, that "the soil, after the moss is carried away, being a rich carse clay, mixed in many places with sea shells, is first formed into ridges by the spade, and commonly yields a few good crops; laying it up in drills, during the first winter, by the spade, is found powerfully, he says, to increase its fertility. When it begins to lose its fertility, it receives a good dose of lime, and is afterwards manured with peat ashes and such putrescent manures as are accumulated on the spot." The writer adds, that "he has heard that the farmers upon the banks of the Forth raised, at first, a great clamour against the improver for washing his moss into the river, as, when it was met by the tide, it was thrown out, and covered up their grass lands upon the banks; but he was told, that they afterwards became very earnest to collect what he had thrown away; for the moss being washed and floated in this manner, is, he says, robbed of its styptic juice, and disposed to putrefaction; it of course makes excellent manure for carse lands, more especially if made into compost with lime and stable dung." Mr. Headrick conceives that "the whole of the plain, extending from Borrostowness to Gartmore, has once been covered by the sea; and the soil is composed of clay washed down by the Forth from the mountains of micaceous schistus, where that river derives its origin. This washed clay has, he thinks, gradually filled up, and towards the ferry is perpetually filling up, the bed of the sea: the carse clay is here and there, he says, intersected by sand and gravel, and other friable soils (called there, dry-field land), which have been washed down by the various streams that run into the Forth, and partake of the quality of the mountains from which they have been washed; but the mere filling up of the bed of the sea would, he thinks, never cause dry land to rise above its surface, and would only raise the water to a higher level." When the plain of the Forth is examined from its origin to its termination, or indeed any part of the island that is near the sea, it is sufficiently evident, he says, "that the sea has retreated into a lower level, by at least 40 feet, than it formerly occupied; and that too, since the solid land was placed in its present position; which, he thinks, accounts for the mud formerly deposited in this arm of the sea now appearing solid land." However, "what chiefly deserves the attention of those who have an interest in this land is, that many parts of this carse clay are filled with oysters and other sea shells, as he has observed them in many ditches, and frequently upon the surface. In some parts where a deep rut is cut by a rivulet, a deep bed of shells may, he says, be seen, which, taken in mass, is as rich in calcareous matter as the generality of limestone, and may be regarded as the material from which a future rock of limestone is to be consolidated. It is easy, he supposes, to select these shells from the mud, when they would be much richer than any limestone." And as "lime is essentially necessary for this species of soil, and in many places difficult to be procured, on account of the distance from which it must be carried, and the badness of the roads; it would, he thinks, be very easy to supply its place, by burning the shells which here and there abound. Digging them would be much less expensive than quarrying lime-stone, and a slight heat would reduce them into very pure lime."

On these grounds, it is conceived, "that it would be more profitable to search for these shells, burn them into lime by means of peats, and employ them in the cultivation of the mosses themselves, instead of being at the expense of floating them away. Beside these dead shells left by the sea, as the Forth and Teath abound in fresh-water muscles; these might, he thinks, easily be bruised by a stone rolling on its edge, and being mixed with moss or earth afford an ample supply not only of calcareous, but also of putrescent manure. They ought to be completely rotted before they are applied, and distended with a large proportion of earth." And where clay marle could be procured, it would make an excellent dressing, he thinks, for the moss, after it is thrown into pasture. It is added that "the mosses there have one advantage which seldom occurs, and which may have been the inducement to adopt this method. The soil, when got at, is excellent, being a rich carse clay, in many parts resting upon, or mixed with, sea shells. In most other places the bottom of mosses is either a solid rock, or a whitish granite, or pyritical gravel, or pyritical and aluminous clay." Which, after removing the moss from such places, are worse than before, as the bottom either does not admit of culture, or requires an expense far beyond its value.

It is suggested by the writer of the Agricultural Survey of Perthshire, that this sort of lands, when of "small extent, where there is a mixture of other earth and the fall considerable, are generally pared and burnt, with profit; but if there be little or no fall, they may be planted with potatoes in lazy beds for a first crop, and the furrows left open for drains. With the first or second white crop, the seed of common grasses, which is always to be met with in meadow land, ought to be sown; which will yield a heavy crop of hay for some years, and afterwards a plentiful spring of strong coarse pasture, consisting mostly of the aquatic plants." And, that "where there is plenty of brush-wood, deep mosses, with a good fall, are most frequently drained and drawn in ridges like other land. The drains may be made with faggots, put in, either longitudinally and sloping, having the slope of the truncheon always in the direction of the fall; or they may be laid transversely, in the shape of a St. Andrew's cross, and the land afterwards pared, burnt and levelled." It is added, that "the spade for paring ought to be similar to that used in Scotland for casting turf, provincially the *flaughter-spade*; only a little more scooped in the iron, and rounder in the fore part, having a perpendicular knife, standing up at one side of the iron sole, to cut the sod, as the Highlanders

have to the *lugged* spade, which they frequently employ in casting peats in tough mosses."

And a practice similar to this of improving moss-land, has been in use in Ayrshire, which is said to be borrowed originally from the practice in Ireland. The principal difference is, the above writer says, that the moss is directed to be *delved* or dug up with spades, and the manure to be chiefly lime. This is observed to be a method that is found by experience to be effectual. John Smith, Esq. of Swinridge Muir near Reith, in the above county, has been very successful in conducting this mode.

It is remarked, that "the first thing to be done is to mark and cut proper master-drains, eight feet in width by four and a half in depth, declining to two and a half at the bottom: which drains cost in Ayrshire at the rate of one shilling per yard. In some instances it will be found necessary to cut these drains much deeper, and consequently at greater expense; and the drains are almost in every case so conducted, as to divide the field into regular inclosures, as well as to carry off the superfluous water.

"Then the ridges are marked off regularly, and in breadth six or seven yards; seven yards are preferable; which ridges are formed with the spade in the following manner: in the centre of each ridge, a space of about twenty inches is allowed to remain untouched; and on each side of that a furrow is opened, which is turned inward so as completely to cover that space, like what is called the *feering* of a gathered ridge. Thus begun, the work is continued by cutting with the spade in breadth about twelve inches and in length as may suit, till the whole be turned over, to appearance as with a plough, reaching back to the furrow that bounds the ridge. That furrow is a space about two feet, which is cut out and cast on the sides of the ridges. The depth of this division-furrow ought to be regulated by circumstances, so as not to lay the ridge at first too dry by being raised in the crown, and at the same time so as to bleed the moss and conduct the water to the main drains.

"The next operation is to top-dress the ridges with lime, the quicker the better, at the rate of from four to eight chalders to the acre; five or six chalders being the ordinary quantity. He has even seen considerably more applied with effect. The field thus prepared is ready to receive the seed, which is sown in the season, whether dry or wet is a matter of indifference, and harrowed in with a small harrow, drawn by two men. Four men, with ease, will harrow at least five or six acres a-day; two and two by turns, drawing the harrow and breaking and dividing the mould with spades.

"But he would recommend planting potatoes, as preferable for a first crop, because oats for the first year frequently misgive. The potatoes are planted in what is called the lazy-bed way. The method is simple and attended with little expense; and the moss is prepared for them in every respect and limed as before directed, for a first crop of oats. The beds are marked off across the ridges, in breadth from five to six feet, with intermediate alleys of about two feet as a furrow. The beds are covered over with a thin stratum of dung. The sets of potatoes are laid on the dung and covered from the intermediate furrows; which is followed with another covering, in all, about four or five inches.

He not only considers the planting of potatoes at first as the most certain crop, but the most successful method at once of reclaiming the moss, not owing perhaps so much to the influence of the dung in aiding the fermentation already begun in the moss, by means of the lime, as to the effect of the potatoe-crop in over-shadowing the ground and causing a stagnation of air, which prevents the exhalation of moisture, and thereby accelerates the putrefaction and decomposition of the moss; and also to the effect produced by the roots in dividing the moss, separating its particles and rendering it into mould. This practice is now followed in general, wherever dung can be commanded; and the produce is between forty and fifty bolls from the acre. When the potatoe crop is removed, the ridges are again put into proper form; which is done, not by throwing the manured surface into the trenches between the beds, but by making two or more cuts with a spade into the sides of the beds, which are pushed in opposite directions to close the lips of all the trenches.

"If potatoes are not planted as a first crop, the field is prepared for a second crop of oats by cutting the furrows across the ridge and turning them over, and by cleaning out the division furrows. To prepare for a third crop, the same operation is performed.

"The most proper season to prepare the moss for a first crop is early in the preceding summer. In which case, the lime aided by the heat, the harvest rains, and the winter's frost has a powerful effect in promoting the process of putrefaction: consequently a mould is formed to receive the seed the ensuing spring. Although he mentions the preceding summer as the proper season to prepare for a first crop, the common practice is to prepare for it in the course of the preceding winter; and to prepare for the crop of the second year as soon as convenient after the removal of the former crop.

"The first year's crop is sometimes good, but very uncertain, because the lime has not had time to exert its influence. The second year's crop will run from five to ten bolls the acre. A first crop after potatoes is seldom less than ten bolls; sometimes considerably more from the acre. Early oats, the small Dutch or Polish oats, are sown as preferable. The grain produced is equal to any in the country. In general, four or five, or even six successive crops of oats are taken without any additional manure, and without any apparent signs of the soil being exhausted. On the contrary the moss is now converted into a dark brown mould; and what alone renders it less productive of corn crops is its running into sweet luxuriant grasses, the soft meadow grass, the daisy and white clover. Along with the fourth, fifth, or sixth crop of oats, grass seeds are sown, which in common produce an abundant crop of hay, and afterwards afford excellent pasture.

"He now considers the moss to be in a permanent

state of improvement; and if its own fodder be converted into manure, and applied to its own use, together with the occasional aid of lime, it will in his opinion be for ever productive in potatoes and corn crops. In support of that opinion, a field of his has been in crop since the year 1783. When it began to run into grass, it was completely delved over, a fresh quantity of moss turned up, top-dressed anew with lime, and planted with potatoes in drills, and hand-hoed. After the potatoes a crop of barley was taken and followed by successive crops of oats; the last to be barley also with grass-seeds. The same rotation to be continued by way of experiment."

Mr. Headrick, in his excellent paper noticed above, observes, that "the expense of delving a moss for the first time, where the surface is tolerably smooth, is $2\frac{1}{2}$d. per fall, or £.1 13*s*. 4*d*. per Scotch acre; but where inequalities occur, which must be thrown by the spade into hollows, it costs about £.2 per acre. If there be eminences which must be removed into hollows, by wheelbarrows running upon boards, the first expense is greater, according to circumstances. The second delving, where potatoes have not intervened, costs from £.1 to £.1 6*s*. per Scotch acre, the division furrows being at the same time cleaned out. The third delving, and cleaning of the division furrows, cost £.1 per acre; but the moss is now so friable that it may be wrought with the greatest ease and rapidity. At the above rates, an ordinary workman will, he says, earn 1s. 6d. per day; and an able and experienced one, from that to 2s. 6d. per day. They use a strong spade edged with steel, and have always a grit stone near them, for sharpening the spade. In the evenings they repair its edge upon a grindstone, and when the steel is worn away, they lay it again with new steel. Sometimes the moss is so soft, that they walk upon boards while they are turning it over." And he adds, that "Mr. Smith has found by long experience, that it is improper to make the ridges too high, or too narrow: when they are made too high, they throw the water off from their sides, without admitting it to penetrate their substance; the top of course gets too dry: when too narrow, there is a loss of surface from too many division furrows: the breadth already mentioned is found to be the best: and when the improvement is completed, the ridges appear like segments of wide circles, with a clean well defined division furrow between each of them. The moisture is thus caused slowly to filtrate through the moss, rendered friable by lime, until it reaches the division furrows, and is discharged. As the moss subsides for some time, and closes in towards the furrows, it is generally necessary to clean these out before winter, and at the time the crop is sown until the moss acquires solidity." And it is further stated, that "some mosses may be ploughed, the second year, to within two bouts, or four slices, of the division furrows; and every operation performed by the force of horses, except turning over with the spade the narrow stripes next to the division furrows. In other mosses it requires three years before this can be done; and it seldom happens but every moss may be wrought wholly by the plough, after it has been wrought four years by the spade. When moss is wrought by the spade, it seems to be of no consequence whether it be wrought wet or dry: but when it is wrought by the plough, opportunities must be watched, as horses cannot walk upon it, for some years, during wet weather."

In regard to "the quality of the potatoes thus produced upon mosses, he does not, he says, scruple to pronounce it most excellent. Potatoes have been tried with dung alone, but they were always watery, and frequently hollow or rotten in the heart: those raised upon mosses that have been well limed, are frequently so dry and farinaceous, that it is difficult to boil them without reducing them to powder; and they are often obliged to lift them with spoons: they come clean out of the ground, keep remarkably well in heaps covered over with moss in the field, and are remarkably well flavoured." It is added, that "no such disease as the curl was ever known among most potatoes;" and that if "Dr. Coventry's opinion be true, that the curl is caused by overloading the sets with too much earth, or from the earth becoming too hard around them, no such thing can take place in moss; but to whatever cause the curl may be owing, it is certainly propagated by diseased seed; it would therefore appear advantageous to transfer the potatoes raised upon moss as seed for solid land. They have remarkably good species of potatoe, he says, in this district, which was brought from Virginia to Largs, about eight years ago; and whether it be owing to the beneficial nature of a mossy soil, or to its own intrinsic merits, this potatoe has long been so much distinguished by the good quality and large quantity of its produce, that it has superseded the use of every other species. There seems to be no occasion for moss improvers to change their seed. Some persons in this district, he says, who have but small patches of moss, have kept them constantly in potatoes, more than ten years, without changing the seed, and that without any sensible diminution either in the quantity or quality of the crop."

In this sort of improvement, it seems from Mr. Headrick's paper that much is owing to the great zeal and perseverance of Mr. Smith. And it is added, that "over all that county, the farmers and proprietors are busy in reclaiming moss. In Renfrew, Lanark, and Dumfries shires, this practice has, he says, made considerable progress. Major Majoribanks and Mr. Pitlow have got workmen from Ayrshire, and have commenced moss improvements upon a very extensive scale, in the neighbourhood of Bathgate. The culture of moss has become, in many cases, a distinct species of farming, to which individuals apply, to the neglect of every other pursuit." And "what may assist the inexperienced to form some idea of the value put upon moss by those who are acquainted with it, is, he says, that a young man, son of a farmer on the estate of Swinridge Muir, has taken 20 acres of moss from William Patrick, Esq. of Trehorn, writer to the signet in Edinburgh, for four crops, at 25s. per acre of yearly rent. All that was done by the proprietor was to dig the master drains, which also serve the purpose of fences; in other respects the moss was delivered in its wild and unsubdued state, the tenant

being at all the expense of working and manures, and obliging himself to lime, at the rate of 10 Ayrshire chaldrons per acre. The moss was in crop in 1797, for the first time. He was several times upon it, and remarked, that where the lime [illegible]ly enough applied, which was the case w[illegible]atest part of it, the crop (oats) was uncommonly good; even the worst was much better than some contiguous land which had been torn from Muir, and limed. On a small corner, which had got no lime, nothing grew. The proprietor himself expected no such rent, had it not been voluntarily offered by the tenant. The solid land there, which has been long in cultivation, does not average 20s. of rent, as the situation is not very accessible." And further that "two small patches of cultivated moss, contiguous to the town of Beith, were lately set at the rate, the one of £.10 per acre per annum, for two crops of potatoes; the other let for £.7 per acre for two crops of oats, to be sown down with grass seeds. The first of these patches had been constantly in potatoes ever since it was reduced to cultivation, and the occupants were to furnish what dung they chose for their crops, at their own expense. The second patch, of more than three acres, had been constantly either in potatoes, or oats, from the time of its first subjugation, and would have given much more, had potatoes been permitted; but it was thought advisable to bring it into grass. It must be admitted that land immediately contiguous to a town, fetches a rent for conveniency, as well as for what it actually produces; at the same time it must be observed, he says, that the best solid land, to which these patches of moss belonged, and some of which had been long in pasture, brought only a rent of from £.3 to £.6 for two years crops, the whole being let in parcels by public auction."

On examination, Mr. Headrick found in this district, "considerable variations in the practice of moss improvers, induced by different circumstances. Those who have large tracts of moss, and who are remote from markets, cannot afford to have so great a proportion in potatoes as those who have only a small patch. They go over as much land as they can with lime, not having dung for the whole. They take crops of oats until the land gets foul, and then leave it to gather grass as it can. Such land never being cleaned, abounds in weeds among the natural pasture. Others, who have a small patch of moss, from four to six acres, have always a part of it in potatoes, with dung occasionally; another part in barley or oats, and another in cut grass. Many of these farmers never apply the plough to their mosses; for, though this may be done with safety, they say they have at least a third more crop with the spade than with the plough. After the moss is completely reduced, it is turned over with great ease, and they apply themselves to this work at intervals, either when the weather is so wet, or other circumstances occur, that they cannot work with their horses. As no plant yet tried, contributes more to the improvement of moss than the potatoe, and as it also affords an opportunity of cleaning the land, those portions of moss on which it has been frequently repeated are clean and fertile." In a word, some of the best land, he says, which he saw in this district was moss of unknown depth.

In closing this interesting sort of improvement, the same writer thinks, that "it would be an improvement to roll moss occasionally during the progress of its cultivation. Dr. Anderson, he says, proposes to do this by a horse running upon planks, but he does not seem to advert, that it would require more men to shift these planks, than would be sufficient to draw the roller, in the way field artillery are drawn." And that "after a moss is laid down into pasture, it would contribute much to its fertility to lay it all over with a good dose of earth, tirrings of quarries stand, or clay pulverized by lime, and then to roll it; this could be done in dry weather, when there is no danger of poaching, or breaking the sward." He adds, that "cattle of every kind should be kept from mosses, at first, during winter. This rule is, he says, also applicable to clay soils of every kind. Perhaps the best stock for pasturing on improved mosses would be sheep; but these have been banished from the improved moss districts, on account of the injury they do to young planting and hedges. He further remarks, that he saw several mosses which were blistery, and naked of herbage, after they were thrown into pasture, on account of springs issuing from the out-crop of rocks that terminated below them. These may, he thinks, be cured by bored drains, and by no other method."

It is observed, that "hedges thrive remarkably well upon moss-land where a bank is thrown up, and lime is previously wrought and mixed among the moss in the thorn-bed; but in that district, with few exceptions, they plant hedges, and then abandon them to their fate: being seldom or never weeded, the grass and other plants soon overtop the hedge, and it never becomes a fence." He supposes, that in extensive mosses, fences may be made out of the moss itself. Suppose, in place of one master drain, to divide two fields, two drains were made, with an interval of 10 or 12 feet betwixt them, and all that was taken out of each drain built up upon the surface of this interval; it would form a rampart, which no animal would attempt to pass: as the cultivation of the moss went on, its surface would sink, and then it would be necessary to deepen the master drains, still throwing what was taken out of them upon the top of the rampart. As no animal could see beyond this rampart, it never would, he thinks, attempt to cross or get over it.

In this district, "they have also, he says, roads running through the mosses, generally along the side of a master drain, and cut off from the contiguous field by a small rut on the other side. These are generally too narrow, but they serve the purpose of conveying lime, &c. in dry weather, and of taking away the crop. Were the cultivation of an extensive flow moss attempted, he sees no other practicable plan but making very broad roads, drained to a great depth on each side, and laid with stone in the centre. These might intersect an extensive range of fields on each side, secured by the ramparts he has mentioned, and serve to convey lime, dung, &c. and take away the crop. At

first it would be necessary to carry the corn crop to the road upon handbarrows; unless it were stacked upon the field, and taken away during frost. Potatoes, except such a portion as may be wanted for immediate use, are best preserved upon the field, in heaps, covered with moss, and can be removed during frost. After land of this kind is sufficiently limed, and wrought during a number of years, it collapses so much, and becomes so solid, that it can endure cartage almost at any time of the year."

Mossy *Soil*. See *Soil*.

Moss *on Trees*, a distemper highly prejudicial to their growth and increase, and which much damages the fruit of the trees when of that kind.

The remedy is the scraping it off from the body and large branches, by means of a kind of wooden knife, that does not hurt the bark; or with a piece of rough hair-cloth, after soaking rain. But the most effectual cure is, the taking away the cause. This is to be done by draining off all the superfluous moisture from about the roots of the trees, and which may be greatly guarded against in the first planting of the trees, by not setting them too deep in the ground.

When trees stand thick in a cold moist ground, they are always covered with moss; and the best way to remedy the fault is to thin them. When the young branches of trees are covered with a long and shaggy moss, it utterly ruins them; and there is no way to prevent it, but that of rubbing it off, or cutting the branches away near the trunk, and even to take off the head of the tree, if necessary, when if the cause be removed by thinning the plantation or draining the land, the young shoots continue clear afterwards.

This disease arises in consequence of the moss plant fixing itself upon the trees which are in an unhealthy state of growth, or which have been planted too closely together, by which proper circulation of air and dryness are prevented. Of course, the trees are not merely injured by the plants establishing themselves upon them, and hindering their growth, but probably also by the large proportion of moisture that is attracted and the dampness induced in consequence of it.

In order to prevent and remove this affection, Mr. Forsyth advises the washing the trees with a mixture of fresh cow dung, urine, and soap suds, in order that the establishment of the moss plants may be prevented, and the bark be kept in a fine healthy condition. Where this disease proceeds from the unhealthy state of the trees in consequence of the unfriendly nature of the soil, Mr. Nicol thinks, they should be removed as soon as possible.

MOTH, an insect of the winged kind, which is very destructive to different sorts of crops of the garden and other descriptions.

False Moth, an insect which proceeds from a small caterpillar, the body of which is smooth and whitish. It has sixteen legs, does not lodge in the grains of corn, but contrives to fasten several of them together with a web which it spins, and with which it makes itself a dwelling place. The sheath in which the caterpillar of the false moth usually abides, is generally in the middle of the little heap of grains which it has collected for its food, and which distinguishes it from the caterpillar of the true moth: it can quit this sheath at any time, to eat the grains around it, one after another. It generally attacks several grains at once, and always without order, eating sometimes of one, and sometimes of another; so that several are gnawed, when not one is wholly consumed. When these insects are very numerous in a granary, all the grains upon the surface of the corn are linked together by a web, so as to form a crust, which is sometimes three inches thick. This caterpillar turns into chrysalis, or aurelia, in a grain which it has hollowed, or in the sheath of its web, and issues thence in the month of June, in the form of a butterfly. When a heap of corn is stirred, in which there are many caterpillars of the species of this false moth, those insects crawl up the walls; but they soon return to the heap, and, by the next day, cover it all over with a new web.

In the state of moth, it is grey, has six legs, and is frequently seen in vast numbers fluttering about the eaves of the windows of granaries, in the spring and summer, when the weather is very hot. The females lay their eggs upon the heaps of wheat, and these eggs produce the caterpillars, or corn-worms, as some call them, which feed on the grain, and envelope it with their silky web, so as to form over the whole surface a crust that is sometimes three or four inches thick. This entirely spoils the corn within that depth, besides communicating a bad smell to the rest. These worms or rather caterpillars, for they have sixteen legs, are smooth, whitish, and seldom exceed a quarter or at most the third part of an inch, when at their full growth. Breaking of their webs avails but little, for they are woven again by the next day: for which reason some have been of opinion, that it is best to let them enjoy undisturbed the surface of the corn of which they have taken possession. But it should be considered, that three inches are a sixth part, and four inches upwards of a fifth, of any quantity of corn spread eighteen inches deep, which is the medium thickness at which it is laid; and that independent of the bad smell with which the rest is tainted, this is a very considerable object, though it extend no farther. When this crust is broken, most of the grains which compose it are found to be either gnawed in their inside or full of live worms, or of aureliæ, according to the season; or the empty sheaths of the caterpillars, if the aureliæ have been transformed into moths, are only seen.

It has been asserted that "strewing the corn with powdered lime, so as to form a sort of crust over it, will preserve it from the ravages of these insects: but from an idea that the surface would be spoiled, M. Duhamel did not try this expedient. From various observations and reflections, he was led to suspect that this insect, as it delights in none but very warm places, would not be able to live in the cold air of his ventilating granaries."

After collecting the various wormy coats and webs formed by these insects, with their ova, he put them into one of his granaries which contained seventy-five cubic feet, and was ventilated from time to time during all the winter. Towards the end of May,

when the vent-holes at the top of the granary were opened, a prodigious number of moths flew out which shewed that they did not like their situation. On being shut, and remaining in this state some time, afterwards when emptied, all the moths and worms were dead, and there remained only a thin crust, not above the twelfth part of an inch thick, on the top of the corn, which had so far lost the bad smell it had when put into the granary, that it sold for the current market price. But not satisfied with this method he tried the effect of the stove upon another parcel of wheat known to be full of these worms. A heat from 45 to 50 degrees of Reaumer's thermometer (from 115 to 124 of Fahrenheit's) killed them all. This corn was then laid up in a common granary, where it remained two years without being attacked by any of these moths, and even in the third, but very few of them appeared.

By either of these methods this insect therefore may be destroyed without injuring the grain.

MOULD, the loose friable particles of earth or soil, which are most obvious on the surface of the ground. It is of different qualities, in different situations. The properties of moulds are in some measure distinguished by their appearances, those of a bright chesnut or hazely colour being generally good, as of this colour are the best loams, and also the best natural earths; and it is an advantage, if they cut like butter, and do not stick obstinately, but are short, and tolerably light, breaking into small clods, and wrought without crusting or chopping in dry weather, or turning to mortar in wet. The next to these are the dark grey and russet moulds: the light and dark-coloured, such as is usually found on common heathy ground, is inferior, and the yellowish red coloured the worst of all: this is commonly found in wild and waste parts of the country, and for the most part produces nothing but goss, furze, and fern, according as the subsoils are more or less of a light and sandy, or of a spewy gravel, or clayey nature. In all moulds of lands that are good, after rain, or breaking up, they emit a good smell. It is easily discovered by the touch whether they consist of substances entirely arenaceous or clammy, or whether they be tender, fatty, detersive, or slippery; or more harsh, gritty, porous, or friable.

Those moulds that have a blackish appearance, and contain much carbonaceous matter, are always found rich and good in most uses of the farmer.

It is of vast utility to have the mould of all the stiffer sorts of soil well broken down, and reduced before seed of any kind is sown upon them.

This is capable of being affected in various ways, as by turning them up in sharp ridges in the autumn, in order to have the action of frosts in the winter, and by frequent harrowing and rolling them with rollers proper for the purpose. See *Roller*.

Vegetable Mould, that sort of mould which is chiefly formed from the recrements of decayed vegetables. It forms the surface stratum of most soils, and is, in general, of a more dark colour than that which is below it. See *Soil* and *Vegetable Mould*.

Mould *on Hops*, a vegetable disease, which is liable to affect the hop plant in the more advanced periods of its growth, and produce much mischief to the crop. See *Fen*.

MOULTING, a term signifying the changing of the feathers in animals of the bird kind. It is a process which takes place annually towards the latter end of the year, when care should be taken to have them well fed, and kept as much as possible in a sheltered situation. In some sorts of birds, as the goose, advantage is taken of this season for collecting the feathers for various domestic uses.

Moulting *in Horses*, a term sometimes applied to horses, when they alter, change, or cast their coats towards the latter end of autumn. As they become weak at this period, they should be well kept, and not have too much work. Great care should likewise be taken in the cleaning and dressing of them.

MOULDINESS, a term applied to an appearance in bodies which are much exposed to the humidity of the atmosphere, and which shows itself by a kind of white down, or *lanugo* on their surface, which, on being viewed through a microscope, seems to be a sort of vegetation.

MOUND, a sort of bank or fence of earth.

MOUNTAIN, a bleak exposed hill mostly of a rugged nature.

Mountain-*Land*, such as lies on the tops or sides of such hills, and which are mostly of a poor barren nature.

Mountain-*Torrents*, such runs of water as discharge themselves suddenly from the more elevated tops and sides of mountain-lands. These torrents may often be converted to an useful purpose in watering the grounds that lie below them.

MOW, a pile, heap, or collection of corn, straw, hay, or any similar substance placed together for the purpose of being kept. See *Stack* and *Rick*.

Mow-*burnt*, a term applied to such substances as are over-heated in the mow by the process of fermentation.

MOWING, the art of cutting down corn, grass, &c. by the scythe.

In the mowing of grain crops, such scythes as are shorter in the blade than the common ones, and which instead of a cradle have two twigs of ozier put semi-circular-wise into holes made in the handles, near the blades, in such a manner that one semi-circle intersects the other, are made use of.

It has been remarked by a late practical writer, that in "the cutting of grass crops for the purpose of being converted into hay, it is necessary that they be in the most suitable states of growth and maturity, for affording the best and most nutritious fodder. With this view, it would seem, he thinks, that they should neither be cut at too early a period, or suffered to stand too long; as in the former case there will be considerable loss in the drying, from the produce being in so soft and green a condition, and in the latter from a large proportion of the nourishing properties being expended. It is probable therefore, that grass when mown before it becomes in full flower, while the rich saccharine juice is in part retained at the joints of the flower-stems, is in the most proper condition for being cut down, as at that period it must contain the largest proportion of nutritious materials,

but which then begins to be absorbed, and taken up in proportion as the flowers expand, and the seeds ripen, so as to constitute the meal or starch of the seed lobes, and is either dispersed upon the land, or fed upon by birds; the grass stems with their leaves being left in a similar situation to that of the straw of ripened grain. But there are other circumstances besides those of ripeness, he says, to be attended to in determining the period of cutting crops of grass, as in some cases when they are thick upon the ground the bottom parts become of a yellow colour before the flowering fully takes place; under such circumstances it will, he supposes, always be the most advisable practice to mow as soon as the weather will possibly admit; for if this be neglected, there will be great danger of its rotting, or at any rate of its acquiring a disagreeable flavour, and of becoming of but little value. Where grass is very tall, as is often the case in moist meadows, it is liable to fall down and lodge, by which the same effects are produced."

In this case also, he thinks, the mowing should be performed as soon as possible, "as when much laid it soon becomes rotten, and of little or no use as hay."

But where there is nothing of this sort, it appears evident, he thinks, that "the most proper time for performing the business, is when the grass has begun to flower before the seed stems become hard and wiry; as at this period it would seem to contain the largest proportion of useful matter. Besides, when let stand too long, the aftergrass is, he says, not only less abundant, but there is great loss in it by the crumbling down of the stems, in the different operations of hay making, as has been stated in the Perthshire Report."

The usual time of cutting for hay in the first crops, is "from about the middle of June to the beginning of the following month, according to the nature of the land, or as the district is more early or late in the produce."

In the operation of mowing, the chief art consists in cutting the crop as close to the surface of the ground as possible and perfectly level, pointing the swathes well out so as to leave scarcely any ridges under them.

It is further stated that, "in cutting rouen or second crops of grass, more attention in these different respects will be requisite than in the first, as the crops are mostly much lighter and more difficult to cut, the scythe being apt to rise and slip through the grass without cutting it fairly, except when in the hands of an expert workman. Crops of this sort should always be cut as much as possible when the dew is upon them; and as soon as ever there is a tolerable growth, as by waiting, the season is constantly getting more unfavourable for making them into hay; and when not well made this hay is of little or no value. When the grass has been decided to be in the proper condition for being cut down, a set of mowers proportioned to the extent of the crop should be immediately provided. In some districts, it is the custom to pay these labourers by the day, but a better and more general practice is, it is supposed, to let the work at a certain price by the acre."

The extent or proportion of ground that can be mown in any given space of time, must obviously vary much according to the nature of the ground, the fullness of the crop, and the goodness of the workman, but in general an acre is supposed a full day's work for an expert mower.

Commonly in mowing barley, oats, or other grain, the corn is on the right hand of the workman: but M. de Lisle had a method of mowing wheat, in which the corn was at his left-hand: he mowed it inward, bearing the corn he cuts on his scythe, till it comes to that which is standing, against which it gently leans. After every mower a gatherer follows, which may be a lad, or a woman. The gatherer keeps within five or six feet of the mower, and being provided either with a hook or stick about two feet long, gathers up the corn, making it into a gavel, and laying it gently on the ground: this must be done with spirit, as another mower immediately follows: as to every mower there is a particular gatherer. And to do this work properly, the mower should form but one tract with his feet, advancing in a posture nearly as if he was going to fence, one foot chasing the other. In this manner the standing corn is mowed; and the workman should take care to have the wind at his left, as it bears the corn towards the scythe, and causes it to be cut nearer the ground. When wheat is bent, the workman takes the corn as it presents itself to him, which has the same effect as if the wind was at his left-side. And when it is laid, it is more troublesome to the gatherer, because the cut corn is apt to be mixed with that which is standing; but a good mower takes the advantage of the wind, and cuts it against the way it is laid. No particular directions can be given for corn that is lodged and entangled, unless it be to take it as it is inclined, as if the wind were on the back of the mower.

But the usual method of moving grain, is in the same manner as for grass, the scythe only having a cradle or bow fixed upon the heel of the handle.

In a communication in the tenth volume of the Agricultural Magazine, it is observed, that in the "practice of every department of the kingdom, the scythe is swung horizontally or nearly level, leaving the stubble of almost an even height; or if it rise on either side, forming what are called swath-balks, the buts of the swaths are suffered to rest upon them, the heads or ears of the corn falling into the hollow or close mown part of the preceding swath width. They are of course liable, in a wet season, not only to receive an undue portion of rain water, but to be fouled with the splashings of heavy showers." But that in the Kentish practice, which is said to excel those of other districts, "the position of the swaths is different. Here, the heads of the corn rest on the top of the swath-balk, provincially the '*beever*,' which is left of extraordinary height, as ten to fifteen inches; so that the wind has a free circulation beneath the swaths. The workman, in performing this judicious operation, proceeds with his right foot forward, entering the point of his scythe with a downward stroke, and raising it as abruptly out, bringing the handle round to the left until it forms nearly a right angle with the line of the swath, carrying the corn in the cradle three or four feet behind the place where it grew,

lifting it high, and letting it fall on the beever behind his left foot, and in the position above described." It is added, that "the disadvantages of this method are, the loss of some straw, the incumbrance arising from the length of stubble, and a little additional labour; but in a district where cattle are not numerous, the loss of straw is not felt, and in any country, the principle of laying the heads, instead of the butts of the corn upon the swath-balk, whether left high or low, might be well adopted."

MOWDHILL, a provincial term applied to a mole-hill.

MOWDIWARP, a provincial word sometimes signifying the mole.

MOY, a provincial word signifying muggy or close.

MOZE, a provincial word applied to moss, or a lake that is overgrown with moss or other aquatic plants.

MUCK, any sort of material, such as dung, straw, &c. that lies rotting. See *Dung*.

MUCK-MIDDEN, a term sometimes used to signify a dunghill.

Muck-*weed*, a troublesome weed, in arable land the common goose-foot.

MUCOR, a vegetable disease signifying a sort of mould or mildew. See *Mould*, and *Mildew*.

MUD, the sediment deposited at the bottom of rivers, ponds, ditches, &c. As much of this sort of material should be collected as possible, and be thrown up into heaps in order to become mellow. It contains much carbonaceous matter, and is an excellent manure either in the simple or compound state. See *Dung*.

Mud-*Croom*, a provincial term applied to a tool used by water-workers. It is a sort of large hook with thin flat prongs, and a stout long wooden handle.

Mud-*Sheep*, a provincial word applied to sheep of the old Teeswater large breed.

Mud-*Walls*, such as are raised of earth. See *Fence*.

MUGWORT, a very troublesome weed, the roots of which creep far under the surface of the ground, so as soon to overspread a large space, if they are not stopped. Its seeds are light, and easily carried to a distance by the wind, producing numbers of new plants the next spring. It has plain cut leaves, ending in many points woolly underneath, and single spikes of pale yellow oval flowers, which blow in June or soon after.

MUIR, a term used in the northern parts of the kingdom to signify moor. It is the common term in Scotland.

MULBERRY TREE, the name of a tree, of which there are several species, but those generally cultivated, are the following:

First, *the white or silkworm mulberry*, which grows to a large size: its leaves are of a clear light green; and open considerably earlier in the spring than those of the other species: its fruit is also paler coloured than that of the other sorts, which makes it take the name of the white mulberry. It delights most in a light dry soil; but there is very little land in this kingdom, which may not be planted with these trees, and probably to great national advantage. It is highly ornamental, and besides the uses of its leaves to the silkworm, it has been recommended strongly as a forest or timber tree.

Second, the *black* or *garden mulberry*, which is principally cultivated for the fruit; and in ornamental plantations. There is a variety of it, with jagged leaves, which makes it esteemed on that account; but the fruit is smaller than that of the common sort.

Third, the *paper mulberry*, which is so called, because the inhabitants where the trees grow naturally make paper of the bark. It grows to the height of about thirty feet; and exhibits its fine large leaves of different shapes, many of them being divided into several lobes, whilst others again are entire. They are of a fine strong green colour, though the under surface is paler than the upper. The flowers, as has been observed, are male and female; and the females are succeeded by small black fruit. It is the bark of the young shoots of which the paper is made; and for this use it is cultivated much in China, as well as Japan, where large plantations are raised. The plants are headed to within about a foot of the ground; and every year the crop of the summer's shoots is taken.

Fourth, the *Virginia mulberry tree*, which grows to be thirty or more feet high. It sends forth many large branches; and the bark of the young shoots is of a blackish colour. The leaves are larger than the common mulberry, and rougher; though in other respects they somewhat resemble them. It produces plenty of katkins, in shape like those of the birch tree; and the female flowers are succeeded by a dark reddish fruit. This is a very scarce plant and little cultivated.

These trees are generally of both sexes, having male-flowers or katkins on the same tree with the fruit; but it often happens, that some of the trees which are raised from seeds, have only male flowers, and produce no fruit; so that those who plant these trees for their fruit, should never make choice of such as have been propagated by seeds, unless they have seen them produce fruit in the nursery. It is also the surest way to mark such trees as are fruitful in the nursery at the time when their fruit is upon them, because those trees which are propagated by layers are sometimes of the male sort.

The old mulberry trees are not only more fruitful than the young, but their fruit is much larger and better flavoured; so that where there are any of these old trees, it is the best way to propagate from them, and to make choice of those branches which are most fruitful. The usual method of propagating these trees, is by laying down their branches, which will take root in one year, and are then separated from the old trees; but as the most fruitful branches are often so far from the ground as not to be layed, unless by raising of boxes or baskets of earth upon supports for this purpose; the better way is to propagate them by cuttings, which if rightly chosen and skilfully managed, will take root very well; and in this method there will be no difficulty in having them from trees at a distance and from the most fruitful branches.

These cuttings should be the shoots of the former year, with one joint of the two-years wood to their bottom; the cuttings should not be shortened, but planted their full length, leaving two or three buds above ground. The best season for planting them is in March, after the danger of hard frost is over; they should be planted in light rich earth, pressing the ground pretty close about them; and if they are covered with glasses, it will forward their putting out roots; but where there is no such conveniency, the ground about them should be covered with moss, to prevent its drying; and where this is carefully done, the cutting will require but little water, and will succeed much better than with having much wet. If the cuttings succeed well, and make good shoots, they may be transplanted the following spring into a nursery, where they should be regularly trained to stems, by fixing down stakes to each, to which the principal shoots should be fastened; and most of the lateral branches should be closely pruned off, leaving only two or three of the weakest to detain the sap, for the augmentation of the stem; for when they are quite divested of the side shoots, the sap is mounted to the top, so that the heads of the trees grow too fast for the stems, and become too weighty for their support. In about four years growth in the nursery, they will be fit to transplant, where they are to remain; for these trees are transplanted with greater safety while young than when they are of a large size.

The white mulberry is commonly cultivated for its leaves to feed silk-worms, in France, Italy, &c. though the Persians always make use of the common black mulberry for that purpose; and it is said that the worms fed with those of the black produce much better silk than those fed with the white; but it is to be observed, that the leaves of the black sort should never be given to the worms, after they have eaten for some time of the white, lest the worms should burst, which is often the case when they are thus treated.

The trees which are designed to feed silk-worms should never be suffered to grow tall, but rather kept in a sort of hedge; and instead of pulling off the leaves singly, they should be sheared off, together with their young branches, which is much sooner done, and not so injurious to the tree.

This sort may be propagated either from the seeds or layers, as the black mulberry, and is equally hardy; but the most expeditious method of raising these trees in quantity, is from the seeds, which may be procured in plenty from the south of France and Italy. The best way to sow these seeds, in England, is to make a moderate hot bed, which should be arched over with hoops, and covered with mats; upon this bed the seeds should be sown in the middle of March, and covered over with light earth about a quarter of an inch deep; in very dry weather, the bed must be frequently watered, and in the heat of the day shaded with mats, and also covered in the nights when they are cold. With this management the plants will come up in five or six weeks, and as they are tender when they first appear, so they must be guarded against frosty mornings, which often happen in May. During the summer they must be kept clean from weeds, which is all the culture they require: but there must be care taken of them the first winter, especially to cover them in autumn, when the frosts come, which will kill the tender plants to the ground, if they are not protected: the following March, these plants should be transplanted into the nursery to get strength, where they may remain two or three years, and then should be removed where they are to continue.

When cultivated for fruit, they may be best planted on grass lands, as the best fruit is apt to fall, which in that case is little injured.

MULE, a mongrel kind of quadruped, usually generated between an ass and a mare, and sometimes between a horse and a she-ass.

It is a sort of monster of a middle nature between its parents, and of course incapable of propagating its species.

These animals are chiefly used in countries where the roads are steep, rocky, and stony.

Those made use of in the southern parts of Europe, are usually black, strong, well-limbed, and large, being mostly bred out of the fine Spanish mares. They are sometimes fifteen or sixteen hands high, and the best of them worth forty or fifty pounds. No creatures are so proper for large burdens, and none so sure footed. They are much stronger for draught than our horses, and are often as thick-set as our dray-horses, and will travel several months together, with six or eight hundred weight upon their backs. It is surprising that these animals are not more propagated here, as they are so much hardier and stronger than horses, less subject to diseases, and capable of living and working to twice the age of a horse. Those that are bred in cold countries are more hardy and fit for labour than those bred in hot; and those which are light made are fitter for riding than horses, as to the walk and trot; but they are apt to gallop rough; though these do it much less than the short-made ones.

It has been observed, that they take so much after the mares that they are bred from, that they may be procured of any kind, light or strong, as the owner pleases. The general complaint made against them, is, that they kick and are stubborn; but this is only owing to neglect in the breeding them, for they are as gentle as horses in countries where they are bred with more care. The mules bred between the horse and the she-ass, are the least valuable. They are commonly very dull, and take after the ass, and are not large; those bred between the horse and the ass are the best. The largest and finest male-ass must be procured for this breed, and the best mares be made use of. If the ass designed to be bred on is suckled by a mare, or the mare suckled with an ass, it makes them much more familiar than they would otherwise be; and this may always be done by taking away the colt that belongs to the dam, and putting the other in its place, keeping them confined ten days or a fortnight.

The success in breeding of these as well as most other animals depends in a great degree upon the manner of keeping them while young.

The she-asses should be well fed, and be kept in

good order, both before they drop their foals, and afterwards whilst they suckle.

And the foals when weaned should be carefully fed and defended from cold in the winter season, sufficient exercise in the open air being allowed every day.

In the West Indies much of the labour on the plantations is performed by these animals. And Mr. Carpenter, in his Treatise on Agriculture, remarks, that "mules used in agriculture on light soils, and particularly in some situations, are very serviceable, though not very common in these parts. He knows but of two teams in which mules do all the work on the farms; the one belongs to Samuel Skey, Esq. of Spring Grove; the other Mr. Teverel's near Worcester, consisting of seven handsome mules, and bred by the former gentleman, who breeds and keeps a considerable number, many of them fifteen or sixteen hands in height, and some of a milk white colour. The most beautiful of the white mules Mr. Skey reserves for drawing his carriage, for which he has been offered a very high price. They are bred from grey or white mares, and a white and spotted foreign ass, which curious animal he has had possession of many years. He has very lately seen Mr. Teverel's mules at work, and afterwards in the stable, where they are fed with good straw, and he was assured that straw was their only food, it being then winter. Their hardiness is certainly a valuable property, as these mules, though kept to hard work, looked remarkably sleek and well. Their longevity is also a very considerable advantage. Mr. Skey remarked that two working mules in Shropshire, had arrived to the age of seventy years each, and he has been informed, by a person who has taken much notice of this breed, that though they will perform a deal of work when only two or three years of age, they do not arrive to perfection till about thirty."

When three years old, mules are proper for use, or being employed as stallions.

In the breeding of these animals, mares that are of a very large breed and well made should be employed. They should be young, full of life, large barrelled, but small limbed, with a moderate sized head, and a good forehand.

It is found of advantage to have the foals from the time of their being dropped often handled, to make them gentle: it prevents their hurting themselves by skittishness and sudden frights; and they are much easier broken at the proper age, and become docile and harmless, having nothing of that viciousness which is so commonly complained of in these animals.

They may be broken at three years old, but should never be permitted to do much hard work till four; as they are thus secured from being hurt by hard labour, till they have acquired strength enough to bear it without injury.

An expert breeder of these animals, found, that by feeding them too well while young, though it made them very fat, it was far from being any advantage to them; as it was not only incurring a much larger expense than was any ways necessary, but also made them wonderfully nice and delicate in their appetites ever after, and also by increasing their weight of flesh, rendered them more subject to strains and hurts in their morning gambols. He therefore contented himself with giving them food enough to prevent their losing flesh, and to keep up their growth without palling their appetites with delicacies, or making them over fat: he also took care to defend them from the injuries of the weather, by allowing them stable room, and good litter to sleep on, besides causing them every day to be well rubbed down with a hard wisp of straw by an active groom. This was scarcely ever omitted, particularly in cold, raw, wet weather, when they were least inclined to exercise themselves.

MULCH, a term applied to straw half rotten.

It is useful to be applied over the roots of new planted trees in dry seasons.

MULLOCK, a provincial term applied to dirt or rubbish.

MULLEIN, a provincial name applied to a biennial plant, which perishes soon after it has perfected its seed. The leaves spread on the ground, are nine or ten inches long, and six broad, very woolly, of a yellowish white colour, and very little footstalk. The stem rises four or five feet high, and the upper part of it is garnished with yellow flowers, which sit very close, and form a thick spike. These flowers have an agreeable odour, appear in July, and the seeds ripen in autumn. It commonly grows on the sides of roads and on banks: but when it once gets into the fields in a warm exposure and is suffered to seed there, it soon over-runs the whole ground. It may be easily destroyed by cutting off the stem, when it is in flower.

MURE, a term applied to the cakes of apples, grapes, &c. left in the press, after extracting the juices.

MURIATE, a saline substance formed by the union of the muriatic acid with different alkaline, earthy, and metallic bases, of which there are a great number.

Muriate *of Iron*, a salt which seldom occurs in nature. It has been supposed highly inimical to vegetation. It is decomposed by fixed alkalies, lime and magnesia, forming digestive salt, sea salt, muriate of lime, and muriate of magnesia.

Muriate *of Lime*, an earthy salt which consists of the muriatic acid and lime. It is found native in sea-water, and in the mother-water of culinary salt. It is likewise obtained either by direct combination, or by the decomposition of sal ammoniac by quicklime.

Lord Dundonald says that it "is very soluble, and when mixed with dung, its effects in promoting vegetation will probably be found similar to those of the *muriate of magnesia*. It is decomposed by fixed alkalies, forming therewith muriate of pot-ash, or digestive salt of silvius, and muriate of soda."

Muriate *of Magnesia*, an earthy salt which consists of the muriatic acid and pure magnesia. It is found in the mother-earth of nitre manufactories, and may be produced artificially both by direct and indirect combination.

According to Lord Dundonald, it is found in great

abundance in sea-water, constituting upwards of one fourth of the saline matter it contains. It may be procured in great quantities from the bitter refuse liquor which at present runs to waste at the salt works. It is a salt very deliquescent, and of difficult crystallization; its acid is capable, in a great measure, of being expelled by heat, and very considerable benefit has been experienced from its use in promoting vegetation, when mixed with dung, or compost dung-hills. It seems to possess, when applied in moderate quantities, he says, the septic powers of sea-salt, and thus to promote the complete putrefaction of dung. It is decomposed by fixed alkalies and lime, forming therewith digestive salt of silvius, sea-salt and muriate of lime. With ammoniac, or volatile alkali, it forms a triplicate salt of easy crystallization.

Muriate *of Soda*, a neutral saline substance consisting of a muriatic acid and soda or the fixed mineral alkali. It has received various denominations, according to the state in which it is found in nature, as rock salt, which is dug out of the earth in solid masses, bay salt, formed by the evaporation of sea-water, and river-salt, obtained from salt springs. But none of these salts is pure, they are always mixed with some heterogeneous parts; thus rock-salt contains gypsum, bay-salt a great deal of muriate of magnesia, and river-salt frequently both. Sometimes they contain by accident bitter salt, alum, ammoniacal salt, &c. It may probably be useful as a manure. See *Sea-Salt*.

MURRAIN, in *Farriery*, a name applied to a disease among cattle, by some supposed contagious.

The common signs of this disease are a hanging down of the head, gumming at the eyes, growing weakly, staggering, the head swelling very much, the breath short, the heart beating, with rattling in the throat; the breath very hot, and the tongue shining.

As soon as the cattle are infected, it is advised to take a pretty large quantity of blood from them immediately, and give them drenches.

According to the observation of Mr. Downing, "this distemper is incident to young cattle; it often begins with a swelling, attended with lameness and a mortifying blackness; this swelling will, he says, alarm you with a crackling noise, like a blown bladder when rubbed with your hand, and the part becomes insensible. It sometimes begins in the mouth, at other times in the head, back, or belly, but most commonly makes its appearance in the legs, which causes immediate stiffness and lameness." It is added, that it is a matter of the greatest importance to manage so as to reduce the crackling or swelling, for, on the proper management of this depends the whole cure.

It is advised in the first place, to foment round the sides of the swelling frequently, with the following mixture or wash.

Take of Oil of turpentine, four ounces,
Vinegar, four ounces,
Oil of vitriol, two ounces.

Mix them together.

As the chief part of the management consists in clearing the mortifying substance; this is to be effected, by taking a sharp knife and making an incision the whole length of the swelling, and then separating all the black substance, till the communication between the living and dead flesh is totally divided: when the mortified matter is wholly cut away, the sound parts will bleed freely, which will be a good symptom. It is recommended not to be too hasty in stopping the blood; but to dress the wound afterwards with the following embrocation:

Take of Spirits of turpentine, two ounces,
Spirits of sal ammoniac, two ounces,
Honey, one ounce.

Mix them, and fill the cavity of the wound with pledgets of tow moistened with them.

At the next dressing, he advises the wound to be well bathed with a fomentation made of aromatic plants; such as wormwood, tansey, camomile, bay leaves, and rosemary: of each one handful, to be boiled in a gallon of strong drink grounds; to which, add spirits of wine and camphor and sal ammoniac, of each two ounces; this will, it is supposed, make the wound digest, by which the matter will separate. Afterwards it may be treated as any common wound or ulcer.

Where the disease begins in the mouth, the symptoms are evident, by the mouth being generally open and a matter falling therefrom: by opening the mouth upon one or both sides of the tongue, a large blackish coloured substance may be found, which will easily yield to the pressure of the finger.

In the treatment, it is advised first to gag the cow, then to take a sharp knife, and totally cut all the discoloured flesh from the sound substance, which may be done by guiding the knife in the hand in a suitable manner, according to its situation; then to dress the wound with the following embrocation;

Take of Mel. Ægyptiacum, two ounces,
Camphorated spirits of wine, two ounces,
Honey, two ounces,
Oil of vitriol, one ounce.

Mix them, and let the wound be dressed three or four times a day, till the discharge is of a good kind, and give the following medicine:

Take of Æthiops mineral, one ounce,
Liver of antimony, in powder, one ounce,
Flour of sulphur, one ounce,
Nitre, in powder, one ounce,
Valerian, in powder, one ounce.

Mix them for one dose, to be given in a quart of camomile tea, and repeated once a day, for several days. The beast should fast two hours before and two after taking of it.

In the after treatment, bleed the beast and keep it by itself, as this disease is very catching. Give a quart of herb grass tea three or four times a day, and let it have the usual food.

In order to prevent the disease

Take of Myrrh, in powder, one ounce,
Epsom salts, two ounces,
Flour of sulphur, one ounce,
Liver of antimony in powder, half an ounce,
Diapente powder, one ounce.

Mix them together for one dose, and give it in a quart

of strong rue tea, and take two quarts of blood from the beast. The animal should fast as in the former case.

Where the disease affects young calves, it is advised to have recourse to the following remedy :

Take of Liver of antimony, in powder, half an ounce,
Myrrh, in powder, half an ounce,
Venice treacle, one ounce,
Grains of Paradise, in powder, half an ounce,
Gentian powder, one ounce.

Mix them for one dose, which should be given in a pint of rue tea, and repeated as there may be occasion.

MUSCLES, a sort of shell-fish which abound on the rocky shores on the borders of the sea in many parts of the island, adhering to the rocks. Where they can be collected in large quantities they may be made use of as an excellent manure, either alone or in the state of compost with earthy substances.

MUSHROOM, an imperfect plant of the fungous kind, composed of a pedicle crowned with a broad head, convex and smooth at the top; and hollow, foliated, lamellated, or pistulous underneath. As they are often produced in large quantities, in the fields, it is of much importance to distinguish the right eatable sort, from several noxious kinds that have been productive of fatal accidents : the true sort appears at first with a roundish head, not unlike a button, the outside of which is then very white, as is likewise the stalk on which it grows; and its under part, when it is taken off the stalk, from which it separates easily, is of a pale or livid flesh colour. Its flesh is very white within. If it remains undisturbed, its head spreads to a considerable size, and opens at the bottom, so as to form an almost flat surface, the under part of which will then be changed to a dark reddish brown colour.

MUST, a term applied to new wine and wort before it is fermented. It is also applied to the saccharine juice of several fruits susceptible of the venous fermentation, and particularly that of grapes, before the commencement of its fermentation.

MUSTARD, a plant of the annual kind, sometimes cultivated in the field as a crop.

This is a sort of plant that may in some cases, where the soil is suitable, be grown to much advantage.

Mr. Young observes in his Calendar, that " in breaking up the rich common of Marshland Smeeth, in Norfolk, the crop that was supposed to pay better than any other, was mustard. The soil is a rich silt and clay, worth 60s. an acre. It was ploughed once, and harrowed twice, sowed one-fourth of a peck of the seed per acre, from Candlemas to the end of March, according to the weather. Few farmers have, he says, a soil that answers for this crop, but where markets are promising they should have it in their mind. It may also be added, that it is hand-hoed twice. The crop is reaped in the beginning of September, being tied in sheaves, and left three or four days on the stubble. It is then stacked in the field. It is remarked that rain damages it. A good crop is six or seven combs an acre: the price from 7s. to 20s. a bushel. Three or four crops it is observed are taken running.

In Kent, according to the survey of Mr. Boys, white mustard is cultivated for the use of the seedsmen in London. In the tillage for it, the ploughed land is, he says, harrowed over, and then furrows are stricken about eleven or twelve inches apart, sowing the seed in the proportion of two or three gallons per acre in March. The crop is afterwards hoed and kept free from weeds. It is usually ripe about July, when it is reaped and threshed out upon a sail cloth in the field.

The best way to save the seeds of this plant, is to sow a spot of ground with it in the spring, to thin the plants when they have about four leaves, and at the same time to hoe down the weeds, as is practised for turnips. This hoeing is to be repeated in about a month after, and the plants are then to be left about eight or nine inches asunder, which will be sufficient space for the growth of this species. If these hoeings are well performed, in dry weather, they will keep the ground clean till the mustard seeds are ripe. The stalks of this plant, which are branched and hairy, will then be about two feet high, and the ripening of its seed is indicated by the pods changing to a brown colour; immediately after which they should be cut down, dried upon cloths, for two or three days, and then threshed out for use.

The larger kinds of mustard are to be treated in the same manner; excepting that, as they grow much larger, a proportionably greater space must be left between the plants: and as their seeds will not ripen so soon as those of the smaller kind, three hoeings, or rather good deep stirrings of the ground may be requisite. The common mustard, grows naturally in many parts of this kingdom; but is cultivated in the fields for its seeds, of which the condiment called mustard is made.

In the second volume of the Annals of Agriculture, Mr. Young observes, " that mustard seed sometimes turns out prodigiously profitable, that is, three or four, and even five quarters, at 4l. a quarter. But it is hazardous, and has a very great evil, of rising afterwards in successive crops, and is hardly ever completely eradicated."

MUZZLE, a term applied to the nose of a horse or other animal. It also signifies a kind of halter put upon the nose of a horse or mule, to prevent eating or biting.

Muzzle *of a Plough*, a term sometimes applied to the copse or part to which the draught is attached.

N

NAG, a provincial term applied to a horse of a small size, for the saddle; this sort of horse is very useful for many purposes, where light labour is required.

NAIL, a small piece of iron of different forms for fastening wood or other materials together.

Horse-NAIL, a small flat pin of iron used for fixing the shoes of horses on with.

It is observed by Mr. Moorcroft, in his account of the different methods of shoeing horses, that eight nails for each shoe are enough for saddle and light draught horses; but for such as are employed in heavy draught, ten are required. A smaller number, it is found, do not hold the shoe sufficiently fast; and a greater number, by acting like so many wedges, weaken the hoof, and rather dispose the crust to break off, than give additional security.

"The manner of disposing the nails," he remarks, "has differed considerably at different times. Some writers have directed four to be placed on each side of the foot, and the hindmost near the heel; leaving between the two rows of nails, a considerable space of the forepart of the foot without any. The nails thus placed, certainly confined the foot, at the sides and heels, left the toe at liberty, and assisted materially the effect of the sloping surface of the common shoe, in altering the form of the foot from a nearly round, to a lengthened figure." But that "latterly, it has been strongly recommended, to place the nails principally at the fore part of the foot, in order to prevent the heels from being confined. And certainly this is a wiser practice than the former; but as the foot should rest on the shoe in the whole extent of the crust, it may be thought, that the best way of connecting them in every part alike, would be that of placing the nails at equal distances from each other, in the whole round of the shoe. However, the objection to this is, that when the foot strikes the ground with considerable force, the back part of it becomes a little broader than when it is in the air, or when the foot is at rest. This spreading is not considerable, nor does it extend far along the sides of the foot, but it is sufficient to act upon the hindmost nails when near the heels: hence arises the necessity for there being a greater distance between the last nail and the heel of the shoe, than between any two nails. Accordingly it may be laid down as a general rule, that the last nail should not be nearer the heel, than from two inches to an inch and a half. Such a distance has been found sufficient to prevent the heel's being confined; and not sufficiently great to allow the shoe to spring, and loosen the last nails, as frequently happens when they are farther distant from the heel."

He further contends, that "all the nails should be at equal distances from each other, except the two in front, which should be a little wider apart than the rest: this, however, is not a matter of essential consequence; but it is of importance that there should not be any nail in the middle of the toe For, generally, the action of the foot on the ground has a direct tendency to push the shoe, as it were, backwards along the foot; and it sometimes happens that the shoe is actually thus displaced; in which case it necessarily follows, that the nail in the middle of the toe must be driven immediately against the sensible parts behind it; whilst the rest of the nails in a great measure follow the line of the crust, and so avoid doing mischief to the parts within."

He advises, that "the nail-holes on the upper surface of the shoe should come through the seat, close to the edge of the bevel, that the nails may have a proper and equal hold on every part of the crust, which will be shewn by the clenched ends being each equally distant from the shoe."

And that, "as the nail-hole is always made with a taper and square-pointed punch, a nail with a head of the same form will fit it better than one of any other shape."

The most general practice to prevent slipping in frosty weather, is what is called roughing; which is nothing more than making two caulkings to each shoe. This is liable to the objections before stated, of throwing the weight too much on the toe, and of the inside caulking sometimes wounding the opposite leg. And it is farther objectionable, because the caulkings soon wear down; as, in order that they may take the necessary hold on the ground, they are made sharp and thin. They therefore require being frequently renewed; and hence it generally happens,

that a horse which is much worked in frosty weather, has his feet more broken and injured than in the common wear of many months.

It is observed that to prevent the necessity of frequent removes, several expedients have been put in practice. Sometimes a few nails of a larger size than the rest, have been so put in, that the heads stood considerably beyond the level of the shoe; but when these did not break off, as was often the case, they soon wore down. At other times, nails with large heads, tapering to a point, were screwed into the web of the shoe. Of these one was usually placed at the toe, and one at each heel. And by this contrivance of the screw, it was imagined, that the nails might be easily replaced when worn out. They are apt, however, to break off at the neck, and are too expensive for common use.

There is another plan, which, as far as it has been tried, justifies the author in recommending it; which is that of having nails with a lozenge head, or what may be called a double countersink, terminating in an edge, instead of coming to a point. This greater breadth of surface prevents its being rubbed away so fast as a point; the thickness in the middle gives it strength; and the regular taper to the shank, causes it to apply exactly to the sides of the hole in the shoe, by which it is equally supported, and prevented from bending or breaking. There should be four nails to every shoe; that is to say, two in the forepart, and one at each heel. The heads of these nails must be struck in tools, or dies; the four holes in the shoe being made to correspond with the neck of the nail; and when the nail is driven, the workman must cover the head with a tool, which will receive its upper part, and prevent its being injured by the hammer. These nails are, in effect, so many caulkings, with the advantages of allowing a more level tread; of being easily replaced, by putting new nails in the old holes; and by being at a distance from the heel of the shoe, they are not so likely to hurt the opposite leg."

Both the nails and nail-holes of the shoes employed at the Veterinary College, are materially different from those in common use. The latter are stamped with a punch, and are of a particular form; the heads being of a conical shape, and are received into the nail-holes, so as to preserve their hold as long as the shoe exists. They are the invention of Mr. Spencer, at No. 7. in the Cloisters, near St. Bartholomew's hospital, and which, though made of a more durable metal, are little more in price than the common sort of horse shoe nails.

On these nails it is observed by Mr. Coleman, that "the head of the common nail is not conical, but nearly square as at *c*, and no part is received into the nail-hole. When the nail is driven into the shoe upto the head, the farrier generally continues to hammer with great violence; and as the nail-hole cannot admit the head, the texture of the nail contiguous to the head is shivered, and, in a few days, is broken:—whereas the head of Mr. Spencer's nail operates as a wedge; the more it is hammered the more closely it is connected with the nail-hole, so as to become part of the shoe. Moreover, the head of the common nail, when not injured by the farrier, projects beyond the shoe; and when worn out, the shoe is liable to come off.

This accident will more frequently happen if the nails are placed in the old nail-holes of the crust: before the nail-holes of the shoe are punched the farrier should therefore examine the situation of the former nails; and by having new crust for the nails, the shoe will be more firmly connected with the hoof and remain longer. See *Shoeing*.

NAEFF, a provincial word applied to the nave of a wheel.

NAPE, a provincial term applied to a piece of wood used for supporting the fore part of a loaded wain.

NARCOTIC, a term applied to such remedies as have the tendency to produce sleep.

NAST, a provincial term applied to any sort of foulness, as weeds in lands under fallow.

NATHE, a provincial term applied to the nave of a wheel.

NATRON, a chemical term employed by modern chemists to signify the mineral fixed alkaline salt.

NATT, a provincial term applied to the hornless breeds of animals of the sheep and cattle kind. Thus we have the natt or Devonshire breed of sheep. It is sometimes written *Rot*.

NATURAL-PASTURES. See *Pastures*.

NATURAL *Woods*. See *Woods*.

NAVEL GALL, in *Farriery*, a term applied to a bruise on the back of a horse, or other animal, by a saddle or other means. It is so termed from its being over the navel.

Where there is a wound it should be dressed with some mild digestive application, taking care to keep the proud flesh down.

But where the part is only swelled, without the skin being broken, it may be rubbed with the hand, or a rag dipped in brandy, a saturnine wash, or vinegar.

NAVE *of a Wheel*, the short thick part in the centre of the wheel, which receives the end of the axle-tree, and in which the ends of the spokes are fixed; it is bound at each end with hoops, called nave bands. It has likewise in each end of the hole, through which the end of the axle-tree passes, a ring of iron called the wisher, which saves the whole of the nave from wearing.

NAVE *Bands*, the iron hoops at the ends of the naves of wheels.

NAVIGABLE-CANALS, such canals as are capable of admitting small ships. See *Canals*.

NEAT-CATTLE, a term applied to all sorts of cattle of the cow kind.

NECK, the part of an animal to which the head is attached. In the horse it should be neat, thin, and have but little flesh upon it. To be well shaped it should, at its going from the withers, rise with a slope upwards, diminishing by degrees toward the head. In mares, it is supposed by some a good quality to have their necks somewhat gross, and charged with flesh, as they are generally too fine and slender.

The neck contributes much to the making a horse light or heavy on the hand, according as it is fine and well shaped or coarse.

In horses as well as cattle it is of much consequence to have the neck falling well into the shoulder.

NEEDLE-WEED, a weed usually termed shepherd's needle. See *Shepherd's-needle.*

NEEDLE-WORMS, the worms called *ascarides*, sometimes producing diseases in horses. See *Worms.*

NEIGHING, the natural cry of the horse or mare.

NEPHRITICS, in *Farriery*, a term applied to such remedies as possess the power of dissolving or breaking down stony concretions in the kidneys or bladder.

NESH, a provincial term commonly applied to such animals of the horse or cow kind as are tender or *washy.*

NETTLE, the name of a well known perennial weed, which may be easily destroyed by cutting the roots before the plant has perfected its seed.

NEWING, a provincial term applied to yeast, or barm. See *Yeast.*

NIB, a term applied to the handles of a scythe.

NICKING, in *Farriery*, the name of an operation performed on the tails of horses, in order to make them carry them well.

Previous to describing the operation of nicking, it may be necessary to enquire how the effect of it, the elevation of the tail, is brought about; and in order to know this, and judge with propriety of the operation, it is necessary to consider the tail as elevated or lifted up by one set of muscles, and depressed or pulled down by another.

The muscles which elevate the tail, are more numerous, large, and strong, than those that depress it; and are closely connected to the bones of the tail by fleshy fibres, terminating in strong tendons at the extremity; but the muscles of the latter soon form into tendinous expansions, and besides three large tendons which are inserted into the latter bones of the tail, there are several small tendons, which run laterally, the use of which is to move the tail sideways: the arteries are four in number, and run sometimes above the bones of the tail, consequently are easily avoided by a dextrous hand.

The art of nicking chiefly consists in a transverse division of these depressing tendons of the tail, and such a position afterwards as will keep their extremities from coming again into contact; so that an intervening substance fills up the vacuity: by these means an additional power is given to the antagonist muscles, viz. the elevators; the counteraction of the depressors being manifestly abated by the division of the tendons, and the intervention of the flesh.

The usual method of supporting the tail by a pulley and weight, is liable to many exceptions, the extremities of the divided tendons not being by that method kept sufficiently asunder; the situation of the tail being rather inclined to a perpendicular than a curved direction: this position too is liable to many variations, from the different movements of the horse, and is the reason that the tail frequently inclines to one side, as the nick may heal up faster on one side than the other; the disagreeable situation the horse must stand in, with a weight consequently hanging to his tail, is another material objection, besides the necessity of removing it when the horse is exercised, or taken out to water. In order to remedy these inconveniences, and perfect the operation, a machine has been contrived for the purpose, which has frequently been practised with success, and which at first view appears in every respect calculated to correct the defects of the former mode.

In regard to the operation, the number of the incisions must be in proportion to the length of the tail, but three in general are sufficient. The most approved method of dressing at first, is with powdered rosin, applying a soft dossil of lint or tow, dipped in the same, between each nick, and lapping the tail up with a linen cloth and broad fillet; which in two or three days should be cut open down the back part of the tail, and the morning after be gently taken off: when it will be proper to plat the hairs, in order to keep them clean, and to set the tail.

Every two or three days, the tail should be let down, and the upper part next the rump bathed with hot vinegar, and if it begins to crack, and the hair come off, a little tincture of myrrh will soon put a stop to it. To obviate any threatening symptoms that may arise from the wounds, recourse must be had to the remedies used in docking.

After six or eight days, it will be proper to let the horse stand without the machine for a few hours, and then be rode about in order to see how he carries his tail, and form a judgment how to fasten it down, whether to confine it closer, or give it more scope: after the wounds are healed up, it may be necessary to keep the tail suspended for a little time.

In the application of the machine when the hair of the tail is properly platted, and tied with a knot or two at the end, the pad, &c. *fig.* 1. plate XIII, must be put on, and the machine, *fig.* 2. buckled to it, letting the part G lie over the part of the tail that joins to the horse's rump; then an assistant, standing on the side rail of the brake, or any other convenient spot that may place him above the horse, must raise the horse's tail very gently till the knot of the tail gets so far beyond the strings L L in *fig.* 2. that it may be tied down; which being done, the tail may be let down lower, or taken up higher at pleasure. It is to be observed, that the ligature is not made on the tail itself, but on the platted hair, at the extremity of the stump. The machine, *fig.* 2. must be made of a piece of tough wood about a foot long, viz. from A to B, and about nineteen inches broad from C to D, and seven or eight inches thick. The under part should be hollowed, so as to let in the horse's rump, and that the wings C D may rest on his buttocks. To receive the tail, a groove must be cut from G to H, about three inches wide, and three deep at G, lessening gradually both in height and breadth to H. Holes must be made at certain distances in the groove, as at H, for the string, and

a nick cut to receive the fillet from the strap K. Two buckets fixed to the machine as at *i i*.

The pad, &c. are sufficiently described at *fig.* 1; the wood must be stopped off from E to C and A, and so on the other side, to lighten the machine, and hollowed at B, G, and F. This figure represents a horse, with his tail in the frame or machine. A is a pad, to which is fastened a circingle B. CC two side straps, one on each side the horse, fastened to the circingle, to keep the machine from going to either side; D, a breastplate to prevent the pad, &c. slipping back. E, a strap fixed to the pad, and buckling to the machine to keep the tail on the stretch at pleasure. F, the string tied on the hair, to confine the tail down to the machine. *Fig.* 2, from A to B is twelve inches; from C to D, measured with a string drawn over E F, is nineteen inches. From the top of the groove at E to the bottom G, is three inches. From E to F, the widest part of the groove, three inches, gradually narrowing as the tail lessens to its extremity. The dots about H are holes in the groove, through which a piece of tape or pack-thread must be put, according to the length of the dock, and the distance of the knot to tie the tail down behind the knot. I I, the buckles to receive a strap from the circingle on each side, as described in *fig.* 1, which keeps the machine from turning to either side. K, the strap with a fillet and buckle, which comes along the back from the pad, and is fastened to the machine, through a nick cut just above H. LL, the strings to tie down the tail. B, G, F, the hollow to let in the rump.

Fig. 3, represents the back parts of the horse with the machine on, standing directly before you, where the depth of it is shewn, being three inches.

CD, the extremities of the wings. E F, the upper part. See *Docking*.

NIDGET, a term applied to a sort of harrow formed in a triangular manner, which is employed in the culture of hops. See *Hops*.

NIGHT-MARE, a malady incident to horses, proceeding from different causes. It causes the horse to sweat more in the night than the day, and of course, deprives him of his rest. It is discovered by observing in the morning, whether he sweats on the flanks, neck, and short ribs, which are sure indications of it.

It is observed by Mr. John Lawrence, that there can be no doubt that horses are frequently troubled with the *asthma nocturnum*, *incubus* or *night-mare*: the symptoms of which are profuse sweats, and twisting and dishevelling of the mane, discovered at their uprising in the morning. The cause he conceives to be a dense and sizy blood, and intestinal accumulation.

And the best method of cure, venefection, purgatives, exercise, and grass.

NINE-PIN COLLAR. See Collar.

NIP, a provincial term applied to a near split-farthing housewife.

NIPPERS, a term applied to the four teeth in the fore part of a horse's mouth, two in the upper and two in the lower jaw: they are put forth between the second and third years.

Nippers, in *Farriery*, the pincers with which the smiths cut the nails, as they are driven in before they rivet them in shoeing: they are also used in taking off a shoe.

NITHERED, a provincial word used to signify perishing with cold.

NITRATE, a chemical term applied to saline products formed by the combination of the nitric acid with different alkaline, earthy, and metallic bases, of which there are a great many.

Nitrate *of Ammoniac*, a neutral saline substance formed by the combination of the nitric acid and ammoniac, or volatile alkali.

It is generated spontaneously in the mother-earth of salt-petre manufactories, though but in small quantities. In general it owes its formation, either directly or indirectly, to the artificial union of its constituent parts. It cannot be obtained in sufficient proportions, for the purposes of agriculture, but is useful in the analysis of soils.

Nitrate *of Iron*, a salt formed by the union of nitric acid with iron, but is a salt rarely presented by nature: its properties or effects, as they may apply to agriculture, are not, Lord Dundonald says, worthy of observation.

Nitrate *of Lime*, is an earthy salt which consists of the nitric acid and lime. It is found in the mother-earth of nitre manufactories, on old walls, and mixed with true native nitre in the kingdom of Naples. The purest is obtained by the artificial and direct combination of its constituent parts.

Lord Dundonald remarks, that it is a saline substance, that is also found in the rubbish of old buildings, and in those materials from which salt-petre is extracted: viz. animal and vegetable matters, which, with a due proportion of calcareous earth, have undergone the putrefactive process, together with a subsequent, sufficiently long, exposure to atmospheric air. According to Dr. Home, it is likewise, he says, contained in what is commonly called hard water, which, by his experiments, was found to promote the growth of plants in a much higher degree than soft water. It is very soluble, and deliquescent: it is decomposed by fixed alkalies, and forms therewith *nitrate of potash* or salt-petre, and *nitrate of soda*, or cubic nitre.

Nitrate *of Magnesia*, is an earthy salt, composed of the nitric acid and pure magnesia. It is found native in the mother earth of nitre manufactories, and on walls. It has been obtained artificially by direct and indirect combination.

It is observed by Lord Dundonald that no agricultural experiments have yet been made with this compound; it is a very deliquescent and soluble salt; and there is reason to expect, that it will produce effects, in promoting vegetation, similar to those which may result from the application of the nitrate of lime.

It is decomposed by alkalies and lime, and forms therewith *nitrate of potash*, *nitrate of soda*, and *nitrate of lime*.

Nitrate *of Potash*, a neutral salt, formed by the combination of nitric acid and pot-ash, or the fixed vegetable alkalie. It is found in the fissures of the lime-stone hills, near Molfetta, in the kingdom

of Naples, in various waters, and even in rain: likewise in the fresh juices of many plants, such as the heliotrope, pellitory, tobacco, and others. It is produced spontaneously wherever its alkaline basis is exposed to a free current of air, and to the exhalations of putrescent vegetable and animal matter; as on damp walls, rubbish, the ordure of stables, dunghills, &c. In Spain, the East-Indies, and near Lima, it is generated upon commons and uncultivated ground; and it is even asserted that in the southern regions of Spain, salt-petre is found in the dust of the high-roads. Lord Dundonald in his treatise, on the connection of agriculture with chemistry, observes, that "it is constituted by the putrefaction and complete decomposition of animal and vegetable substances, when mixed with calcareous matter and wood ashes." It is found to promote vegetation, but is too expensive to be used as a manure.

NITRATE *of Soda*, a very soluble substance, formed from the combination of the nitric acid and the mineral alkali, or soda, which, on account of the figure of its crystals, has obtained the name of *cubic*, or more properly, of rhomboidal nitre. Bergmann distinguishes it by the name of nitrated soda, and modern chemists by that of nitrate of soda. It has not hitherto been found in a native state, but is always produced, either directly or indirectly, by the artificial combination of its constituent parts. Lord Dundonald supposes it capable of promoting vegetation in an equal degree with the nitrate of potash.

NITRE, a term formerly applied to a salt extracted in Persia and the East Indies, from certain earths that lie on the sides of hills; and artificially produced, in some parts of Europe, from animal and vegetable matters rotted together (with the addition of lime and ashes), and exposed for a length of time to the air, without the access of which nitre is never generated. The salt extracted from the earths, &c. by means of water is purified by colature and crystallization. Pure nitre dissolves in about six times its weight of water, and concretes again into colourless transparent crystals; the figure of which is that of an hexagonal prism, terminated by a pyramid of an equal number of sides. It readily melts in the fire; and, in contact with fuel, deflagrates with a bright flame and considerable noise; after the detonation is over, a large quantity of alkaline salt is found remaining. The taste of nitre is sharp, penetrating, and bitterish, accompanied with a sensation of coldness.

It was formerly supposed to have much influence in the business of vegetation. See *Nitrate of Potash*.

NOCKLE, a provincial term often applied to a mallet or beetle. It is sometimes written *knockle*.

NOGG, a provincial word often used to signify strong beer.

NONSUCH, a term provincially applied to trefoil seed and rye-grass, as *black* and *white* nonsuch.

NOONINGS, a term provincially used to signify working dinner times.

NORFOLK *Hand-drill*, a drill machine made use of in that district for drilling in small seed crops. See *Drill-machine*.

NORFOLK *Plough*, a plough employed in that district in the tillage of their light sorts of land. See *Plough*.

NOSE, the organ of smell in animals: according to Gibson, horses are sometimes subject to what farriers call the canker in the nose; some few of these cases, has, he says, fallen in his way; they discharge a sanious matter, and the ulcer looks black, like an eschar made with a caustic. The way to cure this canker is to purge, and give antimony inwardly, and apply pledgets of lint or tow to the part, dipped in a mixture of honey of roses, mel Ægyptiacum, and tincture of myrrh, equal quantities, which should be thrust up with a probe, and renewed as often as they drop out. This sort of ulcer is seldom attended with a swelling of the glands, unless it be neglected, in which case it may indeed end in the glanders. If it is occasioned by the stinging of a wasp or fly, which sometimes happens at grass, he advises to syringe the horse's nostril with a mixture of spirit of wine and vinegar, of each equal quantities, with the addition of a little alum, and half a spoonful of honey. Sometimes a *polypus* is met with in the inside of a horse's nose, though this happens but seldom. This is a fleshy substance of a dark yellow or red colour, with one or more roots that fasten it to the pituitary membrane. He never saw but one, which he extracted from a horse's nose, that was just taken up from grass. The thickest part of it was about three quarters of an inch in diameter. He drew it out with his finger and thumb, without an instrument, and found it had two roots, one pretty large and the other small. The part bled pretty much for two or three days, while the milder applications were used, but it was soon cured with the following injection:

Take of Spirit of wine,
Vinegar, of each four ounces;
Vitrolated zinc, two drachms;
Ægyptiacum, one drachm;
Honey, two ounces. Mix.

It was injected once a-day for about ten or twelve days.

NOSE-BAND, that part of a headstall of a bridle that comes over a horse's nose. Sometimes termed maserole.

NOSTRILS, the openings of the nose in a horse: these should be large and extended, so that the red within them may be perceived, especially when he sneezes.

NOTT, a provincial term applied to hornless sheep and cattle. It is often written *knot*.

NOWT, a provincial word sometimes applied to neat cattle.

NOWT-HERD, a provincial word signifying a cattle-herd or keeper of cattle.

NOWT-FOOT *Oil*, a provincial term applied to the oil prepared from the feet of neat cattle.

NOVEMBER, the eleventh month of the year. In this month the work of the farmer begins in some degree to lessen, but still his attention must be kept to different points of management, to insure the full success of the farm.

The different sorts of cattle and live stock are now mostly taken into the farm yards, where they must be carefully foddered, the lean part of the stock being well supplied with straw, which should be regularly threshed as it may be wanted, in order that they may have it perfectly fresh, as it is eaten much more cleanly, and affords more support to the animals in this way than when much is threshed out at a time, which is the usual practice with farmers. The farm yards must likewise in this month be attended to, both in laying the earthy foundations and littering, in order that the full supply of manure may be provided.

The fences must now be begun to be regarded, as this is the first period in which the business of hedging and ditching can be properly performed. Mr. Young very judiciously advises the young farmer, after he has "once brought his fences into good order, which should always be done within the first three years of the lease, to divide the whole length of hedging into twelve parts, and to make it a rule to do one of them annually ever afterwards: as in this way the whole may be kept in good order with the least inconvenience." And he adds, that "the best method for all old hedges consisting not wholly of white-thorn is the plashing, in which so much of the hedge is made of live wood, that it holds up and lasts far longer than hedges made all of dead wood, which is the practice of some countries; they are rotten, broken down, and gone, before the quick wood gets up to form a fence; whereas, in the plashing method, by leaving as many hedge-stakes alive as possible, and by laying down much growing-wood, the hedge is, he says, constantly impenetrable."

And where the borders in arable and other lands are covered with brambles and other coarse plants extending to great breadths, they should be removed at this season, and the lands occupied by them brought into a proper order for the husbandry of the field, whether it be arable or grass.

In districts where stone walls are the common sorts of fences, this is the proper season to begin building or repairing of them, and they may be made of whatever sort of stone is most plentiful, as lime-stone, rag-stone, or grit-stone. But, the best are lime and grit; as being in common most plentiful, and at the same time much the easiest cut; but whin-stone cannot be used to profit for this or any other work, as it is so hard that it will not cut without great difficulty. Some grit-stones cut with so much ease, that walls may be built of it without mortar, as true as with, and if well laid, they last nearly as long. In the enclosures of wastes, it is particularly proper to begin the business of walling at this time, and it may be continued during the winter.

Where the practice of folding sheep is the system of the farm, much attention is necessary to it at this season in order to obtain the fullest advantage from it, that it is capable of admitting of. When this month proves wet, Mr. Young says, it must be left off for the arable lands, and be begun with on the dry grass fields. "Many farmers, says he, stop about this time for the winter; but that is bad management: the idea that winter folding is of but little use is a mistake. Winter is a proper season for manuring grass lands which could not be folded in summer; nor does winter folding on very dry grass land do such harm to the sheep as arable folding, and the benefit to the land is great. It is added that mossy ground may be often manured before that weed is destroyed; but the treading of the sheep at the same time that the dung and urine are dropped, completely destroys it: and this manuring is more adapted to turf, than dung to be spread on the surface, which is troublesome to get in." This hint deserves to be fully considered where grass husbandry is conducted upon an extensive scale.

This is likewise the proper season to begin to winter water meadow and pasture lands wherever it can be done, an improvement which pays better than most others.

Mr. Young has observed that, "winter's watering answers in the hay, fully equal to a common manuring of the best stuff that can be laid on the land; and the expense, in some situations, is trifling. The lower parts of a farm are generally in grass; the farmer should, he observes, attend to his ditches, so that the water on all the higher parts of the farm may have an unobstructed course to a ditch a little above the bottom, from which it may be let at pleasure over the meadows, observing that it only runs over them, and does not stagnate."

And where grass-lands through bad management are infested with ant-hills, this is the proper period for cutting them off level, or rolling them down and destroying them. Where the first mode is applied, they should be carted away so as to form the bottoms of dung heaps, or to be blended with lime. The latter method, however, often succeeds without having recourse to this more expensive practice. Where the cutting is employed it is done with the greatest ease and at the least expense by means of ploughs contrived for the purpose.

Where the lands of farms are capable of admitting of the practice, this is a good season for digging up and carting out manures of the chalk, marle, clay, or other earthy kinds; but it should never be attempted where the lands are liable to be injured by the poaching of the teams made use of in conveying such manures upon them.

Where the lands have received crops that remain during the winter, great attention should now be paid to see that the water furrows be kept perfectly clean and open, so that neither the crops or the lands may be injured by the water resting too much upon them.

Towards the conclusion of this month, where the lands are sufficiently dry and light, some hardy sorts of peas may be put into the ground, especially those of the hog-pea kind, as they will remain without injury from the frosts, and be much more forward in the ensuing year than the spring sown crops. In these cases the drill method of sowing is probably the most proper, though it has been usual to sow them broad-cast. It is constantly proper to keep the teams fully employed in this month; the too common practice of letting them be little employed is highly injudicious and uneconomical, being never the case with good farmers. When not fully employed in other sorts of

transplanted trees. But if the soil whereon the trees are to be planted be bad, or essentially different from that he is about to describe, and if the situation be bleak, and exposed to violent winds, then he should conceive the attempt to rear nursery plants clean, healthy, and well rooted, opposed to common sense.

After remarking that great care and attention is requisite in rearing young plants; that some are raised with more difficulty than others; he asks, "are the ash, the beech, the birch, the elm, the larch, and the oak, reared in *infancy* with equal ease? Do they not, if properly treated, all equally flourish afterwards on the mountain, in the vale, where soil is hardly found, and where it is found in abundance? Do we sow seed in sand, gravel, clay, the crevice of a rock, on the bleak top of a mountain, or in a fertile vale, with equal expectation of seeing it rise a good plant?"

He considers the following as the best suited for this purpose: "a loam of a middling texture, rather inclining to sand, neither rich nor poor, from eighteen to twenty-four inches in depth; lying on a free, porous substratum; as this will, he thinks, be found more generally congenial to the nature of the different forest trees than any other soil. But there is no general rule without exception. If there be a diversity of soils, and if they do not too nearly approach the extremes of meagre sterility and excessive fertility, so much the better, since all the kinds do not exactly thrive alike in the same soil; and an opportunity would thereby be afforded of placing each in that congenial to its nature. The site should neither be high nor low, sheltered nor exposed, in any extreme, for the same reason, viz. that it may the more generally answer all purposes. For a nursery of this description, nothing can be more eligible than the spot which may occasionally be occupied as a kitchen-garden. The pulverization and mellowness afforded by the previous growth of various culinary crops, bring the land into the most suitable state for the raising of young trees, and at the same time clear it the most effectually from vermin, as the grub and other insects."

He thinks that "in all cases, it will be adviseable to trench the ground to its full depth, in preparing it for a nursery; and if necessary, to give it a dressing with lime, marle, dung, &c. *in compost*. Other manure should never," he says, "be applied to nursery ground at the time of cropping with timber trees. At the time of cropping with esculents, manure, either simple or in compost, may be applied; as conveniency and the nature of the crop in question shall determine. But, that the trees should immediately follow a manured culinary crop, is the best of all methods; as in that case, no manure would be required for the timber crop." He has known an instance, where a field was taken in for a nursery, from an old pasture of a rough sward, and in which myriads of the grub-worm, slug, &c. had found an asylum. It was conceived, that by subtrenching, or deeply digging it, the land might be effectually cleaned; and accordingly the field was planted with nursery, without any preparatory crop of grain, &c. being taken. But the result was, that most of the firs, the larches, the elms, the beeches, &c. became a prey to the vermin, the ensuing season; and their stems were found peeled entirely round, about an inch under the surface. For this reason, he conceives, it becomes a matter of caution, that a like misfortune be avoided, to take a crop, or crops, of grain, potatoes, turnips, &c. in order to thoroughly cleanse the soil of these noxious vermin, before venturing in it, the more valuable crop of nursery." But, "in respect to the proper rotation, much must, he says, be left to the judgment of the operator, and existing circumstances. The following example is given on the supposition that it may be applied, or partly rejected, according to the exigency of the case. 1st, Vegetables, with manure;—winter fallow. 2d, Evergreen and resinous trees, without manure. 3d, Sub-trenched;—deciduous trees, ditto, ditto. 4th, Potatoes or turnip, with manure. 5th, Evergreen and resinous trees, as before, &c."

For the extensive plantations of the Duke of Portland, in Nottinghamshire, according to the Agricultural Report of that district, where the soil is of a light sandy kind, "some well situated valley is chosen, as near the centre of the intended plantations as possible, for the purpose of a nursery. If this valley is surrounded with hills on all sides but the south, so much the better. A piece of ground consisting of as many acres as is convenient for the purpose, is fenced about in such a manner as to keep out all noxious animals. At each end of the nursery, large boarded gates are fixed, and also a road made down the middle wide enough to admit carriages to go through, which is found exceedingly convenient in removing the young trees from thence to the plantations. After the fence is completed, the ground on each side the road is trenched about twenty inches deep, which may be done for about 3l. 10s. or 4l. per acre, according as the land is more or less gravelly. It is best done in the spring, when the planting season is over. If after the trenching two or three chaldron of lime be laid on an acre, the land will produce an excellent crop either of cabbages or turnips, which being eaten off by sheep in the autumn, will make the land in fine order for all sorts of tree-seeds: but as the oak is the sort of tree cultivated in general, this is the method pursued in raising and managing that most valuable species." In "the autumn, after the cabbage or turnips are eaten off, the ground requires nothing more than common digging. As soon as the acorns fall, after being provided with a good quantity, sow them in the following manner:—Draw drills with a hoe in the same manner as is practised for pease, and sow the acorns therein so thick as nearly to touch each other, and leave the space of one foot between row and row, and between every fifth row the space of two feet for the alleys. While the acorns are in the ground, great care must be taken to keep them free from vermin, which would very often make great havock amongst the beds if not timely prevented. Let this caution, says the writer, serve for most other sorts of tree-seeds."

After the acorns are come up, the beds require only to be kept clean from weeds till they want

thinning; and as the plants frequently grow more in one wet season where the soil is tolerably good, than in two dry ones where the soil is indifferent, the time for doing this is best ascertained by observing when the tops of the rows meet; which is done, when that is the case, by taking away one row on each side the middlemost, which leaves the remaining three rows the same distance apart as the breadth of the alleys. In taking up these rows, the workman ought to be careful neither to injure the plants removed nor those left on each side. The rest of the young oaks being now left in rows at two feet apart, let them again stand till the tops meet; then take up every other row, and leave the rest in rows four feet asunder, till they arrive to the height of about five feet; which is full as large a size as is ever wished to be planted. In taking up the two last sizes, the method is to dig a trench at the end of each row, full two feet deep; then undermine the plants, and let them fall into the trench with their roots entire:—the same mode is necessary with other sorts of trees, very much of their future success depending on this point, of their being well taken up."

In respect to the culture, according to Mr. Nicol's plan, he does "not nurse trees in general more than two seasons; as they are either one or two years in the seminary, according to their kinds, before they come under view; and, as the after-treatment for many kinds is the same, for the sake of brevity, he classes such as with propriety may be classed together, and whose culture in the nursery is similar; particularizing those only that are of the greatest importance, and whose treatment is materially different." He advises that the alder and the birch should remain two years in the seminary, and then be removed into nursery rows. The richest and moistest ground in the nursery, provided it be of such soil, and in such situation as is described above, should be allotted for them. They are to be planted in lines twelve inches asunder, and about four inches in line. The roots of the alders may be trimmed a little with the knife. The birches must not be touched." And he adds, that "whether plants should be put in with the spade or setting stick, is a question frequently agitated. He is of opinion it is a matter of little importance to plants of this age, which method is practised, provided either be well performed. The size of the roots should determine." But "it would certainly be improper," he conceives, "to force a large root into a small hole, to the evident detriment of the plant, by its roots and fibres being bundled together in a mass, without the intervention of mould. It is equally improper to force a plant into a slit or gash, whose sides, by the operation of making it, are hardened and rendered impenetrable in a great measure, by the tender fibrils for a time, until rain, and the influence of the weather soften them." He, "therefore, for the better performance of both methods, would advise, 1st, for dibbling: that the ground be well broke in the operation of digging or trenching; that whatever is dug be also planted the same day, that it neither be dug nor planted in too wet or too dry a state; that the hole be made large and loose by a twitch of the hand; that the plant be just sufficiently fastened to keep it in proper position; and that at the end of each day's work, the whole be levelled, and the earth closed to the stems of the plants with a short headed rake. 2d, for laying in with the spade; that (instead of digging over the ground first, and then planting in a slit or gash, whereby the sides of the slit are hardened, and the roots crowded in), the digging and planting be both carried on together; that is, turn one furrow farther than where the row is to be placed, cut perpendicularly by the line; place in the plants; turn another furrow to their roots; turn a second, or, if necessary, a third furrow; cut and place as before, &c." Treading none, but smoothing all with the rake.

And "the ash and the mountain sorb should also remain two years in the seminary. The poorest soil in the nursery should be their portion, reserving better for the kinds to follow." They should also be planted "in lines twelve inches asunder, and four in line. The roots of both being moderately trimmed with the knife.

"The beech and the oak are also to remain two years in the seminary, and should be planted in good soil, in lines fifteen inches apart, and five or six in line. Their roots should on no account," he says, "be pruned at this time; otherwise not one half of the plants will strike.

"They should," he says, "remain for two seasons in this situation; at the end of the first, let their tap roots be cut at the depth of six inches below the surface, a person rutting on each side the row, with a spade sharpened on purpose, so as to effectually cut the tap root of each plant, with as little injury to the upper part as possible, then pointing up the intervals of the rows, levelling all to the stems of the plants." He thinks that "at the end of the second season, the plants will have made fibry roots, and be fit for removal to almost any situation. But, if for any particular purpose it be necessary to nurse them longer, in that case they should be transplanted next season, into fresh nursery-rows; allowing them a little more room, and shortening all roots which have a tendency downwards."

"The common chesnut, and the horse-chesnut should also stand two years in the seminary, and any part of the nursery will suit them. They should then be planted in lines fifteen inches apart, and four or five in line. Their roots may be gently pruned. They should stand two or three seasons according to their progress in this situation. Being chiefly ornamental plants, and designed for the less untoward situations, they are frequently required of larger size. If so, at the end of the second season, they should be moved and planted into rows eighteen or twenty inches apart, and eight or nine inches in line; previously shortening all roots which tend downwards, and tapping, as advised above for beech and oaks.

"The elm, the hornbeam, and the sycamore, are sometimes removed from the seminary at one, and sometimes at two years old; he prefers the latter, planting them in lines at twelve inches apart, and four in line. The roots may be gently pruned

if needful." And, "at the end of the second season, they will be fit for removal to any situation, where soil to the depth of four inches is found; but if intended for more barren sites, they should be removed at the end of the first year.

"The larch," he thinks, "should never remain more than one season in the seminary. He is convinced of this, from having made a variety of experiments for ascertaining the quickest and most advantageous methods of rearing this useful tree. And the result of these experiments has proved to his entire satisfaction, that a healthy seedling of one year, also nursed one year, in moderately good soil, having a sufficiency of room, and being kept properly clean of weeds, will, in any soil or situation wherein it may afterwards be placed, outgrow another of any age within the seventh year after transplanting. He has planted many of this description, and within that period has measured them fifteen feet in height; while those on the same spot, planted the same day, and which were, some two, some three years nursed, did not measure above twelve feet, nor were so straight or beautiful."

In fine, he has found "the progress of this plant, in infancy, follow in this rotation on all soils where he has made the experiment; and these have been very different in quality and depth:—

One year seedling	One year nursed.
Ditto ditto,	Ditto, removed, and nursed a second year.
Ditto ditto,	Nursed in the same row two years.
Two-year seedling,	One year nursed.
Ditto ditto,	Ditto, removed and nursed a second season.
Ditto ditto,	Nursed in the same row two years.
Ditto ditto,	Ditto for three years.

"If this be the case, may we not also, says he, suppose, that, since the first outgrows the others in infancy, and on good soil, it will continue to surpass them on bad and shallow soils; since, by reason of its small size, it could be more effectually planted? Whether of the two, he asks, would be most apt to suffer by inclement weather, and consequently soonest get stinted?" It is therefore recommended that the plants be taken from the seminary at one year old, and nursed one year, in rows twelve inches apart, and four in rows. If plants of a greater size be wanted, they should be removed at the end of one, and nursed another year, in lines fifteen inches apart, and six in line. Beyond this the larch should never, he thinks, be nursed. The infant tap roots may be shortened a little; but after this they should not be pruned at all.

"The Scotch fir, and the Weymouth pine, the former, unless for the purpose of decoration, or where it is wanted for variety, is never nursed, but taken from the seminary at two years old, and then planted out for good." Mr. Nicol approves of this practice, provided the plants stand thin in the seminary; but otherwise, he thinks, they should be nursed one year in lines a foot asunder, and an inch in line. If they are required of a larger size, they should be removed from this into other nursery lines, at twelve or fifteen inches apart, and four or five in line, according to the time they are to remain there, which, however, should not be longer than two years for any purpose whatever."

In respect to the Weymouth pine, "it should also stand two years in the seminary, and then be nursed two or three years in rows; according to the purpose intended, or the quality and depth of soil wherein it is afterwards to be planted. In either case, fifteen inches between the lines will, he says, be sufficient; and if they are to remain two years, four in line; but if three, five or six. The tap roots of the seedlings of either may be shortened a little; but at the second, or any subsequent removal, their roots must not be touched."

The common, or Norway spruce should, he says, "be removed from the seminary at two years old, and nursed in lines twelve inches apart, and three in line, for two seasons. At the end of which, remove them into other lines fifteen inches apart, and four or five in line; there to remain one, or at most two years, in proportion to their progress, or the soil they are to be planted in. If they are intended for *very* barren sites, plants nursed for two seasons *only* are to be preferred. He thinks the roots of this plant should not be pruned at any time, if it can be avoided; nor indeed, should any of the resinous tribes, except a small bit of the tap roots of seedling infants."

The American spruce, and the silver fir, are also, he says, "to be taken from the seminary at the end of the second year, and planted in lines twelve inches apart, and four in line: nursing them there for two seasons, and then removing them into other lines, eighteen inches apart, and six in line; there to remain for one or two seasons more, according to circumstances. Longer they should not be nursed. If they were intended for bleak exposures and barren soil, they should be removed thereto at the end of the two first seasons of nursing."

The quick, or white thorn, which is a most useful plant, may remain either one or two seasons in the seminary, according to the progress it may have made: then planting in lines twelve inches apart, and two in line: at the end of one season, removing the plants into other lines twelve inches apart, and four in line. Their roots may be gently pruned. He observes, that "the reason of removing them at the end of the first year, is to encourage the progress of their fibry roots. At the end of the second, they will be fit for *hedging* in any situation whatever; nor will plants of any age or size outgrow them within the third year, if they are properly kept clean afterwards, as he has proved by repeated experiments made impartially on very different soils and situations."

In regard to time of planting, for the deciduous kinds, he esteems, from the middle of February to about the twentieth of March, the most eligible season. And for the evergreens, from the twentieth of

July to about the middle of August; taking advantage of wet or cloudy weather, and frequently watering in hot, dry weather, till the plants have struck root."

The plants, of all descriptions, should be carefully kept clean of weeds in the summer months; and the interstices of all rows, which stand over year, be pointed in with a narrow spade, in any of the winter months, being careful not to injure the roots of the plants in the operation. And in respect to pruning, the evergreens must not be touched, unless they put forth rival stems or leaders; in which case, the weakest must be displaced. The larch is to be treated in the same manner. All branches of the deciduous kinds which seem to rival the stem in size, or take upon them the office of leaders, are to be cut clean off by the bole with a sharp knife.

NUSHED, a provincial term applied to young animals, to signify their being stinted or starved in bringing up.

NUTRITION, the natural process by which an animal's strength is supported and its growth increased.

NUTRITIOUS Parts of Plants, such parts as afford the nourishment and support of animals. In this respect there is considerable diversity in different sorts of plants, as well as in the different parts of which they are constituted. Dr. Darwin has suggested that those vegetables or parts of vegetables which approach nearest to the nature of animal bodies, are the most likely to supply the greatest proportion of the nourishing material. Hence the esculent mushrooms, the gluten of wheat or other substances, and the oils of seeds and kernels, may be placed in the first rank in this intention. And that as the chyle of all such animals as have red blood, is supposed to be nearly similar, and to consist chiefly of sugar, mucilage, and oil; it may be concluded that those vegetables which contain the largest proportion of such materials, or of such as are capable of being converted into them by the process of digestion, may occupy the next place in respect to their nutritive properties, for such animals; provided that no noxious substances be combined with such useful properties, so as that they cannot be easily separated from them. But though this be the case with these substances, there are others that may nearly supply an equal proportion of nutriment, from their great facility of being changed into sugar or mucilage, as those which abound in farina, consisting of meal or starch, which is partly converted into sugar, and partly into mucilage, in the process of melting, as well as many others.

The sap wood or alburnum of most trees, it is likewise suggested, affords much nutritious matter, in the winter months. This curious subject may be seen more fully handled in the Phytologia of the above author.

O

OAK

OAK

OAK TREE, a well known forest tree, much cultivated for the purpose of timber.

There are many species of the oak, but that of most importance as a timber tree is the English oak, which grows to great stature, and lives to a great age. It is described as being from sixty to a hundred feet in height, with a very large trunk, a very spreading head, oblong leaves broadest towards the top, the edges acutely sinuated with obtuse angles.

Mr. Marshall observes, that "the root of the oak strikes deep, especially the middle or tap root, which has been traced to a depth nearly equal to the height of the tree itself: nor do the lateral roots run so shallow and horizontal as those of the ash and other trees; but perhaps the roots of very few trees range wider than those of the oak. The stem of the oak is naturally short, and if left to itself, in an open situation, it will generally feather to the ground. It has not that upright tendency as the ash, the esculus, and the pine tribe: nevertheless, by judicious pruning, or by planting in close order, the oak will acquire a great length of stem; in this case, however, it rarely swells to any considerable girt."

He adds, that "the English oak admits of some varieties: indeed," he thinks, "if we attend minutely to particulars, we shall find them almost infinite. There is one variegation under the name of the stripe-leaved oak: but the most interesting variety of the English oak is the Lucombe or Devonshire oak. In the sixty-second volume of the Philosophical Transactions, a particular account is," he says, "given of this oak; setting forth that Mr. Lucombe, a nurseryman near Exeter, having, about the year 1765, sowed a parcel of acorns saved from a tree of his own growth, and observing that one of the seedling plants preserved its leaves through the winter, he paid particular attention to it, and propagated, by grafting, some thousands from it. Its being a sub-evergreen is not the only peculiarity of this variety; it has, he says, a somewhat more upright tendency, and seems to be of a quicker growth than oaks in general. The plants however, which he has seen, do not answer altogether the description given in the account above mentioned."

And the *willow-leaved* OAK likewise grows to be a large timber tree. It receives its name from its leaves resembling very much those of the common willow. These long narrow leaves have their surface smooth, and their edges entire; their acorns being almost covered with their large cups.

It has several varieties; some having shorter leaves, others broader, and hollowed on the sides; some large acorns, others smaller, &c. all of which are included under the appellation of willow-leaved oaks.

The *chesnut-leaved* OAK also grows to be a large timber tree; and in North America, where it grows naturally, the wood is of great service to the inhabitants. It is so called, because the leaves greatly resemble those of the Spanish chesnut tree. They are about the same size, smooth, and of a fine green colour.

And there are two or three varieties of it; but the leaves of all of them prove that they are of the species called the chesnut-leaved oak; so that nothing more need be observed, than that the leaves of some sorts are larger than those of others; that the acorns also differ in size, and grow like those of our English oak, on long or short footstalks as it may happen.

The *black* OAK, which is a tree of lower growth, seldom rising to more than thirty feet in height. The bark of this tree is of a very dark colour, which occasioned its being named the black oak. The leaves are smooth, very large, narrow at their base, but broad at their top, being in shape like a wedge: they have indentures at the top, so as to occasion its having an angular look; they are of a shining green colour, and grow on short footstalks on the branches.

There are varieties of it, particularly with *trifid*

leaves, and slightly trilobate, called the black oak of the plains, the leaves and cups of all which are small.

The *red Virginia* Oak, which grows to be a timber tree of sixty or seventy feet high, and the branches are covered with a very dark coloured bark. It is called the red oak from the colour of its leaves, which in the autumn decline to a deep red colour.

There are several varieties of it, the leaves of which differ in size and figure; but those of the larger sort are finely veined and exceedingly large, being often found ten inches long, and five or six broad. They are obtusely sinuated, have angles, and are of a fine green colour in the first part of the summer, but afterwards change by degrees to red, which marks these trees to be of this sort. There are also several subvarieties of it, which exhibit a manifest difference in the size of the leaves, acorns, and cups. That is the best which is commonly called the Virginian scarlet oak; and the bark is preferred for the tanners' use before that of all the other sorts.

The *white* Oak, which does not grow to the size of the former, seldom being found higher than forty feet even in Virginia, where it grows naturally. But though the timber is not so large, yet it is more durable, and consequently of greater value for building to the inhabitants of America, than any of the other sorts. The branches of this tree are covered with a whitish bark; the leaves also are of a light colour. They are pretty large, being about six inches long and four broad. They have several obtuse sinuses and angles, and are placed on short footstalks.

It has a variety or two; and the acorns are like those of our common oak.

In the *Italian* Oak, which grows to about the height of thirty feet, the branches are covered with a dark purplish bark. The leaves are smooth, and so deeply sinuated as to have some resemblance of pinnated leaves; and each has a very short footstalk. The fruit of this species sits close to the branches. The cups are in some degree prickly and rough, and each contains a long slender acorn, that is catable. In the places where these trees grow naturally the acorns are, in times of scarcity, ground into flour, and made into bread.

The *Spanish* Oak, which grows to be as large a tree as our common oak, and is no way inferior to it in stateliness and grandeur; for the branches will be far extended all around, causing, with the leaves, a delightful shade. Though the bark of these branches is of a whitish colour, yet they are nevertheless spotted with brownish spots. The leaves are of an oblong oval figure, but not very long, seldom being longer than three inches, and two broad. They are smooth, and have their edges deeply serrated. These serratures are acute, and chiefly turn backwards. Their upper surface is of a fine light green colour, and their under of an hoary cast; and with these beautiful leaves each branch is plentifully ornamented all over the tree. The cups are most peculiar and singular; for they are very large, and composed of several rough, black, large scales, that lap over one another like the scales of a fish. They almost cover the acorn, though they are pretty large, narrow at the bottom, but broader higher, and have their top flat. The acorns are used in dyeing.

The *Austrian* Oak, which is of lower growth than the preceding species, seldom rising to more than forty feet high. The leaves are of two colours; their upper surface being of a fine green colour, and their under downy. Their figure is oblong; but they are so indented about the middle, as to make them have the resemblance of a lyre. They are wing-pointed, transversely jagged, and stand on slender footstalks on the branches. The cups of this sort also are smaller and prickly, and the acorns proportionally smaller than those of the preceding sort.

There are some other sorts mentioned by writers on rural economy, but they are not of much consequence to the planter.

All the sorts of oaks are raised from acorns, which should be sown as soon as possible after they are ripe; for if they are kept too long out of the ground, they seldom grow.

The manner of sowing the acorns, if designed for a small plantation, or to be removed, is, to prepare some beds of fresh earth, neither too strong and heavy, nor too light and dry; in these beds the acorns should be placed in rows one foot asunder, and about two inches distance in the rows, covering them about two inches thick with the same fresh earth.

In the spring, when the plants begin to appear, they must be carefully cleared from weeds; and if the season proves dry, refreshed now and then with a little water, which greatly promotes their growth. In these beds the plants should remain until the following autumn, observing constantly to keep them clear from weeds; at which time a spot of good fresh earth, in size proportionable to the quantity of plants, should be trenched and levelled for preserving them: then towards the middle or latter end of October, the plants should be carefully taken up, so as not to injure their roots, and be planted out in rows three feet asunder, and eighteen inches distance plant from plant; observing never to suffer the plants to abide long out of the ground before they are planted, as their roots would dry, and endanger their growth.

When they are planted, a little mulch should be laid upon the surface of the ground, near the roots, to prevent the earth from drying too fast: and if the season should prove very dry, a little water should be given to settle the earth to their roots.

When the plants have taken root they will require little more care than to keep them clear from weeds, and dig the ground between the rows every spring; in doing of which such roots as extend very far from the trunk of the trees should be cut off, which will render them better for transplanting again: also prune off such side-branches as extend themselves very far, and would retard the upright shoot; but not by any means all the small lateral branches, some of which are absolutely necessary to be left on, to detain the sap for the augmentation of the trunk; for, where trees have been thus closely pruned, their heads have overgrown their bodies, so that they have bent downward and become crooked.

When these trees have remained in the nursery three

or four years, they will be large enough to transplant to the places where they are to remain; for it is not proper to let them grow very large before they are planted out; as they are very hazardous trees to remove when old, or after they have taken deep root.

The season for this work is, in the autumn; at which time, if they are carefully taken up, there will be little danger of their succeeding. When they are planted, the surface of the ground should be mulched about their roots, to prevent its drying too fast; and if the season is very dry, they should be watered, to settle the earth to their roots, which may be repeated two or three times in very dry weather; but carefully avoid giving them too much water, which is very injurious to these trees, when newly removed. They should also be staked to prevent their being shaken and disturbed by the winds, which would retard their rooting. In transplanting of the trees, by no means cut their heads, which is too much practised: all that should be done is only to cut off any bruised or ill-placed branches, which should be taken off close to the place where they are produced: but there can be no greater injury done to these trees than to shorten their shoots; for when the leading bud, which is absolutely necessary to draw and attract the nourishment, is taken off, the branch often decays entirely, or, at least, down to the next vigorous bud.

The trees, thus raised and managed, when planted in a proper soil, grow to a considerable magnitude, and are very proper for a wilderness in large gardens, or to plant in clumps in parks, &c.

The directions here given are, however, designed only for small plantations in a garden or park, which are only for pleasure; but where these trees are cultivated with a view to profit in timber, the acorns should be sown where the trees are designed to grow, in order to which, provide in autumn a sufficient quantity of acorns, which should be always taken from straight, upright, vigorous growing trees; these should be gathered from under the trees as soon as may be after they are fallen, and, if possible, in a dry time, laying them thin in some open room to dry. Those which are transplanted will never grow to the size of those which stand where they are sown, nor will they last near so long sound: for in some places, where these trees have been transplanted with the greatest care, and have grown very fast for several years after, they are now decaying, while those which remained in the place where they came up from the acorns are still very thriving, and have not the least sign of decay: therefore, whoever designs to cultivate these trees for timber, should never think of transplanting them, but sow the acorns on the same ground where they are to grow; for the timber of all those trees which are transplanted, is not near so valuable as that of the trees from acorns. In this business, the first thing to be done is that of fencing the ground very well, in order to keep out cattle, hares, and rabbits; for if these animals can get into the ground, they soon destroy all the young trees. In a few years the trees grow to be out of danger from the hares and rabbits; but it will be many years before they be past injury from cattle, if they are permitted to get into the plantation; therefore durable fences should be put round the ground. If, in the beginning, a pale fence is made about the land, close at the bottom, and open above, and within it a quick hedge planted, the latter will become a good fence, by the time the paling decays, against all sorts of cattle; and when the trees will have got above the reach of hares and rabbits, so that they cannot injure them.

After the ground has been well fenced in, it should be prepared by ploughing it three or four times, and after each ploughing, harrowing it well to break the clods, and cleanse the ground from couch, and the roots of all bad weeds. If the ground is broken up from green sward, it will be better to have one crop of beans, pease, or turnips, off the ground, before the acorns are sown, provided these crops are well hoed to stir the surface, and destroy the weeds: if this is properly done, the crop will improve the land for sowing; but in this case, the ground should be ploughed as soon as possible after the crop is taken off, the acorns being sown as soon as they can after they are ripe; for although they may be preserved in sand for some time, they will be apt to sprout, by which the shoots are in danger of being broken and spoiled.

In making choice of acorns, those should be preferred which are taken from the largest and most thriving trees; but those of pollard trees always rejected, though the latter are generally the most productive of acorns. Those obtained from the large trees commonly produce the strongest and most thriving plants.

The ground having been thus ploughed and levelled, the acorns should be sown in drills made across the ground, at about four feet asunder, and two inches deep; being scattered in at two inches distance. These drills may be drawn either with a drill-plough, or by hand, with an hoe; but the former is the most expeditious method; therefore in large plantations should be preferred. In the drawing of the drills, if the land has any slope to one side, these should be made the same way as the ground slopes, that there may be no stoppage of the wet by the rows of the plants crossing the hanging of the land. This should be particularly observed in all wet ground, or where the wet is subject to lie in the winter. When the acorns are sown, the drills should be carefully filled in so as to cover the acorns securely; for if any of them are exposed, they will entice the birds and mice; and if either of these once attack them, they will make great havock with them.

The reason for directing the drills to be made at this distance, is for the more convenient stirring of the ground between the rows, to keep the young plants clean from weeds: as if this is not carefully done, it cannot be expected that the young plants should make much progress; and yet this is generally neglected by many who pretend to be great planters, who are often at a large expense to plant, but seldom regard them after: so that the young plants have the difficulty to encounter the weeds, which frequently

are four or five times the height of the plants, and not only shade and draw them, but also exhaust all the goodness of the ground, and consequently starve the plants: therefore, whoever hopes to have success in their plantations of this sort, should determine to be at the expense of keeping them clean for eight or ten years after sowing, by which time the plants will have obtained strength enough to keep down the weeds: the neglecting of this has occasioned many young plantations to miscarry.

About the end of March, or beginning of April, the young plants will appear above ground; but before this, if the ground should produce many young weeds, it will be good husbandry to scuffle the surface over with Dutch hoes, in a dry time, either the latter end of March, or the beginning of April, to destroy the weeds, whereby the ground will be kept clean, until all the plants are come up so far as to be plainly discerned; by which time it may be proper to hoe the ground over again; for by doing it early, while the weeds are small, a man will perform more of this work in one day than he can in three or four when they are grown large: besides, there will be great hazard of cutting off or injuring the young plants, when they are hid by the weeds; and small weeds, being cut, are soon dried up by the sun, but large weeds often take fresh root, and grow again, especially if rain should fall soon after, and then they will grow faster for being stirred; therefore it is not only the best method, but also the cheapest husbandry to begin cleaning early in the spring, and to repeat it as often as the weeds are produced. In the first summer, while the plants are young, it will be the best way to perform these hoeings by hand; but afterwards it may be done with the hoe-plough; for as the rows are four feet asunder, there will be room enough for this plough to work; and as this will stir and loosen the ground, it will be of great service to the plants: but there will require a little hand labour where the plough is used, in order to destroy the weeds, which will come up in the rows between the plants; for these will be out of the reach of the plough, and, if they are not destroyed, they will soon overgrow and injure the young plants.

After the plants have had two years growth, it will be proper to draw out some of them, where they are too close; in doing which great care should be had not to injure the roots of those that are left; for as the plants which are drawn out are only fit for plantations designed for pleasure, so these should not be so much regarded in their being removed, as to sacrifice any of those which are designed to remain. In these thinnings the plants at first should be left about one foot asunder, which gives them room enough to grow two or three years longer; by which time it may be easy to judge which are likely to make the best trees. These may be then fixed on, as standards, to remain; though it will be proper to have a greater number at this time marked than can be permitted to grow, because some of them may not answer the expectation; and, as it will be improper to thin these trees too much at one time, so the leaving double the number intended at the second thinning will not be amiss. If they are then left at about four feet distance in the rows, they will have room enough to grow three or four years longer; by which time, if the plants have made good progress, their roots will have spread over the ground, when it will be proper to take up every other tree in the rows. But, by this, it is not meant to be exact in the removing, but to make choice of the best plants to stand, whichever rows they may be in, or if they should not be exactly at the distance here assigned.

When the plants have been reduced to the distance of about eight feet, they will not require any more thinning. But in two or three years time, those which are not to remain will be fit to cut down, to make stools for underwood; and those which are to remain, will have made such progress as to become a shelter to each other; for this is what should principally be attended to, whenever the trees are thinned: therefore, in all such places which are much exposed to the wind, the trees should be thinned with great caution, and by slow degrees: for if the air is let too much at once into the plantation, it will give a sudden check to the trees, and greatly retard their growth: but, in sheltered situations, there need not be so great caution used as in those places: the plants will not be in so much danger of suffering.

The distance which should be allowed to those trees which are designed to remain for timber, is, from twenty-five to thirty feet, or more, which will not be too near, where the trees thrive well; in which case their heads will spread, so as to meet in about thirty, or thirty-five years; nor will this distance be too great, so as to impede the upright growth of the trees. This distance is intended that the trees should enjoy the whole benefit of the soil.

After one crop of the underwood, or, at the most, two are cut, the stubbing up the stools is advised, that the ground may be entirely clear, for the advantage of the growing timber, which is what should be principally regarded: but, in general, most planters have more regard for the immediate profit of the underwood than the future good of the timber, and, frequently, by so doing, spoil both: for, if the underwood is left after the trees have spread so far as that their heads meet, the underwood will not be of much worth: and yet by their stools being left, they will draw away a great share of the nourishment from the timber trees, and retard them in their progress.

The soil in which the oak makes the greatest progress, is a deep rich loam, in which the trees grow to the largest size; and the timber of those trees which grow upon this land, is generally more pliable than that which grows on a shallower or drier ground; but the wood of the latter is much more compact and hard. Indeed there are few soils in which the oak will not grow, provided there be proper care taken in their cultivation; though this tree will not thrive equally in all soils: but yet it might be cultivated to a national advantage upon many large wastes in many parts of the kingdom, as also to the great profit of the estates where these tracts of land now lie uncultivated, and produce nothing to the owner: as, should the

present practice of destroying this sort of timber continue, and little care be taken to raise a supply; this country, which has been so long esteemed for its naval strength, may be obliged to seek for timber abroad.

In an excellent paper, by the Rev. Mr. Yates, inserted in the twentieth volume of the Transactions of the Society for the Encouragement of Arts, &c. and to which the silver medal was awarded, there are many useful hints on the culture of this sort of tree intended to obviate the difficulties that have been thrown in the way of it. The intelligent writer remarks, that "an opinion is generally prevalent, that the oak is particularly slow in its growth, and requires a great number of years before it affords any advantage. This idea too often, says he, deters from planting, on account of the very great length of time it is supposed the land must be occupied before any return of valuable produce can be obtained from it, after a considerable expense may have been incurred in forming plantations." But "this opinion he considers as entirely founded in error, and to have taken its rise in a great measure from the want of proper management that has hitherto commonly prevailed in the raising of oaks." He conceives however, on the ground of experience, "that the oak may be rendered very rapid in its growth, and that consequently land may be employed to great advantage in its cultivation, as a very considerable and profitable produce may, in a much shorter time than is generally supposed, be derived from proper parts of an estate thus employed." It is added that, "oak-timber in this country, for the most part, appears in trees of a considerable extent of head, but seldom more than twenty or thirty feet in stem; and this, in many instances, the growth of a century. Now, says he, by the course of management here proposed, it is conceived that trees, of at least double this magnitude, may be obtained in about half that time; but it is not his intention to attempt a proof of this proposition by theoretical deductions, but to appeal for its confirmation to the indubitable test of fact, which from the event of repeated trials, impresses a conviction, that experience will be found to support and establish in the most unequivocal manner."

After declining to enter "much on the various qualities of soil, the nature and process of vegetation, and the peculiar properties of the oak," which are amply handled by other writers, he proceeds to the more practical part of the subject, and observes, that "the oak, in the progress of its growth, spreads numerous roots near the surface of the ground, and in an horizontal direction: these assist in supporting and preserving the tree in its position, but seem, he thinks, to contribute very little to its increase and magnitude. The oak appears, he says, to derive its chief nutriment and strength from a root that always descends at right angles to the horizon, and is called the tap-root. The first thing, therefore, to be observed is, that upon a judicious attention to this peculiarity, the planter's success principally depends; and the neglect of this care is the constant source of error and disappointment. In all climates and upon all soils, to preserve this tap-root from injury, and as much as possible to assist its growth, is, he conceives, a general, and indeed the most essential principle in the cultivation of oak. With a due regard to this circumstance, the management of a plantation may, he says, be resolved into the three following practical directions:

"Previously to planting the acorns, loosen the earth intended for their reception, by deep trenching.

"Never transplant, or in any way disturb the saplings intended for timber.

"Keep the plant carefully pruned, till arrived at a proper height."

But in order "more fully to elucidate the subject, and to prevent the possibility of misapprehension, it may be proper, he supposes, to give a more detailed statement." And he thinks that in "determining on a spot to form a plantation of oaks for timber, it must always be recollected that the plants are to remain without removal in their first situation: the clearing and fencing may then be attended to as usual; and in the course of the winter, from September to March, the particular spots intended for the reception of acorns, be prepared for that purpose, by digging a trench about three feet in width, and from three to six feet in depth, according to the closeness and tenacity of the soil. If grass-ground, the first spit should, he says, be placed at the bottom of the trench; and if more than one trench be necessary, they should be prepared in the same manner, preserving a distance of ten yards between each, if it be intended to employ the intermediate space in underwood, or for any other purpose." Then "having made a careful selection of acorns that are perfectly sound, and in good preservation, they are to be planted about the middle of March." For this purpose he advises to "draw a drill in the centre of the trench; two inches in depth, if the soil be heavy and loamy; but three inches in a light and sandy earth: and in this to place the acorns two inches asunder, and cover them carefully with mould. When the plants appear, they must be weeded by hand in the rows, and the earth of the trench round them cleaned with a hoe, once a month during the summer." In October he supposes it necessary to "inspect the rows, and thin them by pulling up every other plant: attention will of course be paid to remove the weak and crooked plants, and leave those that are tallest and straightest. On the second year, the operation of thinning must, he adds, be repeated, at the same time, and in the same manner; and, should any of the remaining plants have made side-shoots stronger than the general character, they must be smoothly cut off with a sharp knife, close to the leading stem. On the third year, the thinning is again to be repeated, and the general pruning commenced, by cutting off close to the leading stem all the side-shoots of the first year; thus leaving the branches of two years to form the head of the following year. The removal of every alternate plant must be continued yearly, till the trees are about thirty feet apart, at which distance they may remain for timber. The pruning is to be continued, by removing every year, very smooth and close to the main stem, one year's growth of side branches, till the plants are

arrived at a stem of forty, fifty, or sixty feet, and they may then be permitted to run to head without further pruning." But "the particular arrangement here recommended may be varied, he says, according to any peculiarities of situation, regard being constantly had to the general and most important principle of loosening the ground very deep previously to planting the acorns. By this mode of culture, he supposes, oaks may be raised in almost any soil; but, where it is possible, a loam or marle is always to be chosen. Oaks thrive much the best in such earth; and, when assisted by deep trenching and judicious pruning, attain in a few years to an immense size." He adds that "those who have been accustomed to notice the slow growth and stunted appearance of oak trees, when denied the assistance of art, and left to themselves in the common way, would observe with astonishment the vigorous and rapid increase of plants under the management now pointed out." And he further suggests, that "the plants thinned out the first three or four years, though not fit to be depended upon for timber, as transplanting generally injures very materially the future growth, may be replanted in the intermediate spaces between the rows, for the purpose of being afterwards removed; or they may be usefully placed in hedges, or other spare and unoccupied spots of ground. They should be headed down at the time of transplanting, as this operation assists the process of nature, in reproducing or remedying any injury the tap-root may have received from the removal: and, if proper attention be given to loosening the soil for their reception, and pruning them as they advance, in most instances an adequate profit will, he thinks, be derived from the labour bestowed upon them. After a few years, the produce of the timber-plantation will be found very advantageous. The young trees that are to be removed yearly, will always find a ready market for a variety of purposes, unnecessary here to enumerate." In addition to these advantages, if, says he, "by this treatment of deep trenching previous to planting, and annual careful pruning during the growth, timber can be produced in about fifty years of equal quality, and much superior in size to that which has been above one hundred years growing under improper management, or without the assistance of cultivation; it will doubtless be allowed that a most beneficial, if not absolutely the best possible method of raising oaks, is here pointed out and ascertained." But, says he, "this method of cultivation may perhaps be thought to occasion so much expense in manual labour as to prevent its being generally adopted: it might perhaps be sufficient to observe, that if the work be conducted with judgment and economy the future produce would afford ample returns for all necessary expenditure: it should also be recollected, that the previous preparation of the ground, and the subsequent pruning of the plants, are both to be performed at that season of the year when a scarcity of work will enable the planter to obtain assistance upon easier terms; with this additional advantage also, of providing employment for the labourer at those times when the general state of agricultural business renders it difficult for him to find maintenance for himself and family without charitable relief."

It is stated in support of this practice, that "in 1750, at Ingestrie in Staffordshire, the seat of Lord Chetwynd, some plantations were formed and managed in a great measure according to these principles, and the growth of the plants was so uncommonly rapid, and so extraordinary, that it could not but attract the notice of all concerned in the conduct of them. The attention to the subject, then excited, has been the occasion and ground, he says, of all the observations and experiments made from that time to the present, the result of which is here given." And it is added, that "the extensive plantations of the late Lord Denbeigh, at Newnham Paddox, in Warwickshire, are well known and much admired. The whole has been conducted with great judgment. About a square acre has been employed in raising oaks upon a plan nearly similar to that here proposed, and affords the best and most convincing proof of the superior utility and efficacy of such management."

It is concluded from "the statements made here and from what may be seen in every part of the kingdom, in the character and appearance of oaks growing without cultivation, that 'it seems ascertained, that acorns set with the spade or dibble, without digging or tillage,' can never be depended on to form good timber; and even in the most favourable circumstances of this case, the growth will be exceedingly slow and precarious. The same may be said of 'young plants, previously raised in nurseries, and transplanted;' for if the tap-root be cut, broken, or in any degree injured, which in transplanting it is almost impossible to avoid, that plant will seldom become a vigorous and flourishing tree."

It is supposed, that "the raising even one acre in the manner here ascertained might be productive of great pecuniary advantage, if the facts and experience thus detailed are permitted to prove the inutility of the other two methods, and consequently to remove the necessity of employing so much ground upon them, at an expense they will never repay."

The facts mentioned in a preceding volume of the Transactions of the same society by Lewes Magendie, to whom the gold medal was awarded, strongly confirm the propriety of the above principles and practice.

It is stated that he planted five thousand three hundred oaks in two separate inclosures, and that "the first plantation, containing four thousand six hundred oaks, was formed on part of the ancient Home Park, surrounding the castle: the soil was dug one full spit, and the turf inverted; the plants were two-years old seedlings, removed with the greatest care from the seed-bed, by undermining the roots, so as to bring them up undamaged and entire in the strictest sense: the sub-soil of the intended plantation being a rich tender loam, holes were bored into it with an iron instrument, used in the country for fixing hop-poles into the earth: into these the trees were planted, using great caution that each seedling should

have a hole suitable to the length of its tap-root, which they were careful to set upright, and without doubling it: the tap-roots of these plants were from eighteen to thirty-six inches in length." He adds, that, "his motives for planting the trees without shortening their tap-roots, were these: it has long been asserted, that the oak suffers greatly in value from transplanting, and that the timber of such trees is of an inferior quality to that produced by sowing the acorn." These facts were well known to Millar and Hanbury.

It is further stated that "a common practice in planting oaks, is to sow the acorns in a bed; and, after one or two years to transplant the seedlings into rows in a nursery, where they remain two or three years longer; when the young trees are taken up, and their tap-roots being previously shortened, are finally planted out.

"Now, says he, by this process, it is plain the tree undergoes two removals before it is finally planted. To avoid this, he determined to plant out his oaks at once from the seed bed, with an idea that, by their receiving only one check instead of two, and this at so early an age, they would soon recover it, so as in the end to suffer no sort of detriment; more particularly as by preserving their tap-roots entire, the trees were planted as much as possible in a natural state." He has observed, that, "with some it is not unusual to plant out young oaks immediately from the seed-bed, but they are for the most part *tapped* at the time of removal; or, this operation is previously effected by an instrument introduced beneath the soil that divides the root, whilst the tree is still growing; after which it is suffered to remain in the ground several years before it is finally removed: but in both these instances the intentions of nature in respect to this tree seem, he says, to be violated. — Would it not, he asks, be preferable, upon all occasions of transplanting, with a view to timber, to remove the trees at as early an age as possible, and without any mutilation, from the seed-bed to the soil where they are to grow? By which, if the seminary (as it ever should be) is at no great distance from the land intended to be planted, and that the essential requisite of taking up the trees with the utmost care is attended to, the removal will be hardly, if at all, felt; and, at all events, until the question is decided, whether it is best, in order to procure timber of the first quality, to sow acorns where they are to remain, or to transplant oaks, it is but reasonable that the practice of transplanting (generally considered as inferior to that of sowing), should be conducted with as few deviations from nature as possible."

It is remarked, by the able writer, that, "at the time of forming this plantation (December, 1786), he made the following experiments, with a view to a comparison between young oaks planted with their roots entire, and those whose roots had been *tapped*. On the 5th of that month, he selected from his seedling oaks twenty-four of the straightest, and which were of an equal length, namely, three feet six inches from the extremity of the tap-root to the top of the plant, the root alone being twenty-seven inches, and the plant fifteen inches in length; twelve of these were planted in the same manner as the rest of the oaks in the inclosure with entire roots, and at the distance of five feet from each other: contiguous to these, and at the same time and distance, the remaining twelve were planted, taking off previously eighteen inches from their tap-roots, so that nine inches only of root remained." And as he wished to observe the progress of these trees, at the expiration of a few years; on the 6th of December 1791, he caused one of each to be carefully dug up, which he found in the manner described below.

But he does not, however, pretend "at present to draw any accurate conclusion from this experiment; for indeed it must, he says, require long experience, and a course of years, to form decided opinions concerning a tree of such slow growth as the oak. He purposes, however, continuing his remarks upon these trees thus experimentally planted, by digging up others from time to time, in order to observe the comparative progress of their roots. His intention in thus planting these trees and remarking at various periods the degrees of difference between their growths, was, he says, with a view of ascertaining hereafter, whether the planting of perfect oak seedlings, without dividing their tap-roots, might not be the means of insuring better timber than by the usual method of planting those which have been previously *tapped* for admitting the oak, from the unremoving acorn, in all cases, to arrive at a superiority of timber to that of the transplanted tree, at however early an age it is removed: still, as long as the practice of transplanting oaks is in use, it may be presumed that a seedling removed with proper care from the seminary, and planted entire, will prove superior to one whose root has been mutilated; as having sustained in its treatment a less deviation from nature."

It is remarked "that, in the perfect tree, alluded to above, the tap-root has acquired a regularity of thickness in its general growth, and that its lateral shoots are mostly fibrous; because the tree, having remained in possession of its natural source of nourishment, was enabled, soon after being transplanted, to vegetate as before: on the other hand, the mutilated tree has thrown out a number of thick woody horizontal roots near the place where the tap root was shortened, as if nature, to preserve her produce, had been intent on repairing the damage she had sustained; after which, the root resumes its natural downward tendency, with a regularity that might almost induce an idea that the root had never been at all divided. But, to remove the most distant doubt on this head, others of these trees have been taken up, in which, after the most careful examination, the same distinct modes of growth appear, as in these. It may be farther remarked, he says, that these trees have not succeeded ill with him, when it is considered they have only been planted five years, and were at that time only fifteen inches in height from the ground.

On digging up the trees the following were the

Admeasurements of each:

Oaks planted with an entire Root.

	Feet.	Inches.
Extreme height from the bottom of the tap root	11	2½
Height from the ground	7	7
Circumference close to the ground	0	6¼

Oaks planted with a tapped Root.

	Feet.	Inches.
Extreme height from the bottom of the tap-root	10	3
Height from the ground	6	9
Circumference close to the ground	0	6½

"He could have selected larger trees from his plantation, but preferred the above for the sake of accuracy, as they were both planted the same day."

It is added, that "the second inclosure, at some considerable distance from the former, and part of the ancient great park of the estate, was planted with seven hundred oaks; and has in all respects received a similar treatment with the first. Both plantations are securely fenced, and in a very flourishing condition, the trees seeming suited to the soil. They have been carefully attended, and judiciously pruned; whereby they have acquired an upright growth, which, together with their being planted tolerably thick, will insure a length of stem." And he concludes "that, under a continuation of the present treatment, he can have no room to doubt the future success of the plantations."

These different statements clearly demonstrate the great advantage of the method of sowing the acorns in the situations where the trees are to remain, and that where this cannot be done, the next best mode is that of removing the plants when young, with their tap-roots intire.

It is obvious likewise, that, where these trees are cultivated on an extensive scale, the land may be well prepared by means of the trenching plough, with much less expense and with greater convenience than by manual labour.

In the Rev. Mr. Smith's trials, much advantage has been found in Yorkshire from the young oaks having shelter afforded by firs which have obtained a year's growth, "as in a plantation made in 1792, and which was last year joined, he says, to this, by another piece of land of about three acres then taken in. The oaks were there set at the same time as the firs, but on one part were not mixed with them; and in that part they thrived so ill, as to make no progress, until some Scotch firs were planted among them; since which they have assumed a different appearance, and are now growing tolerably well." And, "another advantage he has observed in planting, arises from having the holes made the year before the plants are put in: by this method the frost meliorates the sod, and makes it, particularly in bad land, finer, which encourages the fibres of the young plants to shoot more freely. He remarks that two lands in his plantation were not ploughed; and the reason that induced him to mention the circumstance, was the supposition that the trees would grow best upon the land that was ploughed. In this he has not been disappointed; those that were set upon the two lands not ploughed, having made less shoots than the other; and though they grow tolerably well, yet an evident difference is observable in the luxuriancy of their appearance, which certainly is, he thinks, an additional proof that ploughing the land, and making the holes the year preceding the planting of trees, is of material consequence in the success of an undertaking of this nature." This is the case, not only with the oaks but other sorts of timber trees.

It has been affirmed by Mr. Nichols, "that nothing assists more in the propagation and preservation of timber than thorns and bushes, especially where there are no fences to keep off cattle. Underwood, says he, never fails to bring a stock of timber on a favourable soil: and the destruction of bushes in lands not inclosed, will assuredly prevent a succession of timber, by depriving the young plants of their nurses, and leaving the acorns which are casually dropped exposed to various enemies. The constant cutting, therefore, of under-wood by the keepers in forests, under pretence of browse for the deer, is attended with the most mischievous consequences to the growth of timber. The unlimited mowing of fern is also extremely injurious to the growth of timber; for the fern shades the roots, and keeps the young plants moist and cool: and by cutting it up, the young trees are cut up with it as soon as they arise." On this ground, he advises the "making plantations without any previous preparation, as being the cheapest, and answering the purpose extremely well." Which may be an useful mode in forests, and wastes full of bushes: and "he has invented a good instrument for introducing and planting acorns among the bushes. But in raising a new wood, it must be much more effectual to prepare and clean the ground well, and to set the acorns in drills, that the young plants may be kept clean by horse-hoeing till they can bid defiance to weeds."

In respect to the comparison between sown and planted oaks, Mr. Plampin, of Chadacre in Suffolk, affirms, that the latter are so inferior to the former as to induce him to give a general condemnation of planting for timber. But Mr. Marshall endeavours to reconcile the dispute about sowing and planting, by observing that "where the strength of the lands lies in the substratum, while the surface soil is of an ungenial nature, we should sow, in order that the roots may strike deep: but on the contrary, when the top soil is good, and the bottom of an opposite quality, to plant, and thereby give the roots the full enjoyment of the productive part of the soil; or, under these last circumstances, sow, and tap the young plants as they stand, and thereby check their downward tendency, as well as strengthen their horizontal roots."

It has been remarked, that "in raising oaks for

timber, draining should be well attended to; nothing contributing more to their growth and health, than keeping the land dry, if it is in the least inclinable to be swampy.

The other sorts of oak may be raised by sowing the acorns in the same manner, letting them remain longer before they are planted out for good.

And it is observed by Mr. Marshall, in the second volume of the Rural Economy of Norfolk, that "oaks are observed to grow best, and make the finest plants and the most beautiful trees, when they are raised undisturbed from the acorn. The oak having naturally a strong tap-root, it is almost certain death to remove a large plant which has not been transplanted or tapped whilst young: nevertheless, if the tap-root has been properly taken off from the seedling plant, it may afterwards be removed at pleasure, with safety.

"Oaks may however, he says, be tapped by taking up the plants and taking off the tap-root with a knife, or it may be done as they stand, with a tapping iron, or even a common spade ground to an edge. This, being introduced at a proper depth beneath the surface of the ground, cuts off the tap-root; leaving the principal part of the lateral horizontal fibres undisturbed. When the plants have got large (four or five years old for instance), this is perhaps the safest way of treating them; for the lateral shoots in this case receive no check whatever, but continue to throw up a regular supply of sap to the plant: whereas, by taking them up and removing them into a fresh situation, they are several days before they begin to work; in which time the plant may receive irrecoverable injury.

"A seed-bed of oaklings, five years old, he treated in this manner: in March and April he tapped them all with common spades, ground sharp; pruned such as were in any degree straight; and headed down the rest near the ground, to throw out shoots to be trained. Not a plant, he says, is dead. Had there been more of them cut down the effect would, he thinks, have been still better."

It is added that "a striking instance of success in transplanting large oaks for standards occurs on Gunton Common. Scarcely a plant, of some thousands, has miscarried, and there are very few which do not flourish. A person who had some share in the business of this plantation, tells him that it was the employment of two men and a couple of horses, almost all the first summer after they were planted, to water them; not by a pailful, but by a hogshead at once; which served for the summer. This was, he thinks, a rational method: a pailful only tantalises and baulks the plant; whereas a hogshead deposited at its root affords a natural and regular supply, to to be drawn up leisurely by the sun during the course of the summer."

It is likewise observed, that "upon some estates it is the practice to put in, when a new hedge is planted, a holly at every rod, and an oak-plant at every two or three rods, among the white-thorn layer. This is an excellent practice, provided the young oaks be trained to a proper height before they be suffered to form their heads. For, in this case they will become a valuable source of timber, without injuring, in any material degree, the inclosures they grow between. It is the roots of the ash and elm, and the tops of low pollards and tall overgrown hedge-woods, which are injurious to the farmer. A timber-oak, of from fifteen to twenty feet stem, does very little if any injury either to the crop, or the hedge growing under it.

"But if, on the contrary, the oaklings thus planted, be suffered to rise with more than one stem, as stub-wood, or rising singly (which is seldom the case in a young hedge), they be permitted to form their heads at eight or ten feet high, with flat wide-spreading tops, they lose their intended value, and become nuisances, not only to the adjoining inclosures, but to the hedge in which they grow. Eligible, therefore, as it is to plant young oaks among hedgewood, the advantage to be obtained from it rests, he thinks, wholly on the after-management."

In this first volume of the Annals of Agriculture, Mr. Young says, that "oaks are of slow growth, but if you put them at proper distances amongst the quick growing trees, they will sometimes be drawn up beyond your expectations, and he cautions you to watch them, and to cut out such trees as crowd upon them, by transplanting them every third year into a nursery; they may be put out from six to ten feet high" And that "land that will let at from 12s. to 18s. per acre, for any given time, pays better, he thinks, than with wood, if you calculate the compound interest on the annual rent; but who, says he, is there that is so careful as to make it, or that can make it, on very small sums. He considers the appropriating of 50 acres out of every thousand, as laying by a small part of the income of an estate, that will not be missed, at compound interest, as an accumulating fund that frequently comes in very seasonable to stop a large gap." And he has now, of his grand-father's sowing, about 26 acres of as fine young oak timber as can be seen, which may be worth, in 25 or 30 years, 4000l. He has likewise, of his father's sowing, 20 acres to succeed them. His ancestors have done so much: he has only added about ten acres to the fund, chiefly of Scotch fir, on a poor soil where other trees have been tried, and failed; the thinning of these woods likewise pay a fair rent, after a time. He made a purchase upon which were 14 acres of wood-land; there are 400 oak trees upon it, that, in 30 years from the time of purchase, will sell for as much as the estate cost him, 1000l.

It has been remarked, that "one of the most essential things to be observed in the management of oak woods is the judicious thinning of them. When they are thinned so as to be about two feet distant, they may stand twelve or fourteen years, when every second plant may be taken out and sold for hoops or small poles: only observing that if the ground be good, and the trees take to growing well, they will want thinning sooner. In seven or eight years more the healthiest trees must be marked for timber, and the others cut down for poles, and the stools left for under-wood. In thirty years they will be useful for small scantlings, spars, rafters, battings, rails,

props, &c. not quartered." And, that during "this time, according to the opinion of some, they should never on any account be touched with the knife, axe, or pruning-hook. Some recommend the cutting off side shoots; others cutting them to the ground to make the better shoots. But, this is probably the reason why, when oaks are cut up in expectation of finding them clean timber, that a variety of rotten knots grown over with sound wood appear in them, being the places where boughs had been cut off. It is certainly the case where they are advanced in growth, but in their infant state it is generally allowed that they require judicious pruning." Mr. Marshall says, that, "to hack off a large bough from an aged tree is a crime of the deepest dye in the management of timber. But what relation has this mad act to the salutary operation of removing a twig from the stem of a young growing tree, or of pruning the boughs, or even removing the leader of a tree in a youthful growing state? In that case, the size of the wound and the exhausted state of the tree unite to prevent the healing, and a defect in the timber consequently takes place: whilst in this, the wound is inconsiderable, and the vigorous state of the tree enables it to cicatrize the sore, in a few months perhaps after the operation is performed." And "by freeing the stems of young trees from side shoots and keeping their leaders single, a length of stem is obtained; which by afterwards checking their upright growth and throwing the main strength of the head into one principal bough, by checking, not removing the rest, a crookedness of timber is had; and, what is equally necessary in ship-timber, a cleanness and evenness of contexture. The dangerous, and too often fatal defect caused by the decayed stumps of dead stem boughs being overgrown and hid under a shell of sound timber, a defect which every fortuitous tree is liable to, is by this provident treatment avoided: the timber from the pith to the sap becoming uniformly sound, and of equal strength and durability. So that, nothing, it is supposed, but prejudice of the most inveterate kind can reject a practice founded on the most obvious principles of nature and reason. The mischief done to hedge-row trees by injudicious lopping too generally observable, has arisen from the practice of taking large boughs from the stems of aged trees; not from training young trees, during the early stages of their growth."

OAK-*Bark*, the cortical substance stripped from the oak tree.

It is used in tanning of leather, and afterwards as a manure. See BARK and TAN.

OAK-*webb*, a provincial word applied to the May bug.

OAMY, a provincial term applied to such ploughed lands as are light, porous, and flowery.

OATS, the name of a well known species of grain, of which there are several varieties cultivated in different districts.

The most common sorts of oats cultivated in England, are the *white*, the *black*, the *brown* or *red* oat; the *blue*, the *Poland*, the *Friezland* or *Dutch*, the *Siberian* or *Tartarian* oat, the *Essex short small*, the *Churche's* oat, and the *potatoe* oat.

The *white* is the most common about London, makes the whitest meal, and is chiefly cultivated where the inhabitants live much upon oat cakes.

The *black* is more cultivated in the northern parts of England, and is esteemed a hearty food for horses. It bears a wet harvest well, and answers on the wettest soils.

The *red* oat is much cultivated in Derbyshire, Staffordshire, and Cheshire, but is rarely seen in any of the counties near London; though as it is a very hardy sort, and gives a good increase, it would be well worth propagating, especially in strong land: the straw is of a brownish red colour, as is also the grain, which is very full and heavy, and esteemed better food for horses than either of the former sorts.

The *blue* oat is said, according to Martyn, to have been sown about Kighley in Yorkshire. It is probably the same, he thinks, with what is cultivated in Lincolnshire, &c. under the name of *Scotch* greys.

The *Poland* oat has a short plump grain, but the thickness of the skin seems to have brought it into disrepute among farmers. The grains are mostly single, it has no awn, and the straw is short. It answers best on dry warm soils.

The *Friezland* or *Dutch* oat affords more straw, and is thinner skinned than the above. The grains are mostly double, the larger one sometimes awned, with the awn placed high.

The *Siberian* or *Tartarian* oat, which is considered by Mr. Marshall as a distinct species, unnoticed by Linneus. Each flower frequently contains three perfect florets, never less than two, with a pedicelled rudiment of a third. The panicle differs essentially from all the other varieties, the grains are thin and small, the largest awned, the small ones awnless; the straw is tall and reedy.

The *Essex short small* is, according to Mr. Young, remarkably short, and weighs better than most other kinds. It does well, he says, on any land that is tolerably dry.

The *Churche's* oat yields well; is white, and comes into ear more early than any other oat.

The *potatoe* oat, which is but lately introduced, is very heavy and yields largely.

Besides this species and varieties, there is another species sometimes grown, which is the *naked* oat, which Linneus observes, is very nearly allied to the foregoing, differing in little else, except that the grains quit the husks, and fall naked when they are ripe.

"It is sown in Cornwall, according to Martyn, in the poorest croft-land that has been tilled two or three seasons before with potatoes, and for the uses of the poor answers all the purposes of oatmeal. It is a small yellow grain, and for fattening calves accounted superior to any other nourishment."

The oat has an "annual fibrous root with the culm or straw two feet high and upwards, having the panicle various in the different varieties, but always loose with the subdivisions of it on long peduncles and pendulous. And the two glumes or chaffs of the calyx are marked with lines, pointed at the end, longer

than the flower, and unequal. There are usually two flowers and seeds in each calyx: they are alternate, conical, the smaller one is awnless, the larger puts forth a strong, two-coloured bent awn from the middle of the back: both are cartilaginous and fertile."

It has been stated by a late practical writer that "this sort of grain is hardy, and may be cultivated upon almost any kind of soil; but, as in others, it is the most productive on such as are strong, rich, and adhesive, and which have been newly broken up from the state of grass. It is, he says, suggested by the author of the report of Middlesex, that though this sort of grain generally sells lower than barley, yet, from its being a more certain crop, the superior utility of the straw for the food of cattle, and the increase in the quantity of produce, it is equal to barley for medium loams. And that for stronger sorts of lands, and those of the fen kind, it is greatly superior to it, though apt to leave the land in a more foul and compact condition. On the cold, tenacious, fenny, and wet descriptions of soils, the oat may indeed in many cases be sown with more advantage than any other kinds of crop, and likewise where lands cannot be put in a proper condition for barley crops.

"Oats succeed well, he observes, after almost every sort of green and root crops, but should not be cultivated after wheat, rye, or barley, where it can possibly be avoided, as the soil by such cropping would be too greatly exhausted. It has been observed, he says, by the author of Modern Agriculture that, in districts where improved methods of husbandry are adopted, oats are generally grown upon such lands as have been newly broken up from the state of grass, and that the practice is shewn to be perfectly correct, by the abundance of the produce in such cases."

Mr. Young, in his Calendar of Husbandry, after observing that white oats should be sown in March in preference to any other season, remarks that "in the general conduct of them the farmer should by all means avoid the common error of sowing them after other corn crops, by which they exhaust the land. They should always receive the same preparation as barley, nor ought a good husbandman to think of their not paying him as well for such attention as that crop. It is a very mistaken idea to suppose it more profitable to sow barley on land in good order than oats. He is from divers experiments inclined to think that oats will equal, and in many cases exceed barley. The superior quantity of the produce will ever be found to more than answer the inferiority of the price; which, however, sometimes exceeds that of barley.

"What good reasons are to be offered for sowing oats on land in such bad order that barley is not to be ventured in, he knows not. The common argument is their hardiness, which will give a middling produce, about sufficient to pay expences, and leave a trifling profit, when no other crop will do the like. But this is only proving them to be assistants of bad husbandry; nor is such a paltry profit, granting false premises (for he is well persuaded that common oat crops, among bad farmers, are but so much loss), an object that ever ought to influence good husbandmen. Why should a good farmer be at all solicitous to gain 10s. an acre, profit by oats after barley, &c.? Suppose, says he, his course to be, 1. Turnips; 2. Barley; 3. Oats: or, 1. Fallow; 2. Wheat; 3. Oats: in either of these courses, or in any other, where the oats follow another crop of corn, the profit of them must be small. What comparison with sowing clover with the barley, which will pay far more profit, and at the same time prepare, in the best manner, for that most beneficial crop, wheat? What but a fallow, or a fallow crop, can succeed the oats? How unprofitable, compared to the clover system!

"For these reasons he cannot but recommend that oats should be considered in the same light as barley, and never sown unless the land be in proper order for barley, or to sow them after a fallow crop, and clover with them, in the same manner as barley."

And to the practice of sowing them after turnips, the same "observations which have been made on barley, are equally applicable. The farmer should, he says, in the distribution of his farm, consider which of these two crops is likely to pay him best. This will very much depend on his soil. Warm forward sands yield as many quarters of barley, perhaps, as of oats; but upon various other soils, the produce of oats, compared with that of barley, will be as 4 to 3, and on some as 5 to 3. He should also take into consideration, he adds, the greater steadiness of price which oats have for many years yielded, in comparison of the price of barley; circumstances which may reasonably induce him to sow them in a larger proportion than is common among his neighbours. On the other hand, it is not, he well remarks, to be forgotten that they exhaust more."

In the method of putting in oats on lays, which, Mr. Young says, "is very common husbandry both on one ploughing of old grass, and on layers of shorter duration;"—"the method is to plough the land before the frosts, and to dibble in the spring, as soon as the weather is dry enough; but the soil must, from its nature, or from rolling, be in such temper as to permit the holes to stand, and not to moulder in, when the dibble is removed. In some cases, the safe way is, to plough, roll, and dibble immediately.

"But in very many cases (possibly in all) it is better, he thinks, to put pease in on light land, beans on stiff soils, and to follow these with oats or wheat according to circumstances: he has known oats which had produced inferior crops followed by oats again the next year, and produce largely; which proved that they wanted tilth. Pease or beans will rather improve than exhaust land when put in thus in layers, whereas two crops of oats will scourge the land too much. Let it, however, be well remembered, says he, that these observations are made (so far as they relate to old grass) on the supposition that the farmer will not or is not allowed to pare and burn, a method vastly superior, and which ought to be pursued in all cases where it is practicable."

The custom of cultivating oat crops in succession for several years is therefore, without doubt, equally absurd and improper, and should be generally exploded.

In what regards the preparation of the land for this sort of crop, it is recommended by Mr. Middleton, that "when it is intended to be grown after cole, tares, early peas, or such other crops as do not come off the ground later than the beginning of June, on soils that are too wet to admit of being ploughed in the winter season, to make a clean bastard fallow, laying the land up into ridges proper for being sown in the early spring. Or when after such clean crops as come off too late to admit of bastard fallowing, to plough only once, which should be as early as the business of the farm will admit, into ridges proper for putting the seed in." Where the land is inclined to be moist, the best mode is probably that of ploughing the land on to proper ridges, in the autumn, in order to its being rendered fine and mellow for putting in the crop in the early spring by means of scarifying and scuffling without any further ploughing, as has been shown under barley. See *Barley*.

Mr. Donaldson, in his account of the present state of husbandry in this country, has observed, that "whatever may have been the nature of the crop that preceded this, it is but in very few cases that more than one clean furrow is afforded. In some districts it is, he asserts, the common practice to plough the lands over that are intended for oats, in the autumn, in a particular manner, so as to expose as large an extent of surface to the influence of the atmosphere as possible. This in some places is termed by farmers *rib-furrowing*, and in others *slob-furrowing*; it is performed by turning over the furrows at the distance of from twelve to eighteen inches from each other on the unbroken land. In this way one half of the superficial part of the land remains unmoved, and the furrows being thrown on it, much surface is exposed, and the soil greatly improved, at the same time that the root weeds are destroyed. If this process be accomplished in the most perfect manner, and in the autumnal season, the soil is considerably ameliorated and improved by the frosts during the winter; and by being well broken down by the harrow in the spring, having a complete ploughing immediately before the seed is put in, the soil becomes in an excellent condition for this sort of crop, even where the land is of the stiff and heavy kind." On which the author of Practical Agriculture has remarked that "there can indeed be little doubt but that, by the lands undergoing a more full and complete preparation than is usual for this crop, the quantity of produce may be greatly increased, as the fibrous roots of the plants are more enabled to extend themselves in the loose earth, and thereby to afford a more perfect support to the plants. In some cases, as where the land has been much reduced and exhausted by the previous crops, or in breaking up thin poor soils where the proportion of turfy material is considerable, and when the prices of other sorts of grain are low, it may be advantageous to have recourse to the use of manure, as by such means it is probable that a third more produce at least might be grown."

In respect to the time of sowing, or putting this sort of crop into the ground, Dr. Dickson says "it is necessary to keep in mind that the earlier the seed is put into the ground, the sooner in general the crop will be ready to cut. In the more southern parts of the kingdom, it is often, he observes, the case to put this sort of seed into the earth towards the latter end of February, when the season is dry and fine; but March is in general the oat seed season. On such soils as are naturally dry and parching, it is however by much the best practice to sow early, in order that the crop may be well established before the hot weather commences. And besides, there may be a greater chance of the grain escaping the ravages of the worm that often attacks such crops; and when this insect is present, its ravages may be more easily prevented. As this sort of crop is liable to be injured by very severe winters, it can seldom be safe to put it in in the autumn, especially in the northern parts of the island; but in the southern districts it may be done with propriety in particular cases, as where the land is of a very dry and friable nature, large crops having been asserted, he says, by Mr. Middleton to have been grown in this way in combination with tares in some instances."

But in many cases, this kind of crop may be sown still more early: Mr. Young advises, that in January, "if the weather be open, the young farmer should examine such fields as he intends sowing with oats, that he may consider if he has any apprehension of having his hands full of business in February and March, whether he should not lessen the work of those more busy seasons by sowing some oats at this period. The temper of the soil must, he says, govern him: but it is necessary that he should know that oats sown so early succeed well."

This has been fully shown by the interesting experiments made by the late Mr. Macro, of Suffolk, and the present Earl of Winchelsea, and detailed in the Annals of Agriculture. The first remarks, "that, having tried early and late sowing of barley, in the year 1784 and in 1785, he had a mind, the following season, to try the same experiment with white oats; and began by sowing one acre, in December 1785, with one coomb of seed, harrowed in upon a wheat stubble, with one earth.—Value of land 10s. an acre.

"In January 1786, he sowed exactly another acre by the side of it, with the same quantity of seed, and dressed it in the same manner. In February another acre the same, except half a bushel less seed. In the beginning of March he ploughed the remaining part of a piece of land a second time; and, about the middle of that month, sowed it, at the rate of three bushels of seed an acre, ploughing in one cast, or half the seed, and harrowing in the other half; and marked out another acre for the experiment. This last acre had three clean earths.

"Produce of the four acres;

	C.	B.	P.
On that sown in December,	8	2	0
January, -	8	3	2
February,	6	2	1
March,	6	2	2

OAT

Or seed deducted:	C.	B.	P.
On that sown in December,	7	2	0
January, -	5	3	2
February,	5	2	3
March, -	5	3	2

"That sown in December, though it came up thick enough at first, lost so much of its plant, by the winter frosts, that he expected it must have been ploughed up, and sown again in the spring; but observing the plants that were alive beginning to flourish very early, he gave them time; yet it never got to be a full plant, nor did he expect, though the straw was very stout, and the hawes, or ears, very fine ones, that it would have turned out so well. Those sown in January and February both lost some of their plants, so that that sown in March, with the least seed, was the fullest and evenest plant of any."

The latter observes, that "he was induced to make the following trial, from having seen upon two very capital farms in Kent and Essex, great crops of oats, sown as early as Christmas week, and from being informed by the gentlemen who occupied those farms, that they always sowed their oats as early as that, if the season admitted of it; and that they thought it the best time for sowing that grain. He wished to ascertain whether this plan would answer in this more nothern county. The general time of sowing oats here, is from the beginning of March to the end of April; and it is the opinion of most people here, that oats sown much earlier would be liable to be destroyed by spring frosts.

Last winter was very favourable for the experiment, as the weather was open at Christmas for sowing, and the frost in the spring not severe. He divided a field of eight acres equally: one half was sown the day after Christmas day; the other half the middle of March. Five bushels per acre were sown broadcast on each part, and the same oat: the sort, a small white oat, here called *short-smalls*. The early sown were ripe and cut one week before the others; they were harvested equally well, without being exposed to any bad weather. He had a rood of each set out very carefully in the middle of the field, reaped and threshed as soon as carried. The produce and weight were as follow:

	Winch. Bush.		Qrs.	P.
Early sown, -	22	per acre,	11	0
Late sown, - -	19	do.	9	4

"Weight per Winchester bushel as soon as threshed:

Early sown, - 44½lb.
Late sown, - - 42½lb.

"The crop was," he says, very good. The land yielded potatoes the preceding year, 450 bushels per acre, and was not manured for that or the oat crop: it had before that been in grass for six or seven years. The soil a red loam. He is inclined to think that the early sowing will answer here, as this field is very high and much exposed."

There can be little doubt from the tolerably hardy nature of this sort of grain, but that in many instances it may be put into the ground at such early periods with great advantage. And in all late situations it would probably be more beneficial to put the crops in at much earlier periods than is usually the case.

The quantity or proportion of seed that may be required must obviously differ according to the difference of the circumstances that have been stated above; "but on soils of a middling quality, Dr. Dickson observes, four bushels may be sufficient for the more early sowings, and five for the later ones, where they are put into the ground in the broadcast method, which should, he says, constantly be the case where the first modes of preparation are adopted. In some of the southern districts, the *Poland* oat is, he says, sown at the rate of about four bushels the acre for the first sowings; and it has been found in practice that the earliest sown crops constantly afforded the most perfect sample, and in general the most abundant produce. With the oats, clover may be sown when necessary, the seeds being covered by harrowing suitably to the condition of the land; and where the soil is very light or mellow, a roller should be passed over it as soon after as possible, in order to press the mould to the seeds: but in other circumstances it may be more advisable to defer the rolling until the season is dry, and the crop somewhat advanced in its growth. The practice of sowing oats under furrow, though it has been attempted on the lighter and more dry sorts of land, is not by any means, he thinks, to be advised, as in such a method the seed is apt to be deposited to too great a depth, and to be in danger of either being in some measure destroyed, or of coming up in an irregular manner."

He adds, "that the use of the drill has not been so much practised with this sort of crop as to ascertain the utility of it; nor has that of dibbling been tried with that sort of attention that is necessary to determine the propriety of it." According to Mr. Young, "Mr. Walker, near Belvoir Castle, Lincolnshire, sows eight bushels of oats per acre, and finds the crop much better, and the sample more equal than with less seed; the oats are less *taily*, no tillers to give different degrees of ripeness, and the crop ready to cut four or five days sooner than with thinner sowing. Mr. Ducket is of the same opinion, and holds no idea cheaper than that of recommending the drill husbandry as saving seed; he drills five bushels of oats per acre."

The same author further states that, "as this kind of grain is supposed to be more liable than most others to degenerate, by being too long continued on the same land, it has been the practice of some districts to change it for such as has been imported from other countries. It is probable, however, that by collecting and sowing the best and most perfect of our own produce, this expensive practice may be rendered unnecessary. By similar attention most of the different sorts of oats are also capable of being greatly improved both in the quality and appearance of the grain."

Where "this sort of grain is cultivated on such leys as are newly broken up, there may frequently be danger, especially where the land has been long in the state of grass, both from the destructive attacks of insects, and the soil becoming too light, open, and porous, from the decay of the grassy material, for the support of the plants. The first may probably in some measure be obviated, by eating such lands very closely with sheep previous to their being broken up, as by such a method the ova of such insects may be much destroyed, and their propagation prevented. And the treading the crops by sheep, as well as the roller, may likewise be beneficial in both respects." According to Mr. Bannister, "horses have also been turned in for the same purpose. For the above reasons, it has been suggested as improper to put oat crops in on newly broken up land, or even in the second year's cultivation of them, or what in some districts is termed a *lea breech*."

It is observed by the same writer, that "to sow oats on a lay newly broken up, especially if such ground has been many years in grass, is at all times very hazardous, and frequently causes a total destruction of the crop, an instance of which he experienced in the spring of the year 1771. The preceding winter had been very severe, with a continuation of unkindly weather till late in the spring, for at the close of the month of April, the ponds were covered with ice, and sharp frosty nights intervened till the 10th of May. Early in the month of March he sowed with oats a sainfoin lay that had been ploughed up some months before, and covered in the seed with the large two-horse harrow, and as soon as possible closed the soil with a five-horse roll, so that the ground seemed to lie as close as one could desire; but the dry frosty weather above mentioned, setting in for a month afterwards, rendered the surface very porous, and the soil was become dry as ashes, and by far too light for the purposes of vegetation. Towards the middle of April, the oats, by favour of some kindly showers, began to make their appearance, but before they were all fairly out of the ground, the worm seized on the fibrous roots below the surface. The land being at that time not sufficiently dry to admit the use of a roll, he endeavoured to close the lightened soil by treading it with horses. His primary views were to have trodden the upper part of the field only, the lower side remaining at that time unhurt by the worm; but in a few days these insects spread over the whole close, and although he omitted no opportunity of treading and rolling throughout the spring, the crop at harvest was very slender, as well in straw as grain. From hence we may learn, he says, how hazardous it is to sow such lay ground, in the first year after breaking up with oats, or indeed of cropping it with any other grain, than either beans or pease; for though in a very kindly year, such corn may not be totally destroyed by the worm, as it turned out in the event, with the greatest part of his oats; yet there is no doubt but (maugre all his care and pains) the husbandman will then find cause to repent of his conduct, and should a dry frosty time succeed, the destruction of the crop is inevitable. Still more hazardous is it to sow this grain on what is termed a lay breech, as the worm will in such a season be more likely to destroy the crop, than even after the first breaking up of the lay ground."

Peas and beans, according to the nature of the soil, are generally considered as the most proper sorts of crops in these cases.

Writers on agriculture in general, consider it "as a better and more correct practice to sow grass seeds with this crop than barley, as the tillage requisite for the latter may dispose it to become rank and be lodged, by which the grass will be drawn up weak through it, and in that way be greatly injured; as well as the barley, by the humidity thus produced, require a long time in the field, and in that way be exposed to more danger in case of a wet season succeeding, while with oats there is little risk in these respects, as the straw is much stiffer and more firm. Where oat crops are thin upon the ground, they grow strong, and are consequently better capable of supporting themselves without falling on the ground."

In regard to the culture that is afterwards necessary for this sort of crop while growing, it is merely that of keeping it as clean and free from weeds as possible, by means of hoeing and hand-weeding, throughout the month of May. The crops that are drilled should be well cleaned in the rows by the hand as well as the hoe. The author of Practical Agriculture observes, that "it is also a practice in some places to pass a light roller over the crop after it is advanced a few inches in height, when the ground has been slightly moistened by rain; by which the cloddiness of the surface is reduced, and the plants in some measure earthed up, and the progress of the crop not only much promoted, but, where thin, the plants rendered more thick upon the land by the tillering that is thus produced." And he adds "that it is sometimes a practice in this sort of crop, as well as that of wheat, where there is danger of its being too rank or luxuriant in its growth, to feed it down with sheep in the spring months. This is not, however, a method that is to be adopted, except in particular circumstances, as where there is great difficulty in procuring sheep feed at such periods, or where the worm is committing its ravages upon the plants: as this sort of grain is not in general apt to be injured either by the luxuriancy of its growth, or by being lodged."

Oat crops are ready for the scythe, or sickle, when the straw exhibits a yellowish cast, the grain becomes hard, and the chaff opens in such a manner as to render it in some degree naked. This sort of crop does not require to be so dry when put into the stack as those of either the wheat or barley kinds.

The reaping of this sort of crop where cut low is a good practice, as in other modes what is left in the field is lost to the farm yard. The sheaves in wet harvests should not be made too large.

It has been suggested by M. Duhamel, that farmers, especially those who keep many cattle, would find their account in housing their oats directly, without letting them lie out after they are cut, as is the common way, that rain and dews may moisten,

and consequently swell their grain. He earnestly advises them to try the experiment upon a part of their crop; "because," says he, "the fodder will by this means certainly be much better for cattle, and much less grain will be lost in the field. It may be objected, that these oats will be difficult to thresh; to which he answers that if this be the only inconvenience, the superior quality of the fodder, and the saving of a quantity of grain, which would otherwise be shed, will probably more than pay the extraordinary wages of the thresher.

"But allowing that the oats thus housed cannot be threshed quite clean, and that some grain will necessarily remain in the ears, he says that this will not be lost to the farmer; for he is obliged to give his cattle unthreshed oats, and they will easily find the grains remaining in the straw, which will not perhaps exceed the quantity that would have been dropped in the field: and even granting, though it will not happen, that the greatest part of the grain be left in the ear, still it will not be lost in the hands of an intelligent farmer; for what should hinder him from giving it to his horses? Supposing that four sheaves yield a bushel of oats, he need only give his horses those sheaves instead of a bushel of corn. They will certainly be longer in feeding upon four sheaves, than upon a bushel of cleared oats; and at the same time they will eat some straw with corn, which will supply the place of other fodder, and probably prove a more healthy food." This method may be particularly beneficial to such as live in very hot countries, or in very dry seasons.

In respect to the application of this sort of crop, in the northern counties, the meal is frequently made into a wholesome bread, and used in other articles of human food; but in the southern districts its principal use is for the food of horses, for which purpose it is reckoned very nutritive, being sweet and of an opening nature: but it must not be given them before it has sweated in the mow, or been otherwise dried, lest it should prove too laxative.

Wild Oats, a species of this sort of grain which is a weed, and difficult to be extirpated where it has once taken possession; as ripening before harvest, and scattering its seed which remains in the ground till it is ploughed up again, though for a whole year, or more, and will then come up with the corn. Some advise, as the surest way for destroying it, to lay the ground down to clover, and mow the oats and clover together before they are ripe.

Oat-*grass*, a coarse sort of grass that may perhaps sometimes be cultivated to advantage. See *Avena*.

OBSTACLES *to Cultivation of Land*, any sort of impediments placed in the way of its improvement. These are of various kinds, as arising from too much water below or on the surface of the ground, and which can only be removed by suitable kinds of draining; from the growth of wood either of the strong or more shrubby sorts, and which can only be made capable of cultivation by being wholly cleared away and destroyed both in the root and top; and from stones of the rocky or other descriptions, either lying below or above the surface of the ground, and which require to be wholly or in a great part removed before any sort of cultivation can be attempted. All these and various others of a less obvious tendency are frequently met with by the cultivator, and often oppose considerable obstruction to the progress of his improvements. See *Draining and Clearing of Land.*

These are some of the principal obstacles that present themselves from the nature of the lands themselves; but there are others which arise from the nature of the tenure or manner in which they lie or are held, and various other causes which do not depend upon the land. These have been stated by Dr. Robertson, in his very able Agricultural Survey of the County of Perth, to be first *townships*, by which he means a number of *plough-gates* in one village, or several tenants about one plough: secondly, the custom of *runrig*, or an intermixture of property; thirdly, the *uncertain boundaries* of estates; fourthly, the feudal custom of servitudes, which are productive of various ill consequences: fifthly, the custom of *thirlage* to mills; sixthly, the *shortness* of leases; seventhly, the *distance* from manure; and eighthly, *commons*, or lands in the state of commonage. But besides these, the taking of tythes in kind, and some other claims upon land, operate unfavourably to their cultivation. The particular methods in which these different causes operate in preventing the cultivation of lands will be explained under the several heads to which they belong.

OCHRE, a sort of oxyd or calx of iron, which is frequently met with in some sorts of soil. It has been remarked by the author of Phytologia that red ochre may in some cases be favourable to vegetation, though it has generally been supposed prejudicial to it.

It has, however, been stated by Mr. Nicol that "the most untoward of all soils, for the produce of timber in high perfection, is an irony till of little depth, lying on a retentive subsoil, which upholds a poisonous *ochry* water, and which stagnates on the surface or remains latent in the body of the soil, which is the pasture of the roots, contracting the mouths of the fibres, contaminating the juices, and finally operating to the destruction of the tree by poisoning it and hastening its dissolution."

Ochres also form the basis of various kinds of pigments or paints.

OCTOBER, the tenth month of the year, and in which the farmer has often much business to perform before his operations in the field are put a stop to by the heavy falls of rain, snow, or the setting in of frost. But where such field works cannot be fully effected at this season, they should be carefully executed as early as possible in the succeeding month.

This is one of the principal seasons for making changes with respect to farms, which are often points of vast importance to the farmer, and in which he should exercise his best judgment in deciding with regard to the probable advantages and disadvantages of the farm which he may have in view, without being so over cautious as to lose any advantage that there may be by too much deliberation. The chief objects of

his attention in this difficult matter, should be those of the nature of the soil and situation, the capability of providing sufficient manure, the size, the compactness of its lying, the lease and covenants by which it is fettered, the proportion of rent, and the amount of capital that will be necessary for stocking it in the most advantageous manner to insure the fullest returns. These, with the various circumstances necessarily connected with them, should be nicely turned over and weighed in the mind, before the decision is made, as when there is an inattention to such matters much disadvantage may be the consequence. See *Farm*.

This is likewise the period in which the servants of the farm must be engaged, there should therefore be considerable attention bestowed in determining the proportion that may be sufficient for properly performing the work, without loss being sustained by their being more than are absolutely requisite. In this matter, the nature of procuring labourers is to be well considered, as upon it much may depend. The quality of the servants is likewise to be regarded; but where they are to have the performance of such work as requires much art, such as are experienced should always, if possible, be provided. The whole of the family concerns should also be arranged so as in some measure to quadrate with the nature and extent of the farm. And as the year now approaches towards the conclusion, the accounts of the farm should be duly attended to, and brought forward.

In the stocking of the farm, there ought to be particular regard bestowed in the fixing upon such sorts of live stock as are the most suited to their nature and circumstances, and it will seldom be proper to enter into the expensive system of the fine fashionable breeds, as such a scheme may have a tendency to cripple exertions in other points of greater importance. See *Farm*.

The extent of teams is likewise another circumstance that must be well adjusted to that of the farm, in order that the labour of it may be daily performed, with the least possible loss. In this business, the question of horses or oxen is also to be well attended to. It has been observed by Mr. A. Young, that "there are two cases in which oxen are certainly more beneficial than horses: first, when a farmer lives in a district where there is a breed of cattle well adapted to work: and, secondly, when his farm is so large that he can buy in a considerable lot of cattle annually, at a small expense *per head*, and feel no inconvenience in turning out such beasts from the teams to fattening as do not work well. In both these cases he has little doubt of the superiority of oxen to horses. But in countries that do not possess a breed of cattle well adapted for work in the state of oxen; and on small farms whence fairs must be attended perhaps at the distance of an hundred miles to purchase a few, and consequently at a great expense per head, and possibly without land for fattening any, the benefit will, he thinks, be very questionable. In such a case he should prefer the bulls of the country, which are every where to be procured probably much cheaper than oxen; are broken in with but little difficulty; which work well, and which will recover from fatigue sooner than any ox. This he believes, from what he has experienced, and from all the information he has procured, is stating the question of the comparison of horses and oxen as nearly to the truth as it can be done, in few words. There are, however, some works in the business of a farm, in which horses are better than either oxen or bulls, and therefore it may be advantageous to keep a few horses."

He advises, that "the ox teams should this month be kept on straw and cabbages, and, in default of the latter, on turnips; but cabbages are superior. Let them, says he, have good straw always in their racks."

The horse teams should at this season, especially towards the close of the month, be brought to the use of dry food, such as hay, oats, and cut chaff. The hay is best given them, cut with straw in the state of chaff. The allowance of oats, where they are wrought in a constant manner, should not be less than two bushels each horse in the week; with less than that, they cannot probably be wrought in a constant manner, which should always be the case. But this expensive mode of feeding may be considerably lessened by the use of carrots, instead of a large proportion of the corn, in districts in which this sort of root is cultivated to any extent, and in others by steamed potatoes. See *Teams*.

The farm yards should now be got ready, as this may be the last month of the cattle remaining abroad.

At this season great attention is necessary to be paid to the different sorts of cattle stock. The cows, where the practice of the farm is that of feeding in the field, should at this time be brought into the yard, and foddered according to the condition in which they are; the dry ones should have cut chaff or straw with a little hay; and such as are in milk, cabbages with good cut chaff, as the cabbages are not found on experience to injure the milk; and with these the young stock may be kept, as they derive great advantage from being well kept. With some it is a practice to let the cattle out in the day-time into the fields, but this should never be done, as it poaches and greatly injures the grass lands. Besides, such grass, when preserved for sheep at the pinching seasons, is greatly more valuable. The soiled cattle may now likewise have their food changed in a gradual manner to dry meat, cabbages, and roots.

Regard must now also be paid to the fattening cattle; and the large oxen that have consumed the summer's grass, be put to turnips, cabbages, or carrots. Turnips with cut chaff may be used; but they are not near so good as cabbages or carrots, both of which answer well in this intention. The cattle may be either stall fed under cover, or be loose in the straw yard, being in each case well littered, and in the latter having the convenience of open sheds to retire to as they may be disposed.

Smaller sorts of beasts should likewise at this period be bought in for fattening on these sorts of food, especially on the turnips and cabbages, as in this system a vast supply of good manure is provided, when the yards are kept well littered with straw, or other similar materials. See *Stall-feeding*.

The half fat or forward sheep should at this time be put upon the forward turnips or such as were sown early; this is a better practice than that of consuming them with the lean stock, as they seldom pay well for such food. The remainder of the food left by the fattening sheep may be consumed to advantage by the lean stock following them.

At this period also the full-grown hogs should be put up for this purpose of fattening. In this plan much valuable manure is likewise raised for the use of the farm. See *Swine* and *Stall-feeding*.

Where the manure has not been applied to the grass lands immediately after the hay has been taken off, this period should not be omitted to put it on, except where the business can be done with certainty in the very early spring months, which in such cases is probably the best season of all for accomplishing the work.

This is the season when it becomes necessary to take up various sorts of field crops, such as carrots, potatoes, &c. In taking up the former, three-pronged forks are mostly employed, the roots being left till dry, then carted home, topped, and laid up for use. The latter crops are mostly taken up by the plough, as they are not in danger of being injured like the former. When taken up they should be let dry, and then be stored up in the manner which is found the most convenient in the district where it may happen. See *Carrots* and *Potatoes*.

It is at this period that a conclusion is mostly put to autumnal tillage on all the more stiff and moist sorts of soil, while on those of the more light sandy kind, it may proceed during the whole of the winter when not prevented by frosts. Therefore these stubbles should be now and in the following month carefully ploughed up, so that the frosts may have their full influence upon them. And here Mr. Young advises, that the young farmer's attention should "be particularly turned to what he terms the greatest of all modern improvements on strong land; that of discarding as much as possible all spring tillage. The summer fallows intended for barley and oats; the bean, pea, and tare stubbles designed for the same crops; and the white corn stubbles intended for any spring crop, must now, he says, be ploughed very carefully, being the future seed-earth; no more ploughings being allowable on any account whatever." Under the heads February and March some explanations have been given of this system, "which is, he says, of such importance, that too firm a resolution cannot be taken to carry it into execution. By means of it the crops are much greater, and the expences considerably reduced. The leading principle is this: if the land is so laid in autumn, on to ridges of that exact breadth which suits the tools (whatever they may be, whether harrows, scarifiers, scufflers, or drills), so that the horses which draw them may walk only in the furrows, the frosts will have left so fine and friable a surface, that any of these operations may be performed long before the land in the common system could be ploughed. The seed is securely in the ground before the old fashioned farmer thinks of moving. If he ploughs, he turns down a dry crumbling surface, and brings up the stiff wet clung bottom; if rain comes, then he is in the mire, and must wait for a season: if a drying sharp north-east wind comes, his furrows are converted to oblong stripes of a stony hardness. In one case he is plagued with mud, in the other with impenetrable clods: he was possessed of just the surface he wanted, and which once lost, is not often regained. This surface may be scuffled, and immediately drilled securely. If this husbandry be intended, it is of particular importance, he observes, that the lands or stitches be laid out with great exactness."

And, he adds that "a caution in the first forming of these stitches should be mentioned; which is, the difficulty, without two or three ploughings, of bringing them from old breadths into a correct form. If the men are not skilful, they raise the centers too high; and, in reversing, are apt to leave the outside furrows also too high: the stitch should be flat, or, if rounded, very slightly so; without this attention, the seed in some drills will be deposited deeper than in others."

This is a season when different sorts of crops must be put into the ground. Where the sowing of wheat could not be performed during the month of September, or where the weather was too dry or the whole could not be put in, it should be performed as early as possible in this: though this is in general the chief month for putting in crops of this sort. It is always bad management to defer it till November, where it can be performed in this month.

Winter tares may now be put into the soil; and where soiling is the object, it is of vast advantage to make two sowings at the distance of ten days or a fortnight, in order to have a succession of this sort of food.

The ploughings for different sorts of crops, as for beans, peas, barley, and oats, as has been just suggested must now be performed. It is likewise the proper season for giving the first deep ploughing where madder is to be grown, and where ploughing is not practised for liquorice, this is the proper time for digging the land over four or five feet deep, as in both these cases deep tillage is of the greatest importance to the success of the crops.

In particular cases great benefit may at this period be obtained by the application of the haulm of the mown wheat stubbles to the forming of standing sheep folds, by means of hurdles for winter folding, especially in the lambing season. This Mr. Young considers the best and only admissible system of folding on such farms as are not particularly open.

Where there are extensive woods on the farm, it may be advantageous at this time to have the leaves raked up and carted to the farm yards or standing sheep folds, in order to their being converted into manure, by being employed as litter in them.

The rams may now be put to the ewes, in performing which the farmer should be careful in selecting the lots so as to adapt them in the best manner to the particular intention that may be in view, and at the same time to provide them with rams that may be the most suitable. The proportion of ewes to a ram should be about fifty or sixty. The indiscri-

minate practice of turning different rams with a flock of sheep, is never to be thought of by the enlightened sheep farmer.

Such horses as have been greatly reduced by excessive labour from the want of proper attention in the horse keeper, may be sent to the straw yard, where by rest, and proper attention in feeding with such sorts of food as is made use of for the teams in small proportions, they in general become soon restored. The best plan is, however, to prevent the necessity of this as much as possible by due care and attention while performing their work.

Where breeding mares are kept, which can only be done with advantage in particular situations and circumstances, they may be made to perform moderate labour without being in danger of sustaining any injury from it, but they should in such cases be constantly well fed with food of the best kinds.

OFFICE, any sort of farm, building, or place where business is transacted.

Farm OFFICE, any sort of building or erection for the purpose of containing the animals, produce, or other things belonging to the farm. The great points to be aimed at in buildings of this kind are those of convenience and economy in labour. See *Farm Buildings*.

OFFICE *of Estate*, the place where the principal business of it is transacted. According to Mr. Marshall in his useful work on landed property, it should be situated under the roof of the principal residence of the proprietor, round which his estate mostly lies. Where much land lies detached, a secondary office should, he says, be provided. And it may, he thinks, be laid down as a rule in the management of landed property that every distinct part of an extensive estate ought to have a place upon it, however humble, in which the possessor may pass a few days, to diffuse over it a spirit of good order and emulation.

"He has known the most neglected, and almost savage spot, reclaimed, and put in a train of improvement, by this easy method." And "hence, says he, the utility of consolidating landed property, and throwing it into compact bodies; so that due attention may be conveniently paid to every part," without inconvenience.

The same writer adds that a "*principal office* should have a commodious *business room*; a small *anti-room*, lobby, or waiting room; and a safe, keep, or strong room, for the more valuable documents."

In respect to the kinds of *furniture*, with which an office of this sort should be supplied, they are, "1. General maps of the distinct parts of the estate, or of the different officiaries, or districts, into which the more connected parts may be divided,—coloured so as to show, distinctly, each farm, or the lands that are eventually intended to be laid into separate farms.—with the woodlands, waters, &c. &c. in hand." And also separate *pocket maps* of the several farms, or intended farms; exhibiting, at one view, the outlines, the names, and the contents, of the different fields or pieces of land of which they are severally composed,—and coloured agreeably to their occupancy; so that the several fields of the existing farms, (or intermixed parts of farms, intended to be united,) though scattered, may be readily perceived. If separate columns of contents be endorsed on the backs of the maps, one of them of the intended farm, the others of the existing farms, or parts of farms, with their several totals subjoined, all the doubts and perplexity which are wont to arise on large estates, from the intermixture of farm lands, will, he thinks, be avoided." See *Map*.

And 2. "Rentals and *books* of *accounts*."

"3. Books of *valuation*: 'or field books;' namely, registers of the number, name, admeasurement, and estimated value of each field, and every parcel of land, as well as of each cottage, or other building, not being part of a farmstead, on the several distinct parts or districts of the estate.—The valuations being inserted in columns; as they arise whether by general surveys, or incidentally; headed with the names of their respective valuers; so that whenever a farm is to be relet, these columns may be consulted, and its real value be fixed, in a re-survey, with the greater exactness. 4. A general *register* of *timber* trees, growing on the several divisions of the estate; specifying the number in each wood, grove, hedgerow, and area;—with the species, number, and measurement, of each tree. Also separate pocket books, containing those of each division; for the occasional use of the manager, and the wood reeve. 5. A *receptacle* of ordinary papers,—such as contracts, agreements, accounts, letters of business, &c. &c.—intelligibly endorsed, dated or numbered, and arranged so as to be easily referred to. With a *book* of *abstracts*, or heads, of papers of great importance, to be referred to on ordinary occasions; and likewise to serve as an index to the originals; which require a more secure repository than a common business room." 6. And "a safe *repository* of *documents*; as title deeds, legal decisions, awards of arbitration, counterparts of leases, passed accounts, &c. &c. The most secure keep of important papers, is, he thinks, a small room, strongly arched over; having an iron door, opening into the office with a window shutter, also of iron: thus guarding the contents, on every side, from fire; the repository of writings being insulated, in the center of the room." On this he remarks that a "standing regulation, respecting papers, whether they may be lodged in the office, or the strong room, ought to be,—that no person be suffered to carry away a valuable paper, on any occasion, without leaving, in its place, a receipt or memorandum, signifying by whom it was taken, and for what purpose; in order that it may be the more easily traced, in case it should not be returned."

And, he advises, that 7. "from these maps, books, and papers, from general surveys, and incidental occurrences, are to be formed pocket registers of the farms; corresponding, in number and size, with the portable books of maps. One folio, or two opposit pages, being appropriated to each farm; so as to show, at one view, the name of the farm and its number of acres. The name of the tenant and the existing rent. The tenancy; and, if on lease, the term of expiry. Any extraordinary covenant of the lease. The number of cottages let with the farm.

The number of timber trees growing upon it.
——————— orchard trees ———————.
Also, the eligibility of the plan of the farm.
——————— ——————— the occupier ———.
——————— ——————— the present rent ——.
The state of the buildings.
——————— the fences and gates.
——————— the roads and watercourses.
——————— cultivation and live stock.
Likewise the repairs, more immediately wanted.
The improvements of which it is capable.

Together with short notices or abstracts of—
The agreements entered into with the tenant.
The permissions granted him; and
The injunctions delivered to him. With any other incident or occurrence, respecting the farm or its occupier, that requires to be remembered: and with references to the books and papers which may pertain to the several particulars: thus having, at one view, a complete abstract of the history, and present state, of every farm; together with the particulars of attention which each will require." He adds, that "the trouble of forming an abstract of this kind, or of renewing it, when filled, or in order to adapt it to the varying circumstances of the several farms, is inconsiderable, compared with its uses:—which are not only obvious to theory, but are fully established, in practice. On returning to an estate, after twelve months absence, he has generally found, that, by consulting a register of this sort, and, through its means, making systematic enquiries, respecting the incidents that have occurred on the several farms, during his absence, he has in this summary way, and before he entered upon a fresh view, become better acquainted, not only with the general interests, but with the more ordinary business, of the estate, than the acting manager, who had constantly resided upon it, without such a remembrancer:—which ought not to comprehend tenanted farms, only; but should comprise woodlands, quarries, the demesne, &c. in hand; as well as the more important improvements going on: each of which ought to have its separate folio assigned it." He thinks, that "to a proprietor, or his confidential friend, who only goes over his estate occasionally, such an intelligent companion is essentially serviceable. He cannot profitably direct, nor safely advise with, an acting manager, or other agent, or officer of the estate, until he has consulted so infallible an oracle." And "the utility of such a register, while a proprietor is absent from his estate,—if he can be said to be so, with such a faithful mirror in his possession,—is too obvious to require explanation."

He recommends, that "beside those written documents and registers, the office rooms of an estate should be furnished with the mechanic instruments that are useful in its improvement and management:—as earth borers, to search for useful fossils, &c. &c.:—a theodolite, to assist in laying out lands;—levelling instruments, for laying out roads and watercourses, &c. &c. &c. Also models and drawings of draining mills, floodgates, farmsteads, buildings, implements, &c. &c. &c.

Mr. Marshall concludes by judiciously remarking that "there are men who are losing hundreds or perhaps thousands annually by neglect or mistaken frugality in the management of their estates, yet who will consider this executive establishment, and these forms and regulations of business as unnecessary and extravagant."

There can be no doubt but that when the estates are very large, these establishments and regulations must facilitate the management of them in a very considerable degree, and of course be of essential advantage to the owners.

OIL, a fatty unctuous material obtained from animal as well as vegetable substances. These matters are distinguished into different kinds, as etherial or essential and fat or fixed oils: the former are acrid, volatile, odoriferous, and exist in the plants in the same states in which they are found; while the latter are fixed, destitute of odour, and mild to the taste. These last when kept a long time corrupt and become rancid. They do not act upon earths, but readily combine with alkaline salts, with which when caustic they form vegetable soaps.

But these substances, though they cannot be employed by the farmer in their simple states, as being too expensive and having rather a noxious or poisonous effect than a beneficial one on the growth of plants may frequently be used in the condition of composts with advantage, as has been the case in the application of various of the grosser sorts of materials of this nature, such as those of whale blubber, the bottoms and refuse of oil casks, &c. when blended with earthy materials so as to be laid upon the land in an even and regular manner.

In this state of combination they have been found by the experiments of different cultivators to form very strong and powerful manures.

The following is the account of Mr. C. Baldwin's trials with the bottoms or *foots* of oil, and a rich thick South Sea whale-oil, in the whole sixty gallons.

"Having a platform or bottom of twenty loads of mould with eight loads of dung on it, he carried on three loads of light sandy mould, and one load of brick and mortar rubbish, ground fine, and having mixed these well, and made a kind of dish of it, about five feet wide and ten feet long, with a ladle he had put over it one half of the oil.—It was in August, and the warmth of the sun soon made the thick oil soak into the compost, when it was directly thrown up in a heap, broke down again, and by five or six turnings, well mixed together, and left in a heap two days, when it was spread equally over the whole dunghill; twenty load more of good mould was then carried on, eight load of dung, and the remaining thirty gallons of oil was mixed as before, in sandy mould, and brick and mortar rubbish, and equally spread over, and the whole was covered by trimming the four sides of the dunghill, and throwing it on the top." And thus, he adds, "the dunghill lay more than two months, when it was cut down by mattocks, carefully broke, well mixed, and turned over. The end of March it was carried on the field, spread and

ploughed in; it lay about a fortnight, was then ploughed again, and on the 22d of April, it was drilled with the Rev. Mr. Cooke's excellent drill. The field was drilled with barley, two bushels to the acre; the crop came up in a most even and beautiful manner; every seed was up within forty-eight hours of each other; all was ripe at the same time, and, from a couple of months after seed-time to harvest, was rated by all who saw it, and it was seen by many, as a sixty bushel crop. At harvest, three rows were cut across the field, directly thrashed and measured: one load out of thirteen was also thrashed and measured, and both stated the crop to be sixty bushels; but to wave all possibility of dispute or doubt, he is content to state the crop at seven quarters per acre. As to the quality of the barley, he could here cite the opinion of one of the most eminent brewers in London, who saw the crop growing, and declared he would readily give 1000l. to be assured that all the barley crops in the kingdom were of equal burthen and weight; five quarters of it have been lately sent to Nethrapps, in Norfolk, as seed-barley, under the denomination of 15 comb-barley; and an eminent maltster tells him it weighs 220lb. per sack, or 55lb. per bushel, Winchester measure." It is added that "among the many gentlemen and farmers who saw the crop on the ground, was the celebrated Mr. Bakewell; he came with three or four others, and walking down the field, observed the hedge and bank; the bank, upon being touch d with a stick, run down as sand and gravel generally do, and Mr. Bakewell being asked his opinion of the value of the land, if he does not mistake valued it at 18d. per acre, but turning to the crop, and desiring his friends to do so also, he admitted that it seemed as if growing on land of 15s. or 20s. per acre. He must not omit saying that the barley followed oats, upon a lay of six years old; that the land was, as is too common in such cases, much infested with the little red or wire worm, and that the oats suffered much from them; when they were ploughing for the barley the first time, he observed many turned up by the plough, when a distant ray of hope instantly darted upon his mind, that the oil in its then state, or from its strong effluvium, might prove obnoxious to them, and he is happy in saying, that the barley did not suffer from them in the least."

He adds that he is "trying the experiment in Hampshire, having last autumn made up a dunghill, with twenty gallons of oil, on one-third of it, for a six acre field, which is now drilled with pease."

He concludes by observing, that "it is well known that all animal-substances, in a state of corruption, wonderfully promote vegetation, and are the actual food of plants. The whale-oil which he used, is an animal substance, perhaps the richest part of the animal; whether he used enough, or what is the proper quantity per acre, experience must, he says, point out. Say he used eight loads of mould, three or four loads of dung, and twelve gallons of whale-oil per acre. That oil applied to land, as a food for plants, in its crude state, acts as a poison, he cannot deny; but his process is very different: he believes, that oil particularly animal oil, is the pabulum of plants, that is oil subtilized by the salts in a compost dunghill, left there a considerable time in a state of putrefaction, and until the whole is become putrescent; then, he says, he believes he has got the best and richest manure that can be carried on land. The barley evidently, he thinks, proved its excellence; a ridge of summer cucumbers in his garden pointed out to many its great power, the leaves being in general from ten to ten and a half inches broad, and the vines occupied an uncommon space of ground. Five hundred cabbages and savoys, planted by the side of four thousand more, and which had only one handful of the oil manure put in each hole made by the dibble at the time of planting, were, he says, evidently near as big again as the others.

Oil *Cake*, the cake which remains after the oil has been expressed from flax and rape seed, &c.

The cakes of the first sort are found to be extremely beneficial in the fattening of cattle, sheep and other animals, in different districts, where they are made use of upon an extensive scale.

It has been remarked by a late writer, that the late advances in the price of this article have probably rendered it incapable of being made use of with much profit, except in particular cases, and where manure is a principal object: with this sort of food it is the common practice to give some other sort of meat, such as hay, cut chaff, and other substances of the same nature, "and some begin by giving to a beast of a hundred stones two cakes per day of about six pounds each, for six or eight weeks, and then increase them to three, till the animals become fat;" at first however, as the animals seldom like it, much less may be given. "In addition to the cake, he says, from half a stone to a stone of hay is given each day, the whole consumption in cake being about 21 cwt. and in hay 26 cwt. which at the prices previous to the late advance on these articles, rendered the expense of winter fattening an animal of the above size something more than seven guineas: lean cattle of the smaller kinds have been made perfectly fat in the course of eight or ten weeks by this substance in the trials of Mr. Moody. The cake in this application is broken down into small parts, and frequently blended with the chaff or other substances that are made use of with it. On the continent, according to Mr. Young, linseed cake is, he says, sometimes exhibited in a liquid state, being diffused in hot water and drunk by the cattle, hay and other substances being given at the same time. In the Lincolnshire Report a method is suggested of giving cake to cattle while in the pastures in a small proportion with great success, a practice which may be applicable where the cake-fed beasts are not fully fattened for sale in the early spring months. It is an advantage in fattening with this and other similar substances, that the animals may be completed with them at much more advanced ages than in other modes."

Where this expensive sort of food is employed great care should be taken that the cakes be fresh, good, and free from mouldiness. They are the best where the expression of the oil has not been carried too far.

In Lancashire, Yorkshire, Norfolk, and a few

other districts, they sometimes, according to Mr. Donaldson, use oil cakes of the latter kind, after being reduced to powder by means of a machine contrived for the purpose, as a manure, sometimes for wheat and barley crops, but more generally for turnips. It is always sown by hand, and harrowed in with the seed. The quantity used is from three to six quarters the acre. The price is extremely different in different districts.

In Lancashire it is from six to eight shillings the quarter, in some parts of Yorkshire it is from sixteen to twenty. Experience has proved, he says, that the success of this manure depends in a great measure on the following season. If rain happens to fall soon after the rape dust is applied, the crop is generally abundant, but if no rain fall for a considerable period the effects of this manure are little discernible either on the immediate crop, or on those which succeed it on the land.

In an experiment stated in the eleventh volume of the Agricultural Magazine, "four ridges about twenty yards wide each, in the middle of a large field, were alternately manured with lime and rape seed cake. The quantity of lime was, it is supposed, three chaldrons to an acre. The part oil-caked, had a quarter of a ton an acre drilled by a machine, which throws the oil cake, reduced to powder, and the turnip seed, into the same drills. The soil was a strong dry red loam, with a few spots of gravel interspersed in different parts of the field. On these gravelly spots, the turnips were rather superior, on the parts which were limed; but on the loam the oil-caked ridges produced, at least, double the weight of those which were limed."

It is stated in the Agricultural Report of Hertfordshire, "that Mr. Calvert, at Albury, when oil cake was much cheaper than at present, found it the most advantageous and profitable food, that he could give his cows; three cakes a day, with eight or ten pounds of hay, or four cakes and good straw, were the usual allowance; two were given to cows in calf and to growing heifers; he practised this till cake advanced beyond £.9 a thousand. How far it may answer at much higher prices, hay and butter having both greatly advanced, careful experiments will alone ascertain, which he himself should have made, but, Swedish turnips being introduced and answering uncommonly well, he lost the inducement to go on with the other food. Cake gave very good butter, and at £.6 or £.7 a thousand was the cheapest food that could be given."

Oil *Compost*, a substance of the manure kind prepared by incorporating different oily materials with those of other kinds.

This sort of substance has been highly extolled by some cultivators, while others have thought less favourably of its properties.

It is probable however, that the expense of articles of this nature must render their use very limited in most situations.

On the supposition that oil rendered miscible with water, constitutes the chief nourishment of vegetables, and affords their principal support; Dr. Hunter of York has proposed the following oil compost:

	£.	s.	d.
Take North-American pot-ash 12lb.	0	4	0
Break the salt into small pieces, and put it into a convenient vessel with four gallons of water. Let the mixture stand forty-eight hours, then add coarse train-oil, 14 gallons	0	14	0
	£.0	18	0

He observes that "in a few days the salt will be dissolved, and the mixture, upon stirring, become nearly uniform." Then "take fourteen bushels of sand, or twenty of dry mould. Upon these, pour the above liquid ingredients. Turn this composition frequently over, after adding to it as much fresh horse-dung as will bring on heat and fermentation; in six months it will be fit for use. And he apprehends that the above quantity will be found sufficient for an acre: his trials, however, do not give him sufficient authority to determine upon this point."

And "for the convenience of carriage he has directed no more earth to be used than will effectually take up the liquid ingredients. But if the farmer chooses to mix up the compost with the mould of his field, he would advise him to use a larger portion of earth, as he will thereby be enabled to distribute it with more regularity upon the surface. He has not yet had any extensive trial of its efficacy upon pasture and meadow grounds: but he presumes that whatever will nourish corn, will also feed the roots of grass. When used upon such lands, it should, he thinks, be put on during a rainy season, as all top-dressings are injured by the solar heat, and all kinds of cattle must, he says, be kept off the lands for some time, as they will bite the grass too close in quest of the salt contained in the compost, which he has found to be the case in small trials."

He adds however, "that the oil-compost is only intended to supply the place of rape-dust, soot, woollen rags, and other expensive hand-dressings. It is in all respects inferior to rotten dung: where that can be obtained, every kind of manure must give place to it. He thinks that "at the same time that dung affords nourishment, it opens the pores of the earth. Hand-dressings, on the contrary, give food to plants, but contribute little towards loosening the soil. This is, he says, an useful and practical distinction, and may be applied through all the variety of manures made use of by the farmer. And he presumes that the oil-compost resembles the natural food of plants; but, he submits that, as well as every thing else, to experience, our unerring guide. It may, he says, be objected, that it has not sufficiently undergone the putrid ferment, to attenuate the oily particles. The use of rape-dust, soot, horn shavings, and woollen rags, take off that objection, and at the same time confirm, he thinks, the theory upon which the above compost is founded."

But he does "not take upon him to direct the experienced farmer in the manner of using this new compost. He would have every person apply it in

the way most agreeable to himself. Many things will occur to the practical husbandman, that no reasoning of the philosopher could foresee. By attending to the different ways of using it, we may, he supposes, reap considerable advantages. Improvements may be collected even from the highest degree of mismanagement." And, "facts must ever be the foundation of our reasoning. Without them, the philosopher is, he thinks, a kind of *ignis fatuus*. Instead of unfolding nature, he covers her with a cloud, and endeavours, as it were, to bring old chaos back again into the world."

If, however, he should "presume to instruct the farmer in the management of the compost, he would recommend it to be sown immediately after the grain, and both harrowed in together."

He records the following experiment, which, though trifling in its own nature, gave him, he says, the first encouragement to prosecute the subject upon a larger scale.—He took four pots, No. 1, 2, 3, 4.

"No. 1. contained 12lb. of barren sand, with 1 oz. of the sand oil-compost.

"No. 2.—12lb. of sand, without any mixture.

"No. 3.—82lb. of sand, with $\frac{1}{2}$ oz. of slaked lime.

"No. 4.—12lb. of sand, with 4 oz. of the sand oil-compost."

And "in the month of March, he put six grains of wheat into each pot, and during the summer he occasionally watered the plants with filtered water. All the time that the plants were consuming the farina, he could observe but little difference in their appearance. But after one month's growth, he remarked that No. 1 was the best; No. 2 the next; No. 3 the next; No. 4 much the worst.

He adds, that in August, he made the following observations: "No. 1 had five small ears, which contained a few poor grains. No. 2 had three small ears, which scarce deserved the name of ears, containing a few grains, much inferior in goodness to the former. No. 3 had no ears. Only he observed two very small ones within their respective sheaths, which, for want of vegetable strength, never made their appearance. No 4 had no ears; the stalks appeared stunted in their growth.

"He then removed the plants from their pots, and took a view of the roots of each.

"No. 1. The roots tolerably large, and well spread.

"No. 2. The roots not so large.

"No. 3. The roots very short and small.

"No. 4. The roots much the shortest, with the appearance of being ricketty."

Upon this experiment he remarks,

"1. That the oil-compost may be considered as a vegetable food: but that, when used too liberally, the alkaline salt will burn up the roots of the plant, and hinder vegetation. For which reason he would recommend the compost to be exposed to the influence of the air, for some months, before it is laid on. 2. That lime contains no vegetable food, and is, in its own nature, an enemy to vegetation. It is, however, of excellent use in assisting vegetation," in other ways.

His experiments teach him, he says, that "all kinds of soils may be benefited by this manure. The limestone, gravelly, sandy, and chalky soils seem to require it most. The rich loams and good clays have nourishment within themselves, and stand more in need of the plough than the dunghil"

He further states, that it "is observed by farmers that rape-dust seldom succeeds with spring-corn unless plentiful rains fall within a few weeks after sowing. He has more than once made the same observation upon the oil-compost, which induces him to recommend it for winter crops only. From the unctuousness of its nature, it is more than probable, that it should lie exposed for a long time to the influence of the weather, which benefit it is deprived of when used for barley, and such crops as are sown late in the spring. He is confirmed in this idea, from repeated experiments made with the compost upon turnips, which generally proved unsuccessful. And at the same time he invariably found that those parts of the field on which the compost had been spread produced the best crops of grain the following year. From this slow manner of giving its virtues, it seems, he says, to be an improper dressing for all plants that have a quick vegetation."

On the whole, he concludes, "that the oil-compost, as it plentifully restores particles of the oily kind, similar to those that are carried off, has a fair appearance of proving an excellent restorative."

The same ingenious writer has recorded the following experiments in support of the utility of this sort of manure: "In the month of June he selected four lands of equal goodness in a field intended for turnips. The soil was a light sand with a small portion of vegetable earth amongst it. It was ploughed out of sward in November, and had not borne a crop for many years. He distinguished his experimental lands by No. 1, 2, 3, 4.

No. 1 was manured with rotten dung.
2, with oil compost.
3, with lime.
4, was left without any dressing.

"On the 20th of June they were all sown with turnip-seed, broadcast, and during the course of the season were twice hoed.

"In November he viewed the field, and made the following remarks:

No. 1—the best
2—the next.
3—the worst.
4 better than No. 3.

"Here, he thinks the oil-compost appears in a favourable light; but other trials, made with equal accuracy, seem rather to prove that it is not proper for turnips, barley, or quick-growing vegetables. It requires being meliorated by the action of the atmosphere, and therefore is better adapted to winter crops." By repeated experiments made since he first brought forward this manure, he is "convinced that the addition of an alkaline salt is not sufficient to alter the nature of soil, so as to make it fully capable of entering into the roots of plants in its native form: but when decomposed by the mixture of fresh dung, he is convinced that it then becomes the true

pabulum of plants. The farmer considers carbone as giving to "airy nothing a local habitation and a name."

He supposes, that "when the land happens to be stiffer than is required for turnips, it may be good husbandry to lay upon it a large quantity of lime to open its body for the free admission of the tap-root of the turnip. The lands will also be rendered more dry, without which the turnips will never arrive at any size. Farmers, in general, take great pains to pulverize their light soils intended for turnips; but they seldom plough deep enough. A turnip is found to root deep, and in all operations of husbandry we should be careful to follow the bias of nature. It is for that reason, he says, we ought to make ourselves acquainted with the size and shape of the roots of such plants as are objects of field husbandry: when once we have obtained that necessary knowledge, it will be an easy matter to suit the preparation of the soil to the nature of the grain. It will also, he thinks, enable us to direct the variations of our crops upon just and rational principles."

In Mr. Stovin's trials with oil compost in 1769, the results were these:

	£. s. d.	Produce. q. b. p.
"One acre, sown with barley, and manured with oil-compost - -	0 18 0	5 5 0
One acre adjoining, sown with barley and manured with rotten dung, twelve loads, worth - -	3 0 0	4 3 2
Difference		1 1 2

And it is added, that "the compost barley was bolder and better corn than the other. In the year 1770, the dunged acre produced of rye, three quarters. The compost acre, of ditto, two quarters six bushels." And "in the year 1771, the same lands were sown with oats, and the produce was greatly in favour of the dunged acre. This last experiment, being contrary to the idea of good husbandry, was made with a view to determine the absolute strength of the compost. All top-dressings are exhausted in the year. The oil-compost seems to retain its vigour longer. It will here be proper to observe, that these experimental lands were in a common field, which had been many years under the plough."

And in Mr. Townley's experiments, they were as below. "In the spring 1770, he prepared a piece of ground for onions. It was laid out into six beds of equal size, and all sown at the same time.

"Over two of them, the oil-compost was scattered in a very moderate quantity; over other two, pigeon-dung; and over the remaining two, some of his weed-compost, which he esteems one of the best manures, for most vegetables, that can be made." It is composed of vegetable substances reduced into a putrid state. "The onions, he says, came up very well in all the beds; but, in about six weeks, those that were fed with the oil-compost plainly distinguished the advantage they had over the rest, by their luxuriancy and colour; and, at the end of the summer perfected the finest crop that he had ever seen, being greatly superior to the others both in quantity and size.

In another experiment with it in this crop, his success was still much greater though the soil was worn out. The oil-compost was used as a top dressing after the crop was sown. "The same spring he made an experiment upon four rows of cabbages, set at the distance of four feet every way. Two were manured with the oil-compost, and two with his own. All the plants were unluckily damaged, just before they began to form, by some turkies getting into the field, and plucking off the greatest part of the leaves. However, they so far recovered as to weigh, in the September following, from 22 to 28lb. a-piece. The rows proved so equal in goodness that he could not determine which had the advantage."

And "the same year, one part of a field of wheat exposed to the north-east winds, which that spring continued to blow for a month or five weeks, appeared very poor and languid at the time of tillering. Over it he ordered some of the oil-compost to be sown with the hand, which not only recovered, but also pushed forwards the wheat plants in that part of the field, so as to make them little inferior, if any, to the rest."

He also the same spring "made a comparative experiment upon four contiguous lands of oats, between the oil-compost and his own weed-compost. The latter had manifestly the advantage, though the other produced a very fine and large crop. He also tried the oil-compost upon carrots, and it answered exceedingly well. He did the same this year (1771), both upon them and his onions; and has the finest crops of those vegetables he ever saw any where upon the same compass of ground."

In applying this manure to garden culture, "Mr. Roebuck planted twelve alleys that lay between his asparagus beds with cauliflower plants. Each alley took up about thirty plants. One of the alleys he set apart for an experiment with the oil-compost, prepared as above.

"About a handful of the compost was put to the root of each cauliflower plant. In all other respects the alley was managed like the rest. The plants in general flowered very well; but those to which he applied the compost, sprung up hastily with small stalks, and produced very poor flowers. He imputed this unfavourable appearance to the freshness of the compost, which was only a few weeks old. In all future trials, he intends to expose it to the action of the air, in order to abate the heat, and neutralize the acrimony of the salt."

He adds, that "in the September following this unsuccessful experiment, he planted the same alleys with early cabbages. The necessity of meliorating the compost, was in this trial fully confirmed. For the cabbages that grew upon the alley, which in May had received the compost, were larger, and in all respects finer, than the others. The idea that he entertains of the compost is, that when meliorated in the earth, it is capable of giving a richness and freshness to it. Upon this principle he would re-

commend it to gardeners as a subject worthy of further trials.

But though these experiments sufficiently show that substances of this sort may be used with advantage in the way of manures, their expense must in most cases prevent their being made use of.

OIL-*Manure*, such as is constituted of oil with other materials.

The following is the composition of a manure of this kind which has been said to be highly beneficial, with the expense for one acre of land in 1792 :

	£.	s.	d.
Rape or train oil 6 gallons, at 2s. 6d.	0	15	0
Sea sand 6 bushels, at 2d. -	0	1	0
Coarse salt 2 bushels, at 1s. -	0	2	0
Malt coombs 24 bushels, at 4½d. -	0	9	0
	£1	7	0

In preparing it, it is advised to spread the coombs on the floor about four inches thick, then to sprinkle the salt as level as possible, throwing on half the quantity of sand and half the quantity of oil out of a watering-pot, turning it and raking it well, afterwards to add the rest of the oil and sand as before, turning it well till thoroughly mixed, and then throw it into a heap for use.

On this the writer remarks that "as the prolific quality of oil cake is only in proportion to the oil it contains, the composition he recommends must be preferable, having a much greater quantity of oil in it; and as malt coombs are a manure of themselves, especially for turnip land, at about eighty or ninety bushels per acre, he dares venture to assert that twenty-four bushels with the addition of oil is equal to the above quantity or even to twelve loads of muck. The sand and salt mixed with it not only, he thinks, occasion it to imbibe the oil more freely, but likewise give it a better body for the conveniency of spreading on the land." He adds, that "some may think the quantity of salt is too little, but he is truly convinced of the contrary, having found by experience that a ton or even a ton and a half has not answered so well as three or four hundred. The case is very similar, he says, with regard to lands near the salt marshes, where the tide sometimes overflows them, and it is well known by those who occupy such lands that nothing will grow for three or four years, but afterwards they become very fertile. The reason he shall not take upon him to give, but has found it so by his own experience. He concludes by observing that some farmers have used only half the above quantity per acre, notwithstanding which they had good crops."

It has been observed on this, that the extra expense makes against its becoming generally useful from the great price of oil and the expense of the carriage of sea sand and dross salt, in most inland situations.

OIL-*Paint*, that sort of paint which is composed of oil, and the oxyd of lead or some other similar substance to form its basis, or give it a body.

The great expense of paints of this sort has led to the introduction of many other materials, for the protection of wood work, and boarding of different kinds, such as preparations from fossil, coal, &c. But a great objection to all these substances, besides their expense, is the highly disagreeable smell that they afford.

When oil painting cannot be had recourse to, either because it does not dry soon enough and has an insupportable smell, or because it is too dear; the following method has been employed by M. Ludicke for painting ceilings, gates, doors, and even furniture, with the greatest success :

His manner of preparing it is this; take fresh curds, and bruise the lumps on a grinding-stone, or in an earthen pan or mortar with a spatula. After this put them in a pot with an equal quantity of lime, well quenched and become thick enough to be kneaded; stir this mixture well without adding water, and a white coloured fluid will soon be obtained, which may be applied with as much facility as varnish, and which dries very speedily. It must however be employed the same day, as it will become too thick the next day.

With this ochre, armenian bole, and all colours which hold with lime, may be mixed according to the colour which is wished to be given to the wood; but care must be taken that the addition of colour made to the first mixture of curds and lime contain very little water, otherwise the painting will be less durable.

After two coats of this paint have been applied, it may be polished with a piece of woollen cloth, or other proper substance, and will become as bright as varnish.

This, besides being cheap, has other advantages : in the same day two coats may be laid on and polished, as it dries speedily and has no smell. If it be required to give it more durability in places exposed to moisture, it may be done after it has been polished with the white of an egg : which is said to render it as durable as the best oil painting that can be employed.

And another substitute that may be used for painting weather boarding is prepared by taking three parts air slaked lime, two of wood-ashes, and one of fine sand or sea-coal ashes, sifting them through a fine sieve, and then adding as much linseed oil as will bring it to a consistence for working with a painting brush; great care must be taken to mix it perfectly. It is impenetrable to water, and the sun hardens it and renders it a great preserver of the wood.

The following composition has likewise been made use of with great benefit to paint boards, &c. :

Melt twelve ounces of rosin in an iron pot, adding three gallons of train oil and three or four rolls of brimstone : when melted thin, as much Spanish brown ochre first ground fine with as much of the oil as will give the colour, should be added; it should be laid on with a brush as hot and as thin as possible, and some days after the first coat is dry another applied. It will preserve planks for a very great length of time.

OILS, a provincial term used to signify the beards, or prickles of barley, &c.

OLD-*milk*, a provincial word signifying skim-milk.

OLLET, a term applied to fuel of any kind.

OMY, a provincial term employed to signify mellow when spoken of land. It is often written *oamy*.

ON-*stand*, a provincial term applied to the rent paid by the out-going to the in-coming tenant, for such portions of ground as the former has rightly cropped before his leaving the farm.

OPEN, a term sometimes applied to cows or heifers, signifying that they are not in calf.

OPEN *Cuts*, such drains or gutters as are made in land by the spade, and left without being covered in. They are used in draining lands in particular cases. Mr. Nicol thinks, that "perhaps open cuts, if effectual, are the best of all for forest draining, as they cannot be inconvenient, from the plough not being employed after the trees are planted."

Cuts of this sort are frequently found useful in the practice of irrigation or watering of land.

OPE-LAND, provincially ground that is loose or open, from its being ploughed up every year.

OPEN FIELD *Land*, that which is in the state of commonage.

It is observed that the open field or uninclosed lands in this part of the kingdom have undergone very little alteration in regard to the mode of occupation for ages. It is supposed, that to the ancient distribution of manors may be ascribed the origin of what is now known in this part of the kingdom by the name of open or common field lands, and in Scotland by that of runridge. The scattered situation and smallness of the pieces of common field lands, still frequently cultivated by one person, in many instances fifty or a hundred acres situated in nearly as many different places, evince, first, that the mode of division, considering the then state of the nation, was a matter of sound policy, because till about the close of the ninth century, when England was divided into tithings and hundreds, there seems to have been no law but that of the sword for the protection of private property; hence every inhabitant of the parish or township, by having a common interest in the parish fields in case of any invasion, became bound by the strongest tie (self-interest) to associate with his neighbours in order to repel the foe. And in the second place, it is also clear that the occupiers began with cultivating small spots, an acre, or perhaps less, and as population increased, and bread corn became scarce, they gradually increased their tillage lands. Those parts of the parish which were either unimprovable or at too great a distance from home were partly reserved for the purpose of supplying fuel, pit coal, if at all known, being only in common use in a few places. The remainder was allotted for the common pasturage of the parish cattle, which were by mutual agreement kept there during summer and harvest, after which they were allowed to range over the arable lands till the return of spring.

And it ought also to be observed that a certain portion of the manor or estate was set apart for the purpose of producing natural or meadow grass to be made into hay. This meadow grass was divided among the farmers, in proportion to the extent of their farms, either by lot or some kind of understood agreement. The cattle were excluded by mutual consent at a certain period in spring, and it remained shut, as it is now termed, till hay harvest was completed, after which the cattle were suffered to pasture during the remainder of the season.

It is astonishing that in such a length of time as from the original distribution of manors in England to the present period, so little alteration should have taken place in regard to the mode of occupying those lands which remain in the open or common field state, more especially when it is considered that during this long interval a spirit for agricultural improvement seems at different periods to have become pretty general. In regard to the modes of cultivation which are adopted in respect to them it is only necessary to remark that previous to the introduction of turnips and artificial grasses the almost universal practice, was to have three fourths in grain, and one fourth in fallow; and although in some places, alterations have taken place, yet the instances are very rare.

And the arable lands are divided into four fields as nearly equal as possible, and each of these fields (however many tenants may have an interest in the cultivation) must, by the established rules, be wholly under the same kind of crop. This, added to the practice of pasturing their cattle in commons, will, Mr. Donaldson says, "for ever prevent the general introduction of artificial grasses, or indeed almost any other species of improvement, till such time as, either by the mutual consent of all concerned or the intervention of the legislature, the system is entirely abolished."

It is evident from what has been observed, the same writer thinks, "that the open-field lands, which in some counties amount to above one third of the whole, are deficient in point of produce at least one half, when compared with that of inclosed lands under proper management. That open or common field husbandry is therefore an obstruction to agriculture, must be generally allowed, and an obstruction so serious in its nature as to create a deficiency, on the supposition of there being one fourth part of the tillage-land in this country in the open field state, of at least one eighth of the marketable produce of the country. When this is stated, and when it is further added that no proprietor or tenant of open-field lands can introduce any improvements in the modes of cropping or of general management without the consent of the parish-community of which he is a member, and none that can be binding upon them without an act of parliament, the absurdity of allowing lands to remain in the open-field state must appear still more glaring." It is added, that "some facts have been brought to light by means of the Board of Agriculture, which, in proof of these assertions, it may not be improper to mention. The report of the county of Buckingham contains the following statement: 'About eighteen years ago, the parishioners came to an agreement, and obtained an act, to lay the small pieces of land together. One farmer at that period, had eighteen acres in thirty-one different pieces, and at wide distances from each other. When the division took place, the balks were of necessity ploughed up, by which a great portion of the sheep-pasture was destroyed. It be-

came then expedient, and it was agreed upon at a public vestry to sow clover and turnips as a *succedaneum* for the balks. Two years since (that is, sixteen years after this arrangement had taken place among the parishioners), one of the farmers, occupying sixteen acres of these common fields, procured in the month of May a large flock of lean sheep, which he turned on the clover crops, being then nearly in bloom, the greater part of which they devoured." And, "another instance of the impossibility of parishioners being able to arrange any mode by which improvements can be introduced, which individuals are bound to adhere to without the sanction of parliament, is also detailed, he says, in the same report, in the following words: "The parish of Steeple Claydon contains two thousand five hundred acres of strong wet clay. The custom is here, to have one crop and one fallow. About fourteen years ago the proprietors came to an agreement to have two crops and a fallow; but before the expiration of ten years, one of the farmers broke through the agreement and turned in his cattle among the crops of beans, oats, and barley: in which plan he was soon followed by the rest of his neighbours; and the crops on that part of the field, which, agreeable to the ancient custom, would have been fallow, were in consequence totally destroyed." It is added, that "considering the immense national loss arising from so great a portion of the cultivated and cultivatable lands in this country remaining in the open-field and commonable state, the great additional expense which farmers are liable to in cultivating lands dispersedly situated, and the inferiority of crops reaped from lands, however good in quality, that are subjected to a never-ending rotation of corn crops, it is no wonder that the report of every county in the kingdom should contain an earnest solicitation to the members of the Board of Agriculture, to suggest such measures as are most likely to receive the sanction of the legislature and to meet the approbation of all the parties concerned, for removing obstacles, which, while they are permitted to exist, must exclude the possibility of improving the agriculture of the country."

But, he observes, "to arrange general equitable principles, on which manorial rights can be purchased, and commons divided and rendered private property, and on which likewise proprietors of parishes shall be at liberty to inclose, and introduce new and better modes of husbandry on their estates, are subjects of infinite importance to the future prosperity of the country; and as such call loudly for the immediate intervention of the legislature."

He therefore, "after stating and obviating the objections which have been started against the dividing of commons and the inclosing of parishes, and after pointing out the advantages that experience has in many instances proved to have resulted from adopting these means of improvement, begs leave to suggest what to him appears the most probable way in which they can be generally introduced." And, he observes, that "the depopulation of the country, which is supposed a necessary consequence of divisions of commons, or inclosing of parishes, is held out as a grand objection against the general adoption of either of these measures. The fact, however, he says, it appears from the Agricultural Reports, is quite the contrary; and to those who attempt to argue against facts, it is unnecessary to make any reply. Can those measures, he asks, tend to the depopulation of the country which have for their object the production in greater abundance of the means by which an increased population can be supported? Has not every farmer the power of cultivating his land to greater advantage when enclosed, or in severalty, than when intermixed with that of others? Can any farmer cultivate his farm to the greatest possible advantage without more than ordinary labour? Does not this necessarily require an additional number of labourers? To all these questions the answers, he thinks, must certainly be in the affirmative. It may be admitted, that the inhabitants of a parish must undergo a very material alteration in their situation in consequence of its being enclosed: yet it does not follow that the depopulation of the country must be the consequence. Though several of those who occupy small farms must necessarily be removed, in order to enable the proprietors to class the lands into farms of a proper size, it is equally obvious, that a new set of people must be introduced; such as hedgers, ditchers, road-makers, and labourers of every sort. This may therefore be called an alteration in the description of the inhabitants, a shifting of population from one parish to another, rather than an expulsion, or a decrease of the number of inhabitants in one particular parish. Were it evident, however, that depopulation was the consequence of inclosing a parish, it will be found, he thinks, that that depopulation does not arise from the circumstance of the parish having been enclosed, but from the total alteration of system that too commonly takes place in the after-management of the lands. If the lands, in the place of being laid down to grass, as is the prevailing practice, were cultivated in an alternate course of grain and grass husbandry, the number of hands necessary for the cultivation, and for carrying on and following out the various improvements which in such a case would be immediately introduced, would be at least equal, if not greatly superior, to that of the inhabitants at any period while it remained in the common or open field state."

And he adds, that "the next objection against the adoption of either of these measures is, the depriving the commoners of their rights of commonage. This philanthropic argument is apt, he thinks, with the man of humanity, like Aaron's rod, to swallow up every other that can be urged in favour of the public, or of the other individuals concerned. But let us, says he, pause a moment, and inquire what these rights are. It is presumed, after the most minute inquiry, it will be found that the rights of commonage in this part of the country were, as in Scotland, vested originally in the proprietors of the adjoining tillage ands; and that the now claimants of rights of commonage have acquired these rights, such as they are, in almost every instance, through the negligence of the actual proprietors, who allowed these assumed rights

to acquire the sanction of law, in consequence of prescription. That this is the origin of common-rights in this part of the kingdom, and that they are more common on the crown-lands, arising from the cause now assigned, 'negligence,' will not, he thinks, be denied. But they are rights; and 'cursed be he that removes his neighbour's landmark,' is a maxim that ought to be imprinted on the mind of every man. It does not, however, thence follow, that, to accommodate those possessing rights of common, the public, or the principal proprietors, who would be benefited by a division, should sacrifice their interest, should allow the productive powers of these uncultivated wastes to remain dormant, because it is the inclination of those who have thus acquired rights that they should do so; far less does it follow, that, whether these rights have been acquired through legal indisputable title, or through the sufferance of the proprietors of the adjoining estates, the owners of them cannot, on the division of a common, get a full and fair equivalent in property land for their rights of commonage. Whoever would maintain this doctrine, would, he says, maintain that the laws of England were framed for the protection of the rights of the rich, but that the poor had no interest in them. The advantages derived by the cottagers, in virtue of these rights, are, for the most part, merely ideal: yet if ever a division of the commons in England takes place, it will, for the reasons mentioned above, become the indispensable duty of the commissioners acting in such cases, both in point of humanity and sound policy, to act liberally towards the cottager, and to give him an adequate allowance of property land for his prescriptive rights. Commissioners so acting ought to consider, that in a national view, whether A, B, or C are the proprietors of these commonable lands is a matter of no sort of importance, provided they are once put in the train of improvement, and which can only be done by converting them into property. These commissioners ought farther, he thinks, to consider, that scarcely any sum of money which they can award is an adequate compensation for a cottager's right of common. The money may be soon dissipated: but rights of pasturage, or lands in property, are funds more permanent in their natures. When a poor cottager receives a piece of money in compensation for his rights of commonage, which is but too frequently the case under parish inclosure bills, the funds which were allotted for the support of his family are, as it were, set afloat: and it is a thousand to one if they again settle on any friendly shore. It cannot, therefore, be too often repeated, he observes, that there is no compensation a cottager can receive for his rights of commonage so just and equitable, or to him and his family so beneficial, as land in property."

But "another objection to inclosing parishes, or to a division of open-fields lands or commons, is the expense of the act of parliament necessary to carry either of these measures into effect; and when completed, to make the arrangement binding upon the parties. It is certainly, he says, mortifying to a proprietor that he can scarcely adopt any plan for improving his estate without paying some hundred pounds to the clerks of parliament for doing nothing but registering the edicts of the legislature; and for doing which, if they are not properly paid from the public funds, they at least ought to be, so as to prevent them from levying a heavy tax on the more enterprising, public-spirited, and praise-worthy individuals of the community. Let, says he, litigious people, when they make appeals to the supreme tribunal of the nation, pay what the avarice of the official people may dictate; but let every application for the interposition of the legislative authority to sanction measures calculated to promote the prosperity and improvement of the country, be laid before parliament without fee or reward."

The only other objection, which he notices, is, "that if all the open-fields and improveable commons were brought into a proper state of cultivation, it would materially affect the interest of the owners of the already improved lands. Such a narrow-minded sentiment ought, he says, to be treated with silence and contempt, did it not prove, that those who are capable of suggesting it were satisfied that, however much individuals might suffer, the interest of the nation at large would be promoted, were every improveable acre in the island in a proper state of cultivation. This being granted, it may be asked, ought the interest of the public to be sacrificed to promote that of a few individuals? But no apprehensions need be entertained on that account. Although 'trifles light as air' seem with such reasoners to have the weight of 'words of holy writ,' yet the judicious and intelligent must be convinced, that while the commerce of Britain keeps on in a progressive state, there is no extent of superabundant produce that can be raised in the island which will not meet a ready sale in some foreign market."

And "in respect to the advantages to be derived from a general division of the commons, and the inclosure of the open-field parishes in this part of the island, although they are numerous, the most important of them are only mentioned. He observes, that it is only in those countries where the means of subsistence can be had in abundance, and on reasonable terms, that population increases with rapidity.

"In political calculations the riches of a state are estimated by the number of its inhabitants. As these cannot increase to any considerable degree where the means of subsistence are limited, it is evident, he thinks, that by adopting the measures above-mentioned, by which only a great addition can be made to the national stock of provisions, the state would become richer, as it would then be able to furnish from its own lands the means of supporting an increased population.

"Besides, were these measures adopted, it is obvious that the national territorial revenue would be to an immense degree augmented; that of this part of the kingdom, in all probability, one-third at least beyond what it is at present."

This fact is elucidated, he says, by the following extract from his report of the County of Northampton: "The average rent of an acre of open-field

land in this district, including the value of the tithes, which may be reckoned at three shillings and sixpence the acre, may amount to eleven shillings and sixpence; while that of an acre of inclosed land (including a similar sum for tithes) may be reckoned twenty shillings, which makes a difference of eight shillings and sixpence the acre. There are eighty-nine parishes in this county in the open field state, which may contain nearly 150,000 acres; the rent which the proprietors therefore lose, by keeping these parishes in the open-field state, may be estimated, he says, at upwards of £ 60,000 a-year; while at the same time the introduction of agricultural improvements is precluded, and consequently an increase of rent on rational principles."

And it is suggested, that besides "an increase of population, of the quantity and quality of grain, and of territorial revenue, the improvement of the different species of live-stock is another advantage which uniformly results from inclosing land. The farmer, no longer under the necessity of mixing his herds or his flocks with those of others, is at liberty to pursue such measures as he judges most expedient; and while he purchases tups, bulls, and stallions of the best sorts, to improve his stock, he also takes care, by superior cultivation, and a more judicious rotation of cropping than he was before at liberty to adopt, that they shall not be stinted in their growth by the want of provender."

"Such, says Mr. Donaldson, is the account of the advantages that are likely to result from a general division of commons and the inclosure of open-fields, which the writer; from a careful perusal of the agricultural reports of the different counties of England, and his own general knowledge of the subject, is able to lay before the reader. Experience having proved, in very many instances, he adds, that these, and several others of no inconsiderable importance, have actually resulted, it must appear surprising that any peer of parliament should stand up in his place and maintain an opposite doctrine; yet whoever peruses the Parliamentary Register for 1781, will find that this was the case."

ORCHARD, in the common acceptation of the word, is a portion of ground set apart for the growth of different sorts of the more common varieties of fruit, but mostly those of the apple and pear kinds, in which case the trees are mostly of the standard kind, especially where large supplies of fruit are wanted; but in the cider districts it signifies large fields or tracts of land covered by the apple, pear, and sometimes other sorts of fruit trees in mixture with them.

In the former it generally consists of apple-trees, pear-trees, plum-trees, and cherry-trees, and to render it more complete, should contain quinces, medlars, mulberries, service-trees, filberts, spanish-nuts, and barberries, as well as walnuts and chesnuts. For as the two last sorts are well adapted for sheltering the others from high winds, they should, Mr. Forsyth thinks, be planted in the boundaries of the orchard a little closer than ordinary for that purpose.

In providing trees for this purpose in small orchards as well as those of the more extensive field kind, too much care cannot be taken to admit of none but such as have good roots, fair clean stems, and proper heads, and at the same time for small orchards, attention should be paid that a proper assortment of the different sorts be provided for the supply of the cultivator during the whole year, especially of the apple kinds; a few of the summer sorts are sufficient, but more of the autumn and still a larger quantity of the winter will be necessary, as upon this last sort the chief dependence must be placed from the beginning of the year till nearly the period of the fruit being ready again.

In districts where the process of cider making is conducted upon a large scale, large orchards of apples only are often met with, in which those sorts that are most proper for the making of that liquor must be introduced; and in some counties, as Kent, there are orchards wholly of cherries, or those of filberts; in general, however, there ought to be a much larger proportion of apples than of any other fruit in orchards, as in proper situations they are very profitable, and in addition the trees have a delightful appearance when in blossom as well as when the fruit is ripe.

In respect to aspect or situation and soil, different ones have been advised by different cultivators. Some recommend that an orchard should rather be elevated than low as on a gentle declivity open to the south and south east, to give free admission to the air and rays of the sun, as well as to dry up the damps and disperse the fogs, in order to render the trees healthy and give a fine flavour to the fruit. It should likewise be well sheltered from the east, north, and westerly winds by suitable plantations where not naturally sheltered by hills or rising grounds. Such plantations, where they consist of forest trees, should neither be too large nor too near the orchard, as where that is the case, they prevent a free circulation of air, which is injurious to the trees. Where the ground does not admit of such plantation, Mr. Forsyth, in common orchards, advises planting cross rows of fruit trees in the manner directed for gardens, as well as some of the largest growing trees nearest the outsides exposed to those winds; two or three rows of which should, he says, be planted closer than ordinary, which would greatly shelter those in the interior parts of the orchard, and be of great service in addition to the walnut and chesnut-trees, as mentioned above.

It is remarked in the Agricultural Report of Herefordshire, that "plantations of this sort are now found in every aspect, and on soil of every quality and under every culture. The most approved site is that which is open to the south-east and sheltered in other points, but particularly in the opposite. For although Virgil and the other Roman poets celebrate the west wind as the most genial in Italy, and although Philips, in his provincial poem on Cider, recommends the same aspect, it is an unquestionable fact that the westerly winds, and consequently a westerly exposure, are particularly unfavourable to the fruit trees of Herefordshire; they are more cold as blowing over a considerable tract of the Welsh

mountains, which are often covered with snow, even late in the spring; and they are more unkind because from that point proceed a much more than equal proportion of those fogs, and blue mists which Dr. Beale, he says, termed the disgusts of the Black Mountain."

Orchards are, of course planted on many different sorts of soil, and succeed well, but a dry friable loam is probably the most suitable, as trees of this sort are impatient of moisture: such as are proper for gardens will answer perfectly well, and such as produce good crops of corn, grass, or other vegetables are mostly proper for an orchard; and though the above sort is to be preferred, any of a good quality, not too light or dry, nor wet, heavy, or stubborn, but of a moderately soft and pliant quality, will be found to answer the end perfectly. The shingly and gravelly soils disagree very much with fruit trees, unless there be loam intermixed with them. They succeed much better on a chalk bottom or sandy soil. On such a soil, Mr. Forsyth has seen roots twelve feet deep, and the trees thrive well where the bottom is clay. The roots should, he says, in common orchards, be cut once in four years, to prevent them from penetrating the clay, which would greatly injure the trees.

The writer of the Herefordshire Agricultural Report observes, "that the soil best adapted to most kinds of apples, is a deep and rich loam when under the culture of the plough; on this, the trees grow with the greatest luxuriance, and produce the richest fruit. Some trees however, the stire and the golden pippins in particular, form exceptions to this general rule, and flourish most in hot shallow soils on a lime or sand stone. The best sort of pear-trees also prefer the rich loam, but inferior kinds will even flourish where the soil will scarcely produce herbage."

And he adds that "an orchard is generally raised with most success and at least expense in a hop yard, the ground under this culture being always well tilled and manured, as well as fenced against every kind of enemy."

"It also not unfrequenly happens, he says, that the same ground which produces but a very small portion of herbage will make an excellent orchard. Mr. Knight has one of this kind, which, during the last thirty years, has afforded a produce of nearly four hundred gallons per acre. That gentleman is decidedly of opinion, that if the trees were wholly removed, the same acre would not support two small sheep throughout the year, without difficulty, and the trees by no means consist of the most productive variety. The soil is a stiff and deep clay somewhat indurated, and the field would be less worth twelve shillings an acre, as a pasture, than it is worth three pounds an acre, as an orchard. Great Britain probably contains many hundred thousand acres capable of being as much improved by planting as this ground has been, and that improvement might be made at an extremely small expense, and within a short period of time."

"The experiment might easily, he says, be made in any other county with the apple on a single acre of ground and within seven or eight years. If the stocks were to be raised from the seeds of the crab, and afterwards planted in the nursery in rows six feet distance from each other, and with intervals of one yard between each plant in the row, an acre would contain two thousand four hundred and twenty trees; and, if these were grafted with varieties properly selected at three years old, a quantity of apples would be afforded by those grafts in the fourth or fifth year, whilst in the nursery, sufficient to ascertain the merits of the soil, and the fruit might be reduced without the aid of a mill, to prove in some degree the merits of the cider. An opinion very generally prevails that fine cider and perry cannot be produced except in particular soils; but this is certainly to be ranked among the vulgar errors. The planters of Herefordshire, in the latter end of the seventeenth century, supposed that good cider would only be obtained from light and sandy soils such as are here termed rye lands: Philips directs the farmer to

"———look where full ear'd sheaves of rye
" Grow wavy on the tilth; that soil
" Select for apples."

"The present opinion, as already mentioned, is decidedly in favour of a deep and rich clayey loam, except for a few particular sorts. But every soil in which the fruit attains a perfect state of maturity is capable of producing cider and perry in a greater or less degree of perfection.

"The apple and pear are found quite as highly flavoured and as perfect in many other counties as in this; and Mr. Knight is of opinion that if the planter were at liberty to choose his soil, a loam of moderate depth with a sub-soil of chalk would be found equal to any which the counties now celebrated for orchards could supply."

Whatever the nature of the soil may be, it should have a good depth, as two or three feet. And in common orchards, where the soils are wet, they should be well drained in the same manner as directed for gardens, or by forming the land in ridges with furrows between the rows to convey off the moisture, the turf being relaid in case of the ground being in the state of sward.

In regard to the size of an orchard, it may vary from one, to ten, fifteen, or more acres, according to the quantity of fruit wanted, or the proportion of ground that is fit for the purpose.

The *preparation* of the *land* is effected in different ways, but the best method for small orchards is probably, before planting the trees, to trench it two spits deep, and ten feet broad where the rows are to be planted, and to loosen a spit below, unless it be clay, which should, Mr. Forsyth says, be trodden down. When the ground is in pasture it should, he says, be ploughed and well summer-fallowed till the grass be killed, otherwise, when it is laid in the bottom in trenching, which it generally is, it will be very apt to breed grubs, which do much mischief. In bad shingly or gravelly soils, Mr. Forsyth recommends that holes should be dug at least three feet deep, and filled up with good mould; if mixed up with rotten dung, rotten leaves, or other manure, the trees will in time amply repay the expense: the dung

used for this purpose should, he says, be that from the melon and cucumber beds, mixed with the mould from the same when the beds are broken up in autumn or winter, and be laid up in heaps and continued so for one year at least, but be frequently turned and have some good fresh mould mixed with it.

It is the practice with some to only dig holes large enough to receive the roots, especially in grass ground which is to be continued so. Others prepare the ground by deep ploughing if the orchard is to be of great extent. The sward, if pasture, should be ploughed over some time in spring, a good summer fallow should be given it, ploughing it two or three times, which will rot the turf. A fortnight or three weeks before planting it should have a good deep ploughing, to prepare it for the reception of the trees.

In Kent and some other hop districts, they prepare their orchard ground by the growing of hops upon it with the fruit trees, by which they are much promoted in growth and brought forward.

In respect to the season or period of planting, it may be performed with success at different times according to the nature of the land. The best time for planting on a dry soil is, Mr. Forsyth thinks, in October; but if wet, the latter end of February, or the month of March will be a more fit season.

The chief circumstances in this business are to suit the trees as much as possible to the soil, and to plant them at proper distances from each other, which may be from forty to eighty feet, according to the size of the trees when full grown. He observes, that fruit trees when planted too thick, are very liable to blights and to be covered with moss, which robs them of a great part of their nourishment, besides spoiling the flavour of the fruit.

It is remarked by the author of the Herefordshire Report of Agriculture, that "the apple and pear trees which form the orchards of that district, are well known not to be the natural production of any soil or climate, the one being a variety of the *pyrus malus* or crab, and the other derived from the *pyrus communis* or common wild pear; as such, neither of them are noticed by Linnæus. The native wild crab is subject to considerable diversity in the appearance of its leaves, and in the colour, shape, and flavour of its fruit.

"By selecting and cultivating the fairest and the best of these, all our valuable varieties have been produced, and by repeated propagation have been preserved for the time. This principle was, it is said, clearly known by the ancients, whether they applied it to the apple or not;" as is evident from Virgil.

And it is added, that "Normandy and other parts of the continent have occasionally furnished this country with several of these artificial varieties."

It is likewise stated, that "the apple trees are divided into *old* and *new* sorts; each class comprises some called *kernel* fruits, namely the fruit growing on its native root as a distinction from those produced by the operation of grafting.

"The old sorts are the more valuable, and are those which have been long introduced, such as the stire, golden pippin, hagloe crab, several varieties of the harvey, the brandy apple, red streak, woodcock, moyle, gennet moyle, red, white, and yellow musks, pauson, fox-whelp, loan and old pearmains, Dymock red, ten commandments, and others. Some of these names are descriptive of the fruit, and others are derived from the places where they have been first found, or found in most abundance. The modern varieties derive their appellations from such various and capricious causes that a correct list cannot be composed; in several instances, the same fruit bears a different name, even in the same parish. A regular and scientific classification of the whole would be, it is supposed, a valuable acquisition to our rural economy, and there are at this time persons of opulence and public spirit fully adequate to such an undertaking."

And "the pears held in most estimation, are the squash, so called from the tenderness of its pulp; the old-field, from having grown as a seedling in a field of that name; the huff-cap, from the quantity of fixed air contained in its liquor; the bar-land, from fields in the parish of Bosbury, called the Barlands, which were anciently held under the tenure of conveying the provision of the lord, or Barelands from their deficiency of produce at some particular period; the sack pear, from its richness; and the red pear, from its colour."

Of the more common sorts, "the long-land is the most valuable, and for the general use of the farmer, perhaps the best of any." See *Apple* and *Apple-tree*.

In providing trees of this sort, it is a good practice to procure them from a soil nearly similar or rather worse than that where they are intended to be planted; as trees transplanted from a rich soil to a poorer never thrive so well, but if from a poor to a richer soil, they generally succeed in a more perfect manner.

Good trees which have been properly pruned, which are quite free from bruises and disease, should always be carefully selected, and their roots should be preserved as much as possible when taken up.

The most proper sorts of trees for small orchards where cider is not the object, may be those of the janeting, golden pippin, nonsuch, Ribston pippin, nonpareil queen, sky-house, golden rennet, aromatic pippin, grey-leadington, scarlet pearmain, lemon pippin, pommegrice, French crab, russeting and codlin kinds. But various other sorts may be employed where the orchards are extensive and a great variety of fruit necessary, as well as in districts where the orchards are intended wholly for the purpose of affording cider.

In regard to the cider fruits, it has been remarked, that as "the decay of the old and most valuable fruits in Herefordshire is so generally acknowledged and lamented, their renovation or the introduction of others equally good cannot be too strongly urged, and that the public spirit of the present age has not been indifferent on the occasion, as more endeavours have perhaps been directed towards this object within the last twenty years, than during a century pre-

seeding. Grafting, as most expeditious, has been most frequently attempted, but it is presumed that no mode of grafting hitherto practised has been found adequate to the purpose. The shoots being unavoidably taken from old trees, flourish during a few years from the vigour of the crab stock, and relapse into all the infirmities of the parent tree. On this principle the renovation of the old fruits appears impracticable; by the general laws of nature each animated being lives to propagate its species, and after a time resigns its place to a successor. Mr. Knight observes, that the branch from which a graft is taken, evidently partakes of the life of the tree to which it belongs; and that it is equally evident that when part of a tree is detached, no new life is communicated, whether it be used as a graft, or placed to emit roots as a cutting: thus a tree raised from a cutting, soon produces fruit in every respect similar to that of the tree from which it was taken. He also remarks, that the habits of seedling trees are very essentially different, that their leaves are small and thin, and that the general habit changes gradually, assuming annually a more cultivated character: thus, if a graft be taken from a seedling tree of one or two years old, it will retain the character; and undergo the same annual change as the seedling tree, whatever be the age of the stock into which it is inserted; and that it will remain unproductive of fruit or blossom until the seedling tree has acquired its proper age and maturity.

"Hence he infers, as before mentioned, that the cutting must partake of the life, and consequently of all the habits of the original tree. In support of this theory, he states, that a seedling walnut grafted with a part of the bearing branch of an old tree, produced blossom at three years old; that the Spanish chesnut, under a simple process, blossomed in the year after it was grafted; and that an annual scion of mulberry tree, thus grafted, bore a plentiful crop of fruit (considering its size,) in the third year after, and has continued to bear every year since. The grafts in these cases, Mr. Knight remarks, must have carried the mature habits of the parent tree with them, and if they retain the habits, it may fairly be inferred, that they retain also the same progressive tendency to decay. In short, a tree, like an animal, has "*its infancy, its flowering spring, its summer's ardent strength, its sober autumn fading into age, and its pale concluding winter.*

"The opinion of the best informed planters, is, that the seeds of the old fruits should be sown, and the most strong and healthy plants selected for cultivation and a supply of grafts.

"This experiment has been adopted on a large scale by several planters, has hitherto promised the fullest success, and has further the sanction of that period in which orcharding received particular attention."

And it is added, that "a treatise on this subject was published by W. Lawson, a north countryman, in the year 1626, and he states, that the best way to plant an orchard is to turn the ground with a spade in February, and to set from February to May some kernels of the best and soundest apples and pears a finger deep, and at a foot distance, and to leave the likeliest plants only in the natural place, removing the others as time and occasion shall require." And that "Lord Scudamore also fully understood the nature and value of this practice: who, on retiring to Hom Lacy, amidst other useful and honourable employments of a country life, paid great attention to the culture of fruit trees, and particularly to that of the red streak, which he seems to have introduced into general notice and esteem." As late also as the year 1654, a treatise called The Country-Man's Recreation, or, the Art of Planting, Grafting, &c. remarks, that "although the pippins be sown of the pomes of pears and good apples, yet we shall find that some of them do love the tree whereof they came, and those be right which have a smooth bark, and are as fair as those which be grafted." These instances, it is presumed, are sufficient to show that "at the period alluded to, it was well known, that good fruits might be raised by sowing the kernels of good apples, and selecting those plants, which in the absence of thorns and in the general appearance of their leaves and bark bore the greatest resemblance to the cultivated variety of the parent tree, whilst those which approach the native crab were carefully rejected.

"Yet Evelyn, he says, in the Appendix to his Sylva, published several years afterwards, proves that the practice was hardly known there in his time. He writes, nothing is more facile than to raise new kinds of apples *in infinitum* from kernels, yet in that apple county (Hereford) so much addicted to orchards, we could never encounter more than two or three persons that did believe it." This method, however, is now becoming more and more general; the writer says, several thousand grafts thus raised are yearly distributed by the Agricultural Society, and are sought for with the utmost avidity. The most experienced planters consider it as the best, if not the only expedient to preserve their provincial celebrity; and nothing surely can be more unphilosophical than to suppose that a piece of old dying tree can ever form a healthy and vigorous one."

It is added, that "Mr. Knight has now many seedling apple trees, produced between the Siberian crab and our richest apples. The vigour of most of them is astonishing. And as they blossom as early as the pear-trees, he is convinced that they will be found of great value, particularly in high situations, where the Siberian very rarely fails to produce a good crop of fruit."

With regard to the proper distance of planting the trees, it should be regulated, in some measure, by the natural growth or spreading of them when fully grown, as well as the nature and goodness of the soil. It was formerly the practice to have them put in at narrow distances; but at present, ten, twelve, or fifteen yards are more common, and in the cider districts from twenty to twenty-five yards are in use. The usual mode of arranging the trees, is, in open grounds, in lines or rows; but in close plantations, the quincunx method is more in use. In the row

method when it can be done, they should be in the direction of north and south, or one point more to the east, as by this means they will have the advantage of the sun from the early part of the morning in the spring season, which will, in a great measure, prevent the damp fogs from hanging upon them and obstructing the due increase of the fruit.

But, in the Herefordshire Report, after observing, that the rows should be in the above direction for the purpose of each part of each tree receiving equal portions of light and heat, it is remarked, that the distance between each row as well as the space between each tree should depend on the situation and soil. When the former is high and exposed, the trees should be closely planted to afford each other protection; and when the latter is poor and shallow, their growth will, in course, be less luxuriant, and they will consequently require less room. But in low and sheltered situations, and in deep and rich soils, wider intervals should be allowed. In the former instances, twelve yards between each row and six between each tree are sufficient; in the latter, twenty-four yards between each row and eight between each tree will not be too much.

Pruning is not in general used; the most approved method, is that of rendering thin and pervious to the light, the points of the external branches which should be so that the internal branches of the tree may not be wholly shaded by the external parts.

It is remarked by the author of the above Agricultural Report, that in planting pear-trees, a wider interval should be allowed between them, than is necessary to the apple trees. In the most closely planted orchards, the rows should not be less than eighteen yards distant, nor the trees nearer than eight or nine yards from each other. When the ground is to remain under tillage it is better to allow even twenty-five or thirty yards between the rows.

In the act of planting or putting the trees into the ground, where young trees are employed, great care should be taken that they are not put into too great a depth, as where that is the case, they are in great danger of being destroyed. It is also necessary that a bed of fine good mould be provided for them, and that it be carefully put in with them, so as to be properly insinuated among the fibres of the roots, and afford them due support; the whole being carefully trodden round the plants in finishing the business.

Upon this being performed in a proper and perfect manner, and the young trees afterwards kept perfectly steady by suitable supports, the success of the planter in a great measure depends.

In the sorts of orchards where the trees are planted in the quincunx order and at the distance of eighty feet, Mr. Forsyth says the ground between the rows may be ploughed and sown with wheat, turnips, &c. or planted with potatoes. The ploughing or digging the ground, provided it be not done so deep as to hurt the roots by admitting the sun and rain to meliorate the ground, will, he thinks, keep the trees in a healthy flourishing state. It will be necessary to support the young trees by tying them to stakes, until they are well rooted, to prevent their being loosened or blown down by the wind. In the spring after planting, if it prove dry, some turf should be dug and laid round the stems of the young trees with the grassy side downwards, which will keep the ground moist and save a deal of watering; if the trees have taken well, this need not be repeated, as they will be out of danger the first year. The turf should be laid as far as the roots of the trees are supposed to extend, and when it is rotted, it should be dug in, which will be of great service to their roots.

Such trees as are of very different sizes when full grown, should not, he says, be planted promiscuously; but if the soil be properly adapted, the larger planted in the back parts or higher grounds, or at the north-ends of the rows, if they run nearly north and south, and the others in succession according to their size. The trees, when planted in this manner, will have a fine effect when grown up; but if they are planted promiscuously they will not appear so agreeable to the eye; and besides, the smaller trees will be shaded by the larger, which injures them and spoils the flavour of the fruit. The trunks of the trees in those where cattle feed, should be high enough to prevent their branches being barked or injured by the cattle rubbing against them, particularly when young, which in the stems may be done by triangles of wood, or the trees bushed with thorns.

But for orchards where cattle are not permitted to go, Mr. Forsyth prefers dwarf-trees to standards, taking care to proportion the distance of the rows to the size of the trees.

It is advised, that orchards should be dunged once in two or three years with some sort of good manure, as this is of much advantage in rendering them fruitful and productive.

In respect to the after-management, it chiefly consists in keeping the trees properly pruned, thinned, and cut in, as where this is judiciously done, the trees will come into bearing sooner, and continue in vigour for nearly double the common time. But with these standard trees, less culture is necessary than in other cases. No branch should ever be shortened, unless for the figure of the tree, and then it should be taken off close at the separation. The more the range of branches shoot circularly, a little inclining upwards, the more equally will the sap be distributed and the better the tree bear. The range of branches should not be too near each other, that the fruit and leaves may not be deprived of their full share of sun, and where it suits the middle of the tree, should be so free from wood, that no branch may cross another, but all the extremities point outwards.

About October or November, or as soon as the fruit is removed, is the most proper season for this work. It is the best practice to take off superfluous branches with a saw, and afterwards to smooth the place with a knife; for it is essential that every branch which is to come off, should be cut perfectly close and smooth; the wounded part may be then smeared over with a proper composition, such as that employed by Mr. Forsyth, and described in his Treatise on Fruit Trees.

In Herefordshire, large branches are rarely or never amputated. The instrument generally used for the purpose of pruning, is a strong flat chisel fixed to a handle six feet or more in length, having a

sharp edge on one of its sides, and a hook upon the other.

Such branches should always be taken off as come near to the ground, and have received any material injury, and have a tendency to cross the tree, or run inwards, or that where the leaves are much curled. And a little attention may be given to the beauty of the head, leaving all the branches as nearly equidistant as possible. Where there are many remaining blotches, they should be opened or scored with a knife; and where the bark is ragged from any laceration, it should be pared gently down to the living wood, touching over each part with a proper composition. This being done, the moss should be rubbed clean off, and the trees scored. In this last operation, care should be taken not to cut through the inner or white rind which joins the bark to the wood. When trees are much thinned, they are subject to throw out great quantity of young shoots in the spring, which should be rubbed off and not cut, as cutting is apt to increase the number.

It has been stated by the author of the Treatise on Fruit Trees that "when young trees are planted out from the nursery, as soon as they begin to break in the spring, they are to be cut down to three or four eyes, according to their strength to furnish them with bearing wood; if this were not done, they would run up in long naked branches, and would not produce one quarter of the fruit which they do when this operation is properly performed. The same holds good in heading all kinds of old trees.

An opinion prevails, particularly in those parts where apple trees are cultivated to any considerable extent, that trees never bear well after being headed down, and that it kills them. This may no doubt happen when they are improperly headed down all at once, by giving a sudden check to the sap, the few weak shoots not having strength to draw up what is supplied by the roots; and moreover, not being capable of sheltering one another, they are chilled by the cold, and so rendered at least unproductive if they are not totally killed: but if heading were done gradually, that is, if every other branch all over the tree were headed at a proper length, cutting as near to those parts where the shoots appear as possible, in the months of February or March, or even as late as May; in the course of the summer they would throw out fine long shoots. These should not be shortened the first year, unless it be necessary to shorten a few to fill up the head of the tree with bearing wood, and that should be done in the following spring, cutting them to six or eight inches long, according to their strength. In the next spring after the first branches are headed, the remaining old branches may be cut out, and these will soon fill the head of the tree with fine bearing wood. In three years, he says, if properly managed, trees so headed will produce a much greater quantity of fruit and of a better quality, than they did before the operation was performed." It has been remarked, that the management of orchards is capable of being reduced to a system under a few general heads, concentered in the principle of making all trees in orchards healthy, round, large, and beautiful.

Due pruning would greatly prevent the speckled and stunted fruit, occasioned by the trees being overloaded with wood, which obstructs the rays of the sun, and causes a vapour, the cold whereof stunts the fruit in its first growth. When branches of any great size are to be cut off, Mr. Bucknall found it impossible to take them off by a bill without leaving a stump, or improper wound; and as it is essential that every branch be cut perfectly close and smooth, he used saws, and afterwards smoothed over the saw cut with a knife, immediately applying his medicated tar to the wound. The medicated tar is composed of half an ounce of corrosive sublimate reduced to a fine powder, and put into a three-pint pipkin with a glassful of spirits of hartshorn, and stirred well together till the sublimate is dissolved. The pipkin is then filled by degrees with common tar, and constantly stirred till the mixture is blended as intimately as possible. This composition has been found by Mr. Bucknall to answer the purposes of excluding the air, keeping off insects and vermin of every description, and of assisting the wound to heal. But the composition directed by Mr. Forsyth is probably much better.

In heading down old decayed apple trees for the sake of symmetry, the author of the Treatise on Fruit Trees says, "it will be necessary to cut at the forked branches, as near as can be to the upper side of the fork, cutting them in a sloping manner, to carry off the wet, at the same time rounding the edges; the orchardist may begin at the lower branches, cutting just above the lower bark, and proceeding upwards, cut the rest of the branches from one to six joints or forks, according to their strength, till he have finished cutting in, the whole head. If any of these branches should have the canker, all the infected part must be cut out. When the tree is all prepared, the composition must be immediately applied, beginning at the top of the tree, and finishing with the powder of wood-ashes and burnt bones in descending, which will save its being rubbed off during the operation, and the composition will prevent the sun and air from injuring the naked inner bark. A tree thus prepared will, he says, in the course of three or four years, produce more and finer fruit than a maiden tree that has been planted upwards of twenty years."

The great enemy to orchards where apples are grown is misletoe, and often permitted to become very injurious to them; the usual method of clearing trees from it, is to pull it out with hooks in frosty weather, when brittle and readily broken off from the branches. A labourer is capable of clearing fifty or sixty trees in a day.

Moss, moist spring frost, blights, and several other similar causes, are highly injurious to this sort of tree, as is shown under these particular heads

Mr. Marshall remarks, in his Rural Economy of Gloucestershire and Herefordshire, that "spring frosts are an enemy against which, perhaps, it is most difficult to guard orchard trees. Dry frosts are observed to have no other effects than keeping the blossoms back; consequently, are frequently serviceable to fruit-trees. But wet frosts, namely frost after rain or a fog-

gy air, and before the trees have had time to dry, are very injurious even to the buds. An instance is mentioned in which a flying hazy shower in the evening was succeeded by a smart frost: that side of the trees against which the haze drove, was entirely cut off; while the opposite side, which had escaped the moisture, likewise escaped the effect of the frost.

"Much, however may depend on the strength of the blossoms. The spring of the year (1788) had its frosts, and all hope of fruit was more than once given up; yet for quantity and quality, taken jointly, there has seldom perhaps been so favourable a fruit year. But this year, the buds formed, and the blossoms broke forth with unusual vigour; and were enabled by their own strength, to set common enemies at defiance. On the contrary, the preceding spring, many of the blossoms sickened in the bud; and those which opened were weak and languid: the consequence was, in the instances he observed, scarcely an apple succeeded.

"The assistance, therefore, required from art in this case is by keeping the trees in a healthful vigorous state, to enable them to throw out a strength of bud and blossom; and by keeping them thin of wood, to give them an opportunity of drying quickly before the frost set in." See *Blight*.

The author of the Report for the county of Hereford says, that "the pear, although in general producing an inferior liquor, possesses many advantages for general culture when compared with the apple. It will flourish in a greater variety of soils, is more productive, and being incapable (in those sorts which are proper for perry) to be eaten or applied to any common culinary purpose, it is little subject to be stolen even in situations where fruit does not abound. As an ornamental tree, it possesses sufficient merit to entitle it to a place where ornament is the principal object; its form is often picturesque, and it blossoms in the spring, and its fruit in autumn are always beautiful. Every tree when nearly full grown, will afford in moderately good ground an annual produce of twenty gallons of liquor, (taking many years together,) even at the lowest calculation. Many single trees in Herefordshire have produced a hogshead in one season, and an extraordinary tree growing on the glebe land of the parish of Hom Lacey has more than once filled fifteen hogsheads in the same year: when the branches of this tree, in its original state, became long and heavy, their extreme ends successively fell to the ground, and taking fresh root at the several points where they touched it, each branch became as a new tree, and in its turn produced others in the same way. Nearly half an acre of land remains thus covered at the present time. Some of the branches have fallen over the hedge into an adjacent meadow, and little difficulty would be found in extending its progress. An acre of land is capable of containing thirty pear trees of usual dimensions, which taken from new varieties of fruit, would probably continue in a productive state beyond the conclusion of a second century. The produce of an acre planted with apple trees, will generally be found nearly one third less than the same quantity of ground planted with pear trees would afford, with the exception of the halmer pear, and the old field; but the apple tree begins to bear at an earlier age, and cider will ever be justly preferred to the juice of the pear. As an object of sight, the pear tree has every advantage over its rival; but Mr. A. Knight is of opinion that under the system now practising to procure new varieties, the apple tree may in some degree at least acquire the recommendation of ornament, as well as use; those crossed with the Siberian crab, promise to be of this description. The value of the ground as a pasture in closely planted orchards will necessarily be much reduced, but the loss of herbage will in few instances amount to more than one tenth of the value of the fruit."

"The grass produced in an orchard comes very early in the spring, when it is peculiarly valuable to the farmer. Under judicious management it is never suffered to grow long or coarse, and an orchard in this condition will be found to support a very considerable quantity of stock."

It is further observed in the same report, that "if the apple and pear trees were thinly dispersed over the meadows and pastures of every district in which they would succeed, the injury done to the herbage would be extremely small; and such trees might perhaps be made to supply the whole population of the country employed in agriculture, with as wholesome and palatable a beverage as they now possess, and in fruitful years a large quantity would be afforded for the use of the towns. The number of acres now employed in raising hops and poles to support them, might be greatly reduced, and this alone would prove an immense advantage to agriculture. Hops at present occupy the best ground the farmer has to give them, they take his best manure, they are too often the principal objects of his attention, and whilst their culture injures the crops of corn in every district where they abound, it may be questioned whether the produce of a thous and acres annually afford nutriment sufficient to support a human being. By an extended culture of the apple and pear, many millions of bushels of barley, now converted into malt, might be annually saved and applied to better purposes.

"The ground now employed in its culture, might be made to produce wheat, or other articles immediately necessary to society; and that the juice of the apple and pear will afford a liquor as wholesome as any which can be obtained from malt, is sufficiently evinced, he says, by the general appearance of the natives of this and other cider counties."

In the district of Kent, according to Mr. Marshall, in some instances the interspaces of young orchards are occupied by hops, in others by filberts, and in grown orchards the latter are sometimes seen. Some old orchards are likewise in permanent sward, others under arable or garden crops, and some in sainfoin, while others are in lucern. See *Planting*, *Fruit Trees*, and *Apple Trees*.

It has been observed by the author of the Rural Economy of Gloucestershire and Herefordshire, that "the cultivation of fruit trees, for the sole purpose of liquor, is peculiar to the western provinces. The

southern counties, when the London markets are over stocked with fruit, make a sort of liquor from the surplus: but the eastern, the northern, and the midland counties, may be said to be as much unacquainted with the business of a liquor-orchard, as they are with that of a vineyard. Even Staffordshire, which is divided from the cider country by a narrow ridge of hill only, has not, generally speaking, he says, a barrel of cider made within it.

"Herefordshire has ever borne the name of the first cider county: Gloucestershire, however, claims a preference in the two most celebrated fruit-liquors the district affords. Worcestershire and Monmouthshire have their claims of excellency. May Hill may be considered as the center of this division of the cider country.

"Devonshire and its environing counties form, he says, another division; which, though upon the whole much inferior to this, produces one species of liquor (the coccagee cider) which is in high estimation." See *Cider*.

Orchard-*Fruit*, that sort of fruit which is grown in orchards. In some districts, and particularly that of Kent, besides apples and pears, they have other sorts of orchard-fruits, such as plums, cherries, filberts, &c.

Orchard-*Grass*, a small, fine, very sweet grass, rising under the trees in orchards. This sort of grass is of a very purgative quality. It should be kept eaten down well, in order to render it the most productive.

Cherry Orchard, that sort of orchard which is principally destined to the raising of cherries. These sorts of orchards are common in the county of Kent, in which the common black cherry is mostly cultivated, though, according to Mr. Marshall, it is now on the decline. In Hertfordshire, about King's Langley and Watford, they employ the caroon and small black, as the Kentish will not thrive there at all. In Kent they are planted in lines at the distance of twenty feet asunder, but in Hertfordshire they allow each tree nine square perches of land." In about ten years after planting, cherry trees begin to bear, and a full grown tree will produce fifty dozen pounds in a good year, and from ten to twenty years six dozen. The prices vary from ten pence to three shillings the dozen. They are very beneficial to the poor in the quantity of employment which they afford in gathering the crop, in which they are paid from 4d. to 8d. per dozen pounds.

ORE, a native substance, containing some metal or other in an altered state, which is constantly either combined with some foreign substance which deprives it of malleability and metallic brilliancy, or else so intimately mixed that the particles of metal cannot be discerned. In all cases wherein the metallic substance is clearly distinguishable, it is not called an ore, but a native metal.

"The metal in most ores is in the state of oxide or calx, combined with vital air. And when ores contain nothing but the calx of the metal, with the addition of more or less fixed air, they are, according to Mr. Nicholson, said to be calciform; but when they are combined with other substances, they are said to be mineralized. The mineralizers are either arsenic or sulphur. Besides the mineralizers, there are various stony matters which accompany ores in a certain peculiar way with regard to crystallization and appearance, which has occasioned miners to consider them as possessing an affinity to the ore. This stony accompaniment, of which a better notion may be formed by inspection of ores, than from any general description, is called the *matrix* of the ore. The rocks that lie over the veins are called the roof, those that lie under them the floor, and by some the *hading*. The matrix is almost always a finer species of stone than the surrounding rocks, though of the same genus. Even the rocks themselves are of a finer grain as they approach the vein. There is no matrix peculiarly appropriated to any metal; it has only been remarked that tin is generally found among stones of the siliceous genus, and lead very frequently among those of the calcareous."

He adds that "ores therefore consist, 1, of metallic substances in a combined or rather calciform state, or 2, of these substances combined with other matters, with which they are said to be mineralized. Calcined metallic substances, or calciform ores, are metallic substances in the state of a calx or metallic earth.

"Such are all ferruginous ochres which are calces of iron. And mineralized ores are 1, simple, containing only one metallic substance; or 2, compound, containing two or more metallic substances.

"Of the simple and also of the compound ores, four kinds may be distinguished.

"1st. Ores consisting of metallic substances mineralized by sulphur. Such is the lead ore called *galena*, composed of lead and sulphur.

"2d. Ores consisting of metallic substances mineralized by arsenic. Such is the white *pyrites*, containing iron and arsenic.

"3d. Ores consisting of metallic substances mineralized by sulphur and by arsenic. Such is the red silver ore, containing silver, arsenic, and sulphur.

"4th. Ores consisting of metallic substances mineralized by saline matters. Such are the native vitriols. Such also is probably the corneous silver ore, which according to Cronstedt is a *luna cornea*, or silver combined with marine acid. To this class also may be referred the silver mineralized by an alkaline substance which Mr. Von Justi has discovered."

It is further stated, "that metals and metalliferous ores are met with in various places. First, that they are found under water in beds of rivers, lakes, and seas, and chiefly at the fluxures of these; such are the auriferous and ferruginous sands, grains of native gold ochres, and fragments of ores washed from mines. Secondly, that they are found dissolved in water. Such are vitriolic waters containing iron, copper, zinc. Thirdly, that they are found upon the surface of the earth. Such are many ochres, metalliferous stones, sands, and clays, and lumps of ores. Mr. Gemelin says, that in the northern parts of Asia, ores are almost always found upon or near the surface of the ground. And fourthly, that they are found under the surface of the earth. When the quantity of these collected in one place is considerable, it is called a mine. This is the case which chiefly interests the rural economist."

It is remarked in addition, "that subterranean

metals and ores are differently disposed in different places."

1. "Some are infixed in stones, and earths forming nodules or spots diversely coloured.

2. "Some are equally and uniformly diffused through the substance of earths and stones, to which they give colour, density, and other properties. Such are the greater part of those earths, stones, sands, clays, crystals, flints, gems, and fluors, which are coloured.

3. "Some form strata in mountains; such are the slates, pyrites, copper ore, lead ore, silver ore, or blend. These lie in the same direction as the strata of stones betwixt which they are placed; but they differ from the ordinary strata in this circumstance, that the thickness of different parts of the same metalliferous stratum is often very various, whereas the thickness of the stony strata is known to be generally very uniform.

4. "Fragments of ores are frequently found accumulated in certain subterranean cavities, in fissures of mountains, or interposed betwixt the strata of the earth. These are loose, unconnected, frequently involved in clay, and not adherent to the contiguous rocks or strata immediately, nor by intervention of spar or quartz, as the ores found in veins are. Tin and iron mines are frequently of this kind.

5. "Large entire masses of ores are sometimes found in the stony strata of mountains. These are improperly called cumulated veins, because their length relatively to their breadth and depth is not considerable.

6. "Some instances are mentioned of entire mountains consisting of ore. Such is the mountain Taberg in Smoland, and such are the mountains of Kerunavera and Luosuvara in Lapland, the former of which is 400 perches long, and 100 perches broad. These mountains consist of iron ore.

7. "Lastly and chiefly, metals and ores are found in oblong tracts forming masses called veins, which lie in the stony strata composing mountains."

It is observed that "the direction of veins greatly varies, some being straight, others curved. Their positions also respecting the horizon are very various, some being perpendicular, some horizontal, and the rest being of the intermediate degrees of declivity. The dimensions, the quality, and the quantity of contents and many other circumstances of veins are also very various. Miners distinguish the several kinds of veins by names expressive of their differences. Thus veins are said to be deep, perpendicular, horizontal, or hanging, or diluted, rich, poor, morning, noon, evening, and night veins, by which their direction towards that part of the compass, where the sun is at any of these divisions of the natural day, is signified.

"Some parts of veins are considerably thicker than others; small veins frequently branch out from large ones, and sometimes these branches return into the trunk from which they issued. These veins from which many smaller veins depart, have been observed to be generally rich land.

"Veins are variously terminated: 1, by a gradual diminution, as if they had been compressed while yet soft by super-incumbent weight, or by splitting and dividing into several smaller veins; or, 2, they are terminated abruptly together with their proper strata in which they lie. This abrupt termination of veins and strata, is occasioned by their being crossed by new strata running transversely to the direction of the former, or by perpendicular fissures through the strata, which fissures are frequently filled with alluvial matters, or with water, or are empty. These perpendicular fissures seem to have been occasioned by some rupture or derangement of the stratum through which the vein passes, by which one part of it has been raised, or depressed or removed aside from the other, probably by earthquakes. Where the vein is terminated abruptly it does not cease, but is only broken and disjointed, and is often recovered by searching in the analogous parts of the opposite side of the deranged stratum.

"A principal part of the art of miners, consists in discovering the modes of their derangements from external marks, that they may know where to search for the disjoined vein."

With regard to "the contents of veins, these are metals and metalliferous minerals, as the several kinds of ores, pyrites, blends, gulves, vitriols; the several kinds of fluors, spars, quartz, horn-blend, in which the ores are generally imbedded or inveloped, and which compose the matrix of the ore; stalactites, crystallizations of these metalliferous and stony substances, incrusting the small cavities of the circumjacent rock; and lastly water, which flows or drops through crevices in that rock. In a vein, ores are found sometimes attached to the rock or stratum through which the vein runs, but more frequently to a matrix which adheres to the rock; and sometimes both these kinds of adhesion occur in the same vein at different places. Frequently, between the matrix and the rock, a thin crust of stone or of earth is interposed, called by authors the *fimbria* of the orea." And "the matrix or the stone in which the ore lies inveloped, is of various kinds in different veins. And some kinds of stone seem better adapted than others, to give reception to any ore, or to the ores of particular metals. Thus quartz, spar, fluors, and horn-blend, give reception to all ores and metals, but slates chiefly to copper and silver; and never to tin, calcareous and sparry matrix, to lead, silver, and tin, and mica to iron. Veins lie in strata of different kinds of stone, but more frequently in some kinds of stone than in others.

"Thus, of the simple or uncompounded stones which compose strata, the following are metalliferous: calcareous stones, slates, sand-stone, felt, spar, quartz, sometimes jasper, frequently slates, and chiefly micaceous or talky stones and horn-blend. No veins have been found in gypseous or siliceous strata, though cherts and flints frequently contain metallic particles, and some instances have been observed of ores of silver and tin in alabaster. Of compound stones, those are said to be chiefly metalliferous which consist of particles of horn-blend. Veins have also been found in the red granite, but seldom, if ever, in any other granite, or in porphyry. In general, veins are more frequently found in soft fossile and friable strata, than in those which are compact and hard. "It is added, that a vein

sometimes passes from one stratum into the inferior contiguous stratum; sometimes even the veins of one stratum so correspond with those of an inferior stratum, the contiguity of which with the former is interrupted by a mass of different matter, through which the veins do not pass, that they seem originally to have been continued from one stratum to the other. Thus, in the mines of Derbyshire, where the veins lie in strata of lime-stone, the contiguity of which strata with each other is interrupted in some places by a blue marle or clay, and in other places by a compound stone called load-stone, the veins of one stratum frequently correspond with the veins of the inferior stratum of lime-stone, but are never continued through the interposed clay or load-stone. But we must observe that these interposed masses, the blue marle, clay, and load-stone, have not the uniform thickness observable in regular strata, but are (especially the load-stone) in some places a few feet in depth, and in others some hundreds of yards. The above disposition seems to indicate that these several strata of lime-stone have been originally contiguous: that the veins now disjoined have been once continued; that these strata of lime-stone have been afterwards separated by some violent cause, probably by the same earthquakes which have in a singular manner shattered the strata of this mountainous country; that the interstices thus formed between the separated strata, have been filled with such matters as the waters could insinuate, probably with the mixed comminuted ruins of shattered strata, or with the *lava* of neighbouring volcanos, of which many vestiges remain."

In addition to the above history, the able author has given several conjectural remarks in regard to their formation. "Those ores which are found under water upon the surface of the earth in fissures of mountains, and subterranean cavities, accumulated but not adherent to the contiguous rocks, seem from their loose unconnected broken appearances to have been conveyed by allution. And all martial ochres have probably been separated from vitriolic ferruginous waters either spontaneously or by calcareous earth, and these waters seem to have acquired their metallic contents by dissolving the vitriol which is produced by the spontaneous decomposition of martial pyrites. The ochres of copper, zinc, and perhaps of several other metals have probably been precipitated from vitriolic waters by some substance, as calcareous earth, more disposed to combine with acids; and these vitriolic waters have probably been rendered metalliferous by dissolving the vitriols produced by a combustion of cupreous pyrites and of the ore of zinc called blend for these minerals are not as martial pyrites, susceptible of decomposition spontaneously, that is, by air and moisture. Further, the metalliferous nodules and spots seem to have been infixed in stones while they were yet soft. Perhaps the metalliferous and lapideous particles were at once dissolved and suspended in the same aqueous menstruum, and during their concretion crystallized distinctly as different salts do when dissolved in the same fluid. The earths and stones uniformly coloured by metals were also probably in a soft state while they received those tinges. The opake-coloured stones seem to have received their colours from metallic calces mixed and diffused through the soft lapideous substance; and the transparent-coloured stones have probably received their colours from vitriolic salts or from metallic particles dissolved in the same water, which softened or liquified the stony substances, which metallic salts and particles were so much diffused that they could not be distinctly crystallized. That all stones have been once liquid and dissolved in water appears probable not only from their regular crystallized forms, but also from the solubility of some stones, as of gypseous and calcareous earths, in water, and from the water which we know is contained in the hardest marbles as well as in alabasters, to which water these stones owe the crystallisation of their particles."

It is further stated that "the veins called cumulated and the entire metalliferous mountains are believed by Wallerius to be analogous to the nodules, and that these metalliferous substances seem to have been originally formed or concreted in the places where they are found. It is likewise suggested that the metalliferous strata have probably been insinuated between the lapideous strata after the separation of these from each other by some violent cause, in the same manner in which it was supposed that the clay and loadstone have been insinuated betwixt the several strata in Derbyshire: the matters thus insinuated may have been either fluid, which would afterwards crystallize and form entire regular masses; or they may have been the ruins of shattered strata and veins brought by water and there deposited, in which case they will appear broken and irregular. The metalliferous strata, though frequently confounded with the horizontal or dilated veins, may be distinguished, according to Wallerius, from these by the following properties:—1. They are generally thinner and much broader than the veins called dilated. 2. They are seldom found at a greater depth than an hundred perches, and generally in the neighbourhood of veins from which they probably have received their contents. 3. From their want of the thinin crustations called *fimbriæ*, which, as has been observed, are frequently interposed betwixt the rock and the ore or its matrix, and from their want of the other properties of veins. But in veins properly so called, the strongest marks exist of ores having been there concreted, and not carried thither and deposed in their present state. Their regular unbroken appearance, their adhesion to the contiguous rock either immediately or by intervention of a matrix, the regular appearance of this matrix inveloping the ore, the frequent crystallization of the ore, and of the other contents of the veins, indicate that ores as well as the other solid contents have been there concreted from a fluid to a solid state. And it is added that most authors believe that veins and the perpendicular clefts in the stony strata of mountains called fissures have been produced by the same cause, or rather they consider veins only as fissures filled with metalliferous matters. They further believe that fissures have been occasioned by the exslocation of strata while these were passing from a fluid to a solid state. Wallerius

thinks, he says, that fissures have been formed from exsiccation, but that veins were channels made through the strata while soft and fluid by water; or by the more fluid parts of the strata penetrating and forcing a passage though the more solid parts, he thinks that these fluid parts conveyed thither their metalliferous and stony contents, which were then coagulated or concreted. He supports his opinion by observing, that all the veins of the same stratum generally run parallel to each other, that they frequently bend in their course, that the same vein is sometimes contracted and sometimes dilated, that veins are frequently terminated by being split, or divided into inferior veins, that veins are frequently wider at bottom than at top; whereas fissures are always widest at top and are very narrow below: all which appearances, he thinks, could not have been produced by exsiccation.

"From these reasons, fissures appear to have had a different, and from the disjunction and rupture of veins crossed by fissures, they seem to have had a later origin than veins. Whether fissures could have been produced by the very gradual exsiccation of these large masses of strongly coherent matter, or whether they have been produced by the same violent causes, namely, earthquakes, by which the strata in which fissures are generally found have been broken and deranged, and by which metalliferous mountains themselves have been formed, or their strata raised above their original level, as some others have with great probability conjectured, cannot with certainty be determined. But veins are seldom, if ever, found but in mountains, the reason of which may not, Mr. Nicholson thinks, improbably be, that in metalliferous mountains we have access to the more ancient strata of earth, which, in plains, are covered with so many deposited, alluvial, and other later strata, that we can seldom, if ever, reach the former. That these mountains consist of strata which have been originally lower than the upper strata of adjacent plains, appears from an observation which has been made, that the strata of mountainous countries dip, with more or less declivity, as they approach the plains, till they gradually sink under the several strata of those plains; and are, at last, immersed beyond the reach of miners. This leading fact in the natural history of the earth has, he says, been observed by a sagacious philosopher, Mr. Mitchell, in his Conjectures concerning Earthquakes, &c. in the Philos. Trans. for 1760."

And, that "the inferior strata of the earth contained large quantities of pyritous, sulphureous, and metalliferous matters appears, he says, 1. from the subterranean fires in those inferior strata, which produce volcanos and probably earthquakes, (as Mr. Mitchell ingeniously conjectures). 2. From the observation that all kinds of mountains are not equally metalliferous, but that veins especially are only found in those mountains, which being composed of very ancient strata, are called primæval, which form the chains and extensive ridges on the surface of the earth, which direct the course of the waters, and which consist of certain strata, the thickness of each of which its genuine qualities, and its position relatively to the other strata, are in different parts of the chain of mountains, where that stratum is found, nearly uniform and alike, notwithstanding that the numbers and the inclinations of the strata, composing contiguous mountains or even different parts of the same mountain, are often very various; and therefore that veins are seldom if ever found in the mountains called by authors diluvial and temporary, which are single or detached, which consist not of strata uniformly disposed, but of alluvial masses, in which fragments of ores may be sometimes but veins never found. Nevertheless, singly and seemingly detached mountains in small islands have sometimes been found to be metalliferous.

"But we must observe that these mountains consist of uniform strata; that islands themselves, especially small islands, may be considered as eminent parts of submarine ranges of mountains, and that the mountains of such islands may be considered as apices or tops only of inferior mountains. It is added, that those mountains are said to be most metalliferous, which have a gentle ascent, a moderate height, and a broad basis, the strata of which are nearly horizontal, and not much broken and disjoined. In these mountains at least the veins are less interrupted, more extended, and consequently more valuable to miners than the veins in lofty, scraggy, irregular, and shattered mountains."

Ores of various kinds are found in many different districts of the kingdom, in greater or less states of purity; Cornwall and Derbyshire are well known to afford different kinds of these substances in great abundance.

In the Herefordshire Report, it is remarked, that "iron ore was discovered in the sandy districts of Wormelow Hundred as early as the time of the Romans in Britain; and many of the *hand blomaries* used by them, have been met with on Peterstow Common, and also several quantities of ore imperfectly smelted. It is said of late years, however, no iron has been manufactured in Herefordshire, but very extensive works are situated in the forest of Dean, at the distance of a few miles only from the tract alluded to; a richer ore is probably met with there, and the situation and other circumstances being more favourable to the improved modes of extracting it, the practice has gradually been discontinued here. Small particles of lead ore have occasionally been found in the lime-rocks situated on the north-west parts of the county, but it does not appear that any other mineral has been discovered. Many attempts to find coal have recently been made, but although first appearances have been flattering, no success has hitherto attended them." And it is added, that "of the more rare kinds of earths and clays, there have been found red and yellow ochres, fullers earth, and tobacco-pipe clay; but probably from the want of an adequate supply, or from some imperfection in their qualities, they are generally procured from other places. Fullers-earth is, however, still dug occasionally for sale in small quantities on the estates of the late Honourable Edward Foley, of Stoke-Edith."

In the Shropshire Report to the Board of Agriculture, it is stated, that "there are mines of lead ore of a good quality on the western side of this county, which have been very productive. The bog-mine in the parishes of Wentnor, and the white-grit-mine in the parishes of Shelve and Worthen, adjoin the Stiperstones; they are high hills with bare and rugged summits, resembling the ruins of walls and castles; they are, to Dr. Townson, a granulated quartz much harder than common sand-stone, but apparently not stratified. The bog-mine has been worked to the depth of 150 yards; a solid lump of pure ore of 800lb. has been got up there; the vein is in some parts three feet thick, and generally bedded in white spar. One ton of this ore will run 15 cwt. of lead, besides slag. Dr. Townson says, it is observed, these mines are an argillaceous schistus, and produce galena lead ore. This is lead mineralized by sulphur, and is the most common lead ore. It is sometimes called potters' lead ore; sometimes, spatous or lead ore crystallized in the form of spar, lead ore and blend. The ores at the white jet-mine, are the common galena and the steel-grained ores, sometimes the white spatous and considerable quantity of black-jack. The ores from this mine are not melted separately, they differ much in their product, and little experiment has been made to ascertain it. The writer adds, according to Mr. Pennant in his Welsh Tour, Vol. I. p. 447, the lamellated or common kind of lead ore, usually named potters' ore, yields from 14 to 16½ cwt. of lead from 20 cwt. of the ore, but the last produce is rare."

"At Snailbach, in the neighbourhood of the same hills, but nearer Shrewsbury, lead has been gotten for a long time. The vein was in some parts four yards wide. The vein stones are heavy spar, mixt with calcareous spar and quartz. The ore here is the common galena and the steel-grained, and sometimes the white spatous ore." It has been "worked to the depth of 180 yards. The matrix of the ore is crystallized quartz and carbonate of lime. The ore is, 1, sulphuret of lead, both galena and steel-ore, which latter contains silver; 2, carbonate of lead, crystallized; 3d, red-lead ore.

"Mr. Aikin says this ore was discovered in these mines by Raspe, a German. The writer does not know that these two red-lead ores have been ascertained to be precisely the same, or that any difference between them has been discovered."

4. "Blende or black jack." Lead-ore has been met with in many other places in this part of the county. As far west as Llanymynach, lead is found in small quantities, and copper, which the Romans are supposed to have worked to a great extent. Tools judged to be Roman have been found in these mines, and some of them are preserved in the library of Shrewsbury free-school. In this hill the lead is met with in bellies of ore, that is, a small string leads often to a body of ore, about four or five yards in diameter, but from which there is no vein issues, that may lead the miner to the other bodies of ore remaining in the hill. Calamine also is here met with. The rock at Pimhill is strongly tinctured with copper. Symptoms, both of copper and lead appear also in the Cardington hills, many miles S. E. of the spot we are speaking of, and not very far south of the centre of the county. "Lead is also sound at Shipton in the road from Wenlock to Ludlow, but never yet in sufficient quantities to reward the adventurers.

"In this parish, Mr. W. Reynolds, about ten years ago, put in practice an idea he had conceived some years before, of uncovering the strata of ironstone and coal which lie near the surface, so as to get the whole of the strata of ironstone and coal, clay, &c. to a certain depth; when, in the old method, large quantities, both of ironstone and coal, were unavoidably lost, and which never afterwards would be of any use to the proprietor or occupier of the mines. This method is now followed in other works, where the strata lie sufficiently near the surface."

In the Report of Agriculture for Somersetshire, it is remarked, that "the Mendip hills are famous for their mines, particularly of lead and lapis calaminaris. The former are nearly exhausted, or at least the deep working is so incumbered with water, that little can be done, and in all probability millions in value may remain concealed in the bowels of this mountain, till spirit enough be found in the country to perforate it by cutting a level, or audit, through its base, namely, from Compton-Martin to Wookey-Hole. The distance is about five miles, and the depth from the surface about one hundred and fifty yards. Such a tunnel would not only convey off all water, but the driving it, or the sinking of the shaft or perpendicular pits, might lead to a discovery of veins of lead hitherto unexplored, and perhaps as valuable as that now at West-Chewton, which, tradition says, yielded 100,000l. within the space of an acre." It is added, that "in times past many thousands a year have been annually paid to the see of Wells for the lord's share (that is, one tenth) of the lead dug on the forest in the parish of Wells only; and is it not more than probable, that lead, like coal, may be most valuable in the deep? On Broadfield-down there are also, he says, veins of lead; and in the parishes of Rowberrow, Shipham, and Winscomb, there are valuable mines of *lapis calaminaris*. This mineral is sometimes found within a yard of the surface, and seldom worked deeper than thirty fathoms. Between four and five hundred miners are constantly employed in this business, and the average price is about five pounds per ton. In the parishes of Compton-Martin and East-Harptry are also many mines of a similar nature, and a considerable number of men are constantly employed therein." And, it is added by R. Paget, that "there are marks and indications of calamine from these parishes in the west, through the whole tract of Mendip to Wells at the eastern extremity. At Merchant's-hill, in the parish of Binegar, several tons were raised some years ago. It was of very good quality, and more would have been landed, had not the influx of the water put a stop to the works. At the same time a large quantity was raised at Wells, remarkably pure, free from heterogeneous mixture, and of excellent quality.

It did not there descend, in regular courses, between the lime-stone rocks, but was found in large masses or hulks, lying horizontally, at about four or five feet from the surface, on a thin scale of free-stone which covered the rock; and it is highly probable that much more remains to be discovered."

And in the county of Stafford, according to the author of the Report of that district, "the strata of iron ore in the neighbourhood of Wednesbury, Tipton, Bilstone, part of the parish of Sedgely, and other parts of the coal country, are very extensive. These strata generally lay under a stratum of coal, and have occasioned some very considerable iron-works to be lately established on the banks of the Birmingham canal, where the iron trade is very much increasing; and it is to be hoped, the writer says, the capital, spirit of enterprize, and exertion of our iron-masters will, in time, produce this necessary article in sufficient quantity to preclude the necessity of an importation from abroad; or at least to lessen the quantity of such importation, the balance of trade in which, is very much against this country."

And it is added, that "the other minerals are principally those of copper and lead, of both which considerable quantities are raised at Ecton, near Warslow, upon the estate of his grace the Duke of Devonshire. Also a copper mine is worked at Mixon, within a few miles of Leek, and a lead mine near Stanton-Moor. And there are several smelting and brass works in this part of the county, particularly at Whiston, Oak-Moor, and in the neighbourhood of Cheadle."

It is observed, that "the coal land of Staffordshire, which has been proved such, and where the existence of that mineral, near enough the surface to be easily raised, has been ascertained, contains a space of about 50,000 acres: of this space the quantity exhausted by consumption, from the earliest times to the present day, does not exceed a tenth of the whole."

It is remarked in the Report of Salop, that "coal of an excellent quality is gotten on the eastern side of the country, particularly in the parishes of Wellington, Lilleshall, Wrockwardine, Wombridge, Stirchley, Dawley, Little Wenlock, Madeley, Barrow, Benthall, and Broseley," and which "promise a lasting and plentiful supply for the great iron manufactures in that neighbourhood, for domestic use, and as an export to other countries by the river Severn, on or near the sides of which they lie."—South of these works and on the other side of Bridgenorth from them, "coal appears again. It may be found in most parts of the hundred of Stottesden; but the roads in general are an obstruction to its being removed. South again of these, and of the Clee-hills, are very valuable coal works, in some of which the canal, or kennel coal, is found."

It is stated, that "Mr. William Reynolds has favoured the writer with the following lists of strata in five different collieries in the eastern district. His name will add an interest and value to the communication, in the opinion of all those who have the pleasure of knowing him."

Strata in Light-Moor Wimsey Pit.

	Yds.	Ft.	In.
"A good loam and mixed soil,	6	0	0
Pale-blue clunch,	16	0	0
Dark-grey rock, not very strong,	5	0	0
Sky-blue clunch,	2	1	6
Three stinking coals, divided by pale-blue earth, two inches between each,	1	1	6
Strong clod mingled, pale-blue and red,	16	0	0
Brown rock, called the stinking-coal rock,	7	1	0
Three stinking coals, divided by pale-blue earth, four or five inches between each,	3	0	0
Blue clunch,	4	2	0
Red clunch, pale,	4	0	0
Rough rock, so called from being full of dark-brown hard pebbles and iron-stone,	7	0	0
Bind, a pale-blue clod,	14	0	0
Stone-clod, ditto, in which lies a bed of ironstone, called ballstone,	5	0	0
Black slate,	0	1	0
Coal, called top-coal, exceeding good fuel,	1	1	0
Top-coal tough, a dark-blue earth, and a very heaving measure,	0	1	0
Coal, called the foot-coal,	0	1	0
Slumbs, black-slaty earth, and a heaving measure,	2	0	0
Coal, called the three-quarter coal,	0	2	0
Rotch, dark-grey hard rock,	0	2	0
Coal, called the double-coal,	1	0	0
Dark-grey clod; will fire from its own nature,	2	0	0
Coal, called yard-coal,	1	0	0
Black (a black slate coal, and rock mixed),	2	1	6
Clod, a pale white, in which lies a bed of ironstone, called	2	0	0
Flan, a dark-slate,	0	0	6
Coal, called upper flint-coal,	1	1	6
Upper flint, a dark-grey rock,	7	1	0
Pinny-measure; a pale blue clod, in which lies a large quantity of small balls of ironstone, called pennystone,	5	1	6
Stinking-coals; three beds, divided by three or four inches of dark-brown earth,	0	1	9
Pale-blue clod,	2	0	0
Coal, called the silk-coal,	0	1	2
Clunch, of a dark-blue,	5	1	6
Coal, called the silk-coal, divided by a few inches of grey earth,	0	1	6
Clunch of a dark blue, with coal in the middle, seventeen inches thick: the coal is called silk-coal,	3	1	10
Coal, called the two-foot coal (feet),	0	2	0
Carried forward	133	2	9

	Yds.	Ft.	In.
Brought forward	133	2	9
Lintseed-earth (dark brown—a very shuttle measure),	0	1	2
A black slate,	0	0	6
Coal, called the best coal,	0	1	6
Black-bass, or slate,	0	0	6
Coal, called the middle coal,	0	2	9
Dark-brown stony clod,	1	0	6
Coal, called clod coal,	0	1	10
Clod, of a pale blue,	1	1	8
Coal, called little-flint coal,	0	2	2
Little flint; a rock of a dark grey, mixed with pebbles and ironstone,	16	0	0
	152	1	4
Die earth; a pale blue hard clunch: this measure continues the same, to the depth of more than	100	0	0

So far he has proved on the rise of the work." How much deeper it is, not known.

Strata at Wombridge, at the Pit next the Engine.

	Yds.	Ft.	In.
"Earth and catbrain, of various thicknesses,	4	0	0
Top-rock,	7	0	0
Bind-bass,	0	1	6
Bind,	4	0	0
Ballstone and earth,	2	2	0
Short-earth,	3	0	0
Top-coal bass,	0	1	0
Top-coal,	1	2	0
Top-coal and poundstone,	0	1	0
Slums,	0	1	6
Foot-coal,	0	1	0
Three-quarter coal,	0	2	3
Rock,	1	1	4
Double-coal,	2	0	0
Double-coal poundstone,	0	1	6
Yellow-stone, earth and stone,	2	0	0
Yard-coal,	1	0	0
Yard-coal poundstone,	0	1	0
Quiest-neck,	0	1	0
Blue-flatstone, earth and stone,	1	1	6
Picher-basses,	1	1	6
Flint-coal rock,	3	2	0
Flint-coal roof,	3	0	0
Flint coal,	1	1	6
	43	2	7

Strata in Madeley field.

	Yds.	Ft.	In.
"Suppose the soil, clay, or sand, may be, in general, about	8	0	0
Stinking-coal rock,	7	0	0
Ditto clod, blueish-grey,	1	0	0
Carried forward	16	0	0

	Yds.	Ft.	In.
Brought forward	16	0	0
First stinking coal,	0	2	0
A tough pricking,	0	0	4
Second stinking-coal,	0	0	4
A strong clod, darker than the first,	3	0	0
Freestone rock, containing plum-pudding-stone,	7	0	0
A clod, much like the first,	1	0	0
Top-coal,	1	0	0
Basses, or blacks,	1	2	0
Blackstone, earth and ironstone,	0	1	0
Bottom-coal,	1	0	0
Great-flint and ironstone,	5	1	6
Prenny-measure and ditto,	2	0	0
Third stinking-coal,	0	1	0
Pricking,	0	0	2
Upper clunches,	3	0	0
Sill-coal, or big-coal,	0	0	7
Two-foot rock,	6	0	0
Two-foot coal,	0	1	6
Lower clunches,	2	1	6
Little ganey coal,	0	1	0
Pricking,	0	1	0
Ganey-stone,	0	0	9
Ganey-coal,	0	1	6
A clunch,	2	0	0
Best coal,	1	0	0
A Bass,	0	0	4
Middle coal, or randles,	0	2	0
A clod,	0	0	6
Clod-coal,	0	1	8
Pricking,	0	0	6
Clod-coal poundstone,	1	1	0
The hard-man, with little flint-coal—ironstone in it,	0	2	6
Little flint-coal,	0	2	0
Little flint-coal, rock with crawstone in it, and its measure a little coal for a pricking, half inch thick,	7	0	0
	67	2	8

Underneath is a clayey earth, called die-earth, of an unknown thickness."

It is remarked that "this measure is found to consist of stratifications, and appears to have been lifted up like the upper measures; and though this circumstance is not perceived at first, or when it is exposed to the day, yet, on sinking some yards into it, it is very perceptible."

Strata in Slaneys Dawley Deep Work.

	Yds.	Ft.	In
"Soil and loose rock,	3	2	0
Yellow, blue, and red stuff, with stones,	5	1	6
White clunch, with pieces of white rock,	10	0	0
Grey rock,	1	1	6
Yellow cloddy stuff,	5	1	6
White clunch, or rocky stuff,	3	0	0
Carried forward	29	0	6

	Yds.	Ft.	In.
Brought forward - -	29	0	6
Grey rock, - - - -	3	2	5
White clunchy stuff, - - -	1	1	6
White rock, - - - -	0	1	6
Pitchy rock, - - - -	14	2	0
Bass and coal, - - -	0	0	6
Blue tough stuff, - - -	0	1	0
Coal, - - - - -	0	1	5
Blue clunchy stuff, - - -	6	0	5
Red ditto ditto, - - -	2	0	0
Blue ditto ditto, - - -	1	0	8
Red ditto ditto, - - -	2	2	0
Blue ditto ditto, - - -	9	2	8
Coal, - - - - -	0	0	6
Blue clunch, - - - -	0	2	6
Fleece of white rock (casing), -	0	0	6
Blue clunchy hard stuff, - -	8	1	8
Coal, - - - - -	0	2	0
Blue clunchy stiff hard stuff, - -	4	1	1
Red ditto, very strong, - -	2	1	9
Hard (very hard white rock), - -	0	1	9
Mingled red and white strong stuff, -	2	2	1
Very hard white rock, - - -	1	1	10
Rock, red and white, hard, - -	3	2	11
Ditto, very hard and white, with spar, -	0	0	6
Hard white rock, - - - -	4	1	0
Yellowish stuff, called the callimanca earth, - - - - -	5	0	5
White rock, - - - - -	0	1	7
Mingled red and white, and greyish stuff, - - - - -	3	2	9
Bass, - - - - -	0	2	0
Stone-clod, - - - -	0	2	6
Ironstone, supposed the logs, - -	0	0	5
Clod, - - - - - -	0	1	8
Coal, mixed with rock, - -	0	2	0
Flint-coal, or bottom-coal, - -	0	1	3
	116	1	3

"It is obvious therefore, that in the first-mentioned coal-pit, no coal was found within much less than 30 yards of the surface, and that then three small layers of bad coal only were gotten; that after sinking near 24 yards deeper, three other layers of the same coal were procured, but that the first vein of good coal lay 92 yards beneath the surface; that this vein was 4 feet thick, that none of the veins appear to have been more than 5 feet thick; and that in 154 yards, and more, regularly worked, or above 254, taking in the whole experiment, 13 yards 2 feet coal were found. In the second pit specified, the coal appears to have been met with in little more than 21 yards from the surface. One of the veins proved 6 feet thick; and in sinking somewhat less than 44 yards, above seven yards thickness of coal was discovered. In the third pit specified, the sulphureous, or bad coal, was met with in 16 yards from the surface, and good coal in less than 28 yards; no vein exceeded 3 feet; and the aggregate in almost 68 yards, was not quite 9 yards of coal. In the fourth pit specified, the first unmixed coal was 50 yards from the surface; and in sinking above 116 yards, it does not appear that here was any vein thicker than 2 feet; and the aggregate of unmixed coal measured only 5 feet 2 inches in thickness."

The writer remarks, that "Dr. Townson, in his Tracts, p. 166, has given the strata of two other pits in the same district, and has added to the colliers' names for the different measures, his own definition of each. He observes, that 'annually about 260,000 tons of coal are raised in this district,' a very large proportion of which are consumed in the adjacent iron-works, he presumes; for he has understood, that in the Ketley iron-works they use at least 6 ton of coal out of every 7 they raise. What he has called the collieries of the eastern district, comprehend pits on both sides the river Severn. The veins of coal in this district, are equal in thickness, he believes, to most in this country, but very inferior to those of the Staffordshire works, from 15 to 20 miles east of these, where, he has been told, there is a bed of coal measuring 13 yards or more. The next coal works to be mentioned, are those of the Clee-hill, from 20 to 30 miles south of those he has been describing. Collieries indeed are now working at Billingsley, connecting them, in some measure, by their situation; and again west of the eastern coal district pits have been lately sunk with success."

The following lists of the strata in two of the Clee-hill collieries, are, he says, from Dr. Townson's Tracts.

"*Strata found in sinking the deep pit in the southern part of the hill:*

	Yds.	Ft.
Earth and sandstone rock, - -	10	1½
Basalt, called here Jewstone, - -	64	1½
Sandstone-rock, bind, clunch, and coal roof: dry clays, - - -	23	0
The great coal, - - -	2	0
Coal-bottom and ironstone-roof: these are dry clays, - - -	1	1
Ironstone-measure: a dry clay, - -	1	0½
Three-quarter coal, - - -	0	1½
Clumper: hard dry clay, - -	2	0
Smith's coal, - - - -	1	2
The smith coal-bottom: dry clay, down to the four feet coal-rock, - -	0	2
	107	1

"*The strata in the water-pit, which is about a quarter of a mile to the north-east of the preceding, are:*

	Yds.	Ft.
Basalt, here called Jewstone, - -	48	0
Brown and white clunch: dry clay, -	6	0
Red rock: a yellowish sandstone, -	9	0
Bind and clunch: dry clays, - -	9	0
Finney ironstone measure: dry clay, -	1	0
Clunch: dry clay, - - -	3	0
Brown rock: a yellowish sandstone, -	6	0
Tuff (plastic clay), and sand, - -	1	0
Carried forward	83	0

	Yds.	Ft.
Brought forward - - -	83	0
Black bind: a dry clay, - - -	4	0
Rock: very coarse sandstone, - -	5	0
Strong clay, - - - -	1	0
Horse-flesh earth: a variegated red and white marl, - - -	6	0
Grey rock: sandstone, - - -	6	0
Bind: a dry clay, - - -	2	0
Great coal-rock: whitish sandstone, -	6	0
Coal-roof: dry clay, - - -	3	0
The great coal, - - - -	2	0
Coal-bottom pounsin: a dry clay, -	1	0
Ironstone-roof and measure: a dry clay, -	1	1
Three-quarter coal, and bass, - -	0	2
Clumper: a hard dry clay, - -	3	1
Smith-coal, and clod in it, - -	1	2
Strong clunch: dry clay, - -	2	0
Flan and bass: hard dry clay, - -	0	2
Strong clunch: dry clay, - -	3	0
Four-foot coal, and bass, - -	1	0
Strong brown clunch: dry clay, - -	1	0
Sunk into the four-foot coal-rock, -	3	1
	137	0

It is remarked, that "in the first of these Cleehill pits, the first strata of coal is found 98 yards below the surface; that the thickest vein is 6 feet; and that the aggregate of coal in 107 yards 1 foot, is 12 feet 6 inches. In the second pit, they must sink 116 yards before coal is found, the vein of which is also 6 feet thick; and the other veins which are not pure coal, measure in the aggregate 10 feet; so that, in 137 yards, there are only 16 feet of coals, and of these, only six that are unmixed."

It is further observed, that "of the collieries in the west and north-west extremity of the county, the most considerable were those of Llwyn y Main and Trevor Claudd, which appear to be nearly exhausted; but other collieries have been lately opened between Oswestry and Chirk-bridge. The colliers describe these veins as diverging rays from an ideal centre, marked here by the part of the horizon where the sun appears from eight to ten o'clock in the morning. To this ideal centre the Ruabon collieries dip from north-west to east on the north side the Dee. The Chirk collieries, from west to east on the south side the Dee, and between that river and the Ceiriog; and again, the Pen y bryn collieries, lately begun to be worked, and the only work of the three in Shropshire, dips from west to east on the south side the Ceiriog. These veins range up against a ridge of lime-rocks, that run from north to south-west. Those near Ruabon, as well as those on the south side the Ceiriog, are a strong bituminous coal, with the baking quality of the Newcastle coal, yielding a strong heat, but no bad smell, except the top-coal. The veins between the Dee and Ceiriog, are, it is observed, a lighter coal, burning more quickly, and the ashes are white. This difference is supposed by the colliers, to arise from the less weight of water that is over these veins."

In several other districts, ores of other sorts are likewise found.

The stratified order of several other pits may be seen in the same report.

ORE-WEED, a general name for weeds growing at the bottom of the sea and also on the muddy and rocky parts of the shore. These sorts of sea-weeds are so beneficial a manure, that farmers ought not to grudge the expense of carrying them a few miles. In Devonshire, Cornwall, and other maritime parts of England, these weeds are laid in heaps till they are rotten, and then spread upon the land, about a load to three rods; but this lasts only one year, unless sand, or a stiff earth, according to the quality of the soil intended to be improved, be laid on or mixed with them; and then they become a lasting manure. In some places these weeds are gathered in heaps, and burnt as soon as they are dry; after which about a bushel of their ashes is laid on upon three rods of ground. But these, like all other ashes, should be mixed with sand, or stiff earth, in order to have the land last good: otherwise they are only an improvement for a year. These ashes are particularly good for grass-grounds over-run with moss. Loose sandy soils are likewise peculiarly benefited by this weed; but being a sub-marine plant, the wind and soil soon exhale its moisture; so that the more speedily it is taken from the shore, where storms often throw it up in great quantities, the better it is. When spread on the ground, and afterwards covered over, it soon dissolves into a saline mucilaginous slimy matter, proper to fertilize and bind light soils; this is the most approved way of applying it: though some lay it naked and fresh from the sea, upon their barley land, towards the end of March and beginning of April, and have a good crop of corn: but such quantities of rank weeds are apt to shoot up afterwards, that no wholesome plant is to be expected that year.

The value of the lands on some of the coasts of Scotland has been more than doubled by the use of this excellent manure. It is chiefly used there for barley; and the farmers watch every opportunity, when it is thrown in by the sea, and lay it on at all seasons, in autumn, winter, and spring. But if they could choose their time, it would probably do best about the month of March; for being then ploughed into the ground, and afterwards ploughed up again to the seed, it would be better incorporated and blended with the soil; whereas, if it be laid on in autumn, before the fallowing or first ploughing, it is too much wasted before the spring; and if it be laid on the seed furrow, it is apt to burn the ground in a dry season, though it will do very well in this method in a wet summer. Its effects are but just felt the second year; though it is laid on thicker upon strong clay land, which receives no other manure for three crops, viz, barley, oats, peas, and beans; a method which might, perhaps, be altered for the better, by omitting the oats and sowing alternately barley, and peas and beans, and laying on the sea-ware as these weeds are commonly called, for every second crop of peas and beans.

It is evident from Mr. Scott's account of the manner of using sea-ware in Scotland, (published by Mr.

Maxwell,) that much of this valuable manure must necessarily be lost through want of proper management, as they have no reservoirs to keep it in, when thrown ashore at a season in which they cannot use it, or where there is no ground in tilth, as is generally the case in winter, and during the busy part of their hay and corn harvest. It should be collected on these occasions, and lodged in a place free from any running water; and as it is equally beneficial to strong or light lands, it might be there covered with sand or clay, according to the nature of the soil for which it is intended. This will prevent its being parched by the sun or its dissolving into a putrid mass, which if not secured in this manner, would either be washed away by rains, or fly off into the air; whereas when thus covered, it would greatly enrich the clay or sand, and render them good manures for their opposite soils. If it be thrown ashore at a time when it can be ploughed in directly, that is supposed the best manner of using it.

It is added, that there is a kind of land all along the coast, which is gravelly, and covered over so thick with sea-stones, that to look at it, one would not think corn could spring through them; and another sort of land which is a deadish sand. To both these grounds sea-ware is the only manure; for dung of all kinds has been often tried, but with no success; and yet sea-ware makes them bring excellent crops of barley: this kind of ground is seldom ploughed more than twice, and the sea-weed is generally laid on before the first ploughing. Barley is sowed during two years, and peas the third; a fresh manure of sea-weed being laid on each year that barley is sown. As little wheat is cultivated in some parts, the farmers there might probably improve their practice of raising barley and peas, by sowing them alternately, and laying the sea-ware to the peas. In the summer it is carried to a distance from the sea, and laid upon ley-ground, (arable land under grass,) which, though in very ill heart, will bear a good crop of oats with only once ploughing, or of barley if ploughed again in the spring.

Another kind of sea-ware, of a much stronger nature than that which is thrown up by the waves, is cut from the rocks at low water, and will last three years. It costs more labour, but brings greater recompence. The best time of laying this on the ground, is supposed to be in autumn, before the land is ploughed rough for a spring crop.

The farmers on the coasts of Scotland prefer this manure to any other, especially for their light grounds; and it has the advantage of being much more easily transported, because one load of it will go as far as two of dung. It does very well in kitchen gardens, where Mr. Scott says he has seen pot-herbs and roots of an extraordinary size produced by its help; to which he adds, that he has known fruit-trees, perfectly barren before, rendered extremely fruitful by laying this manure about the roots.

It is observed also by Mr. Duhamel, that ore or sea-weeds are used with great success in the maritime provinces of France. See *Sea-weed*, and *Manure*.

OSIER, a particular sort of willow which is often planted in moist boggy situations on the borders of rivers, for the use of the shoots in basket-making and other purposes.

The names and uses of the species employed in the vicinity of Brentford are thus stated in the Middlesex Report:

"1st. The *salix vitallina*, or yellow willow, which is cultivated chiefly by the nurserymen, and being of a tough yielding nature, is used for binding packages of trees and shrubs in the drawing season, and for tying up the branches of wall and espalier trees.

"2d. The *salix amygdalina*, or almond-leaved willow, which is a species of which there are several varieties, one of which is called by the planters 'the small red willow,' or 'binding rod;' it being chiefly used for binding the produce of garden-grounds. Another kind of this willow is at present known by the loose appellation of the 'new kind;' it is of large growth, and produces a great crop; is used both by the basket-makers and the corn sieve-makers, and is fit for any work which requires a firm as well as a tough rod.

"3d. The *salix viminalis*, or osier willow—Of this species there are also several varieties, which are called among the planters by the name of 'the yellow and brown osiers,' or, 'Comb's osiers.' They are chiefly used by the basket-makers, being very pleasant working rods, and, as they produce a great crop, are much cultivated.

"These three descriptions comprehend the most useful varieties, and are the most profitable in point of crop, of any that are cultivated in that district. There is, however, a coarse sort of willow, known by the name of 'the Spaniard:' but whether it is a distinct species or not is not decided: it might be rendered extremely useful in counties where much brush or underwood is bound." According to Mr. Young, "February is the proper time to plant osiers and other sorts of willows. No part of the farmer's business pays, he says, better than such plantations, especially if he has any low, spongy, boggy bottoms near a stream. The land shouldbe formed by spade-work into beds six, eight, or ten feet broad, by narrow ditches: and if there is a power of keeping water in these cuts at pleasure by a sluice, it is in some seasons every advantageous to do so." It is observed by John Phillips, Esq. of Ely, in the sixteenth Volume of the Transactions of the Society of Arts, &c. that he has "made many experiments on different soils, with the view of ascertaining which are most appropriate to osier plantations; and which, of the almost infinite variety of osiers, are best adapted to the different soils; but as his plantations are *chiefly* in the fens, he has directed his attention more particularly to determine what species of osiers are most profitable in a black peat soil, and which is the most advantageous way of planting them, and at what season of the year. It would have been of much public utility, he thinks, if the basket-makers had given a specific description of the best kind of osiers, the planting of which they wished to be encouraged by premiums. The planters would in that case have procured those only; much expense would have been saved to other gentlemen as

well as himself, and a very considerable addition would have been made in the plantations to the stock of the best osiers which are imported from abroad. As we have no generic or specific terms, he will endeavour to give a plain vulgar account of those only which are selected by the most experienced planters in his neighbourhood. Osier, in common, is a word of very indeterminate signification: it is certainly a species of the salix, but admitting of many varieties. He has endeavoured to reduce them to two classes; first, those which are so called by the growers and basket-makers, distinguishable by their more blunt, mealy, or downy leaf; and, secondly, those that have a leaf more pointed, smooth, and green, resembling that of a myrtle. Of the first class he has nine or ten varieties, all of which he shall eradicate, save one, *viz.* that which is called the *grey*, or *brindled osier*. It has, in common with the others, the light-coloured leaf, but is known by having its bark streaked with red, or blood colour. It has not been long introduced into this country. It grows vigorously, is very hardy and tough, and bleaches well. All the others of the first class delight in a wet soil, and will flourish even in the most barren kind of peat; but they are coarse and spongy, have a large pith, are brittle, and very perishable: they are, however, used sometimes for the stouter parts of large baskets, and unpeeled for wine-hampers. They grow quick and large, and a small number will fill the ell bunch, by which all osiers are sold; they are profitable to those growers only who live near London, or whose plantations are contiguous to water-carriage. He has some acres of them; and were he to send them there by waggon, which is the only mode of conveyance, they would not pay for the carriage. In time of war, when our intercourse with France and Holland has been interrupted, where they grow better sorts, they have been too much resorted to, which has brought our baskets into disrepute, and lessened the demand for them in foreign markets: this, together with the enhanced price of insurance, accounts for the fact, that war makes osiers in this kingdom both dear and cheap; that is, dear at the commencement for want of importation, and cheap during its progress for want of exportation, after having been manufactured into baskets, and other works to which they are applied."

And he adds that, "of the second class are, 1, the Welsh, both red and white; the red having the preference, and is said to have been brought originally from Wales; they form an almost essential part of every plantation, as no other is fit to tie the bunches after the rods have been peeled and whitened. A bunch is formed by compressing the osiers in an iron hoop or band, of an ell in circumference; eighty bunches make a load, which four years back sold at £.18; it is not now worth £.12. The best land will produce a load on an acre, but half a load is not a very bad crop on bad land. The expense of weeding, renewing, cutting, and peeling, is about £. 5. per acre, when the business is well done; but they often go unweeded, when they are sold at a low price, to the great decay of the plantations. The *Welsh* are also used to tie reed sheaves for thatch; they are so bitter that cattle will not browse them, unless driven to the extremity of hunger, and rats will not touch them, although they will destroy almost every kind of bandage. They were formerly grown for the coopers, to bind their hoops; but for this use they have long given way to the hazel; they are very tough and durable, and would rank with the best sorts for the use of basket-makers, were they of a better colour when peeled." And "2. The *west country Spaniard*, which is supposed to have been first introduced into the west of England from Spain. It is very different from the *Spaniard*, which is a species of the larger willow, and used for hedging-wood and hurdles. In the Isle of Ely it was long in high estimation, until others were introduced, supposed to be superior in some of their qualities: the bark is of a blueish grey colour; it grows stout and stately, and objects to no soil; the grower, however, urges against it what he thinks to be a strong objection, viz. that it produces a small crop. It bears, comparatively, only a few shoots on a head: this is certainly true; but what then? it is not so profitable. He admits it, provided only an equal number be planted on an acre with those that bear more shoots; but why should the grower tie himself to plant an equal number of different sorts on a given quantity of land? The nurseryman is governed by no such rule; and the farmer would become an object of pity, were he to sow an equal quantity of every sort of grain on an acre. The planter and farmer should be guided only by the burden which the land is capable of bearing. His experience teaches, that an acre of land will carry, of this sort, 14000 plants with more ease than 12000 of the best new kind. 3. He has not been able to learn where the *new kind* originated. It is well known every where; and although it must be much older in some counties than others, it is universally called by that name. There are, however, two sorts; the other is called the *last*, or *best new kind*. The bark of the former is of a light brown colour; that of the latter resembles rusty iron, with light longitudinal stripes: it is on that account called, by some persons, the *Corderoy*. When the new kind was first introduced into the Isle of Ely, it soon expelled most of those of the first class; the few that are retained are used by the fishermen to make grigs, or twig tunnels, to catch eels and other fish: it still maintains considerable reputation, but yields to the *last* new kind, which, besides possessing most of the best properties, produces, on an average, at least four shoots on the head more than any other, and it will grow well on a dry mellow soil. As its shoots are more numerous, a greater space should be allotted to it, to draw nourishment from the earth, and to admit the rays of the sun and circulation of air, so necessary to the growth of every plant: 11000 an acre is quite sufficient on good land. But the best of all, considered in a public or political view, is, he says, 4. the *French*. Under this name the *ground-setter* is, he supposes, frequently sold; and, he is informed that it was so called, from its tendency,

when neglected, to direct its shoots amongst grass and weeds, parallel with and near the ground: it is of the same quality, colour, and appearance with the French, except that it has at the point a tuft formed of leaves curled inwards, which has the appearance of a small withered rose-bud. You will easily know both from all others, thus: draw them through your fist from the top to the bottom, and the leaves will snap off with the brittleness of glass. The ground-setter grows very slowly, and is rejected by the planters on that account: the French, although more luxuriant, is also of comparatively slow growth; and it requires a great number to make up the bunch; but it is exceedingly taper, pliant, close-grained, tough, and durable. The basket-makers are more desirous of it than any other, as it is best suited to make the smaller and finer baskets, hats, fans, and other delicate articles. As it is much disregarded by the planters in this kingdom, the basket-makers, in times of peace, import vast quantities from France, the Austrian Netherlands, and Holland, where it is cultivated with great success. It is singular that it should be imported cheaper than our planters can afford to grow it; the lands in France and Holland are much dearer than our fens. As an article of commerce, or as a raw material, it deserves every encouragement that the public or individuals can give it; and if it be not so profitable to the grower, it is always of ready sale."

And he has heard of another sort, which is well spoken of, called the *red Kent willow;* but he is doubtful whether he is possessed of it or not; we have in this neighbourhood a very hard, tough willow, of a reddish colour, of which hurdles, cribs, &c. are generally made. He planted it last year, in foot-sets, for the use of basket-makers: but as the experiment is now only in process, he can say nothing of its utility.

The method of planting in these cases, on the banks of the Thames, is thus described in the Transactions of the Society for the Encouragement of Arts, &c.

"The ground is dug during the winter a full spade's depth, and left rough, to prevent the tides from running it together again before it can be planted.

"The work begins in the month of March. The planter having procured the sets or plants, which are fifteen or sixteen inches long, cut diagonally off the strongest shoots of the last year's growth, care being taken that they are not cut near to the top of the rods, that part being too porous to make a sound plant, the ground is then marked out into rows two feet asunder; and the sets are stuck in the rows, eighteen inches from each other, leaving about seven inches of the sets above the ground. This work is very easily done, without using even a dibble or a setting-stick; but, when planted, care must be taken, by hoeing, to keep them as free from weeds as possible; or, if the ground be too wet for the hoe, a weeding hook may be used to keep them down: this is absolutely necessary to ensure a good plantation. It is also equally necessary to keep the ground well drained, to prevent the tides remaining upon it any considerable time, for on that also depends the firmness and good quality of the rods.

The willows are cut over the first year with a bill-hook; the shoots are cut off close to the stock and bound up in bundles, or boults, as they are called, which measure forty-two inches round, at sixteen inches above the butt ends. The same process of weeding must be pursued every summer: while they are shooting up from the stem. The next season a cutting portion of them is left to stand another year where large stuff is wanted for the ribs of large baskets, &c.

"The planting of willows is expensive in the first year; but if well managed they produce a great profit, as they improve in quantity every year."

However, in regard to the most advantageous modes of planting, there is, it is observed, in the sixteenth volume of the Transactions of the Society of Arts, &c. a diversity of opinion. The different qualities of soils are not sufficiently attended to. A single experiment is liable to deceive; what may hit or fail one year, may be the contrary the next. "It requires a diversified series of experiments to enable us to form a right judgment. The plantations of the year 1794, made on banks of soil thrown out of the ditches on each side, and those made on the level ground, flourished equally well that year. It was difficult to judge of them the next year, for they had been more or less injured by the vast inundation of all the fens of the Isle of Ely, and which was not removed in many places until late in the summer; but in the third year the advantage was manifestly in favour of those which had been made on banks or elevated beds. They have in this district, he says, from ten to fourteen inches of vegetating soil on the surface; immediately beneath it is a black or brown barren peat, of a loose texture. In the drought of summer, when the moisture is exhaled from the upper and more tenacious soil, the water instantly filters through the peat, and leaves the plants destitute of their best nourishment; but when the peat is thrown upon the solid earth, it will prevent the rays of the sun from penetrating to the bottom; and when the water falls in the ditches, the lower and more tenacious soil will retain a sufficient quantity of it for the use of the plants. Care should be taken to insert the sets through the peat into this lower stratum: they will strike their radicles the first year into this more solid earth: but when the peat has been meliorated by the sun and air, and been compressed, and become more adhesive, they will strike higher in the stem, until the radicles or fibres approach the surface. It must be admitted, the writer says, that this is an expensive method, and lessens the quantity of land to be planted upon. To remedy this inconvenience, he lays out his land in beds or barrows, of eighteen feet wide; ditches, of nine feet wide, are dug on each side; the top of which, fourteen inches thick, is laid on the barrows; turf for fuel is then dug in the ditches, the expense of which is about 1s. 8d. a thousand; they are sold for 2s. 6d.

The beds or barrows, now consisting of about two feet and a half thick of solid earth, above the surface of the peat, are planted the following autumn, and produce good crops: when the water is sufficiently low, he casts upon these beds a fetid vegetable sub-

stance, vulgarly called bear's muck; it resembles wet shag tobacco, and lies under the peat; it is extremely useful to the plants; and although it is, in its primitive state, a perfect caput mortuum, when exposed some time to the air it putrifies, affords mucilage, and becomes a good manure. In embanked districts, subject to frequent and long inundations, two other advantages are obtained from these raised beds: the osiers are thereby removed farther from the reach of the ice, which on a thaw floats into the lower plantations, and does them much injury. When the waters are high, in the cutting or planting season, the beds are more accessible than the level ground; but having had the command of the water last summer, by a mill or engine, he dug out the peat into turf, having first laid aside the upper spit; the turf being removed, he shall return this spit into the ditch, and plant upon it; thus no ground will be lost."

He further states that "in the year 1796 he made an experiment on an acre of land of this quality; he ploughed one half of it, and the other half was dug with the spade, about fourteen inches deep; the sod of that thickness was inverted by the spade. The plantation on the ploughed land was very weak, and failed in many places; that which followed the spade did better; but they are both so bad, that they must be renewed this year. On the former, the best land lay uppermost, which, when deprived, by the heat, of its moisture, derived no assistance to support the plants from the peat that lay underneath; on the latter, some of the best land was laid in the ground, but not deep enough to retain a sufficient quantity of moisture. The preceding year he planted in a piece contiguous, on banks as before described, and there the osiers do well. And he has a rich loam lying on a bed of potters clay: the situation is low, and exposed to the water: French osiers were very scarce, and he could procure only a few hundreds last year; determined to eke them out as far as he could, he laid them down in their whole length, and pegged them on the ground; they struck good roots into the earth, and threw out abundant shoots. This experiment, together with that of planting upon banks, will enable him, he says, to answer the question often asked, 'Of what length ought the set to be?' It depends entirely upon the nature and situation of the land. There should be so much of it in the ground as to enable it to procure moisture, and so much of it out of the ground as to make it accessible in the cutting season, where much weeding is not required: and where there are no floods, or where they subside quickly, there ought to be very little of it out of the ground. The nourishment, in that case, will pass immediately from the roots to the rods or shoots, without the burden of first supplying the head or stock."

In respect to the time of planting, every experiment that he has made, he says, confirms his opinion, that the autumn, and not the spring, is the most proper season for planting. Those who think with him say, that the fall of the leaf indicates the proper time to cut the sets; it certainly is so in general; but the leaf of the osier, like that of the oak and other trees, will sometimes prolong its departure. The stagnation of the juices is the true criterion by which to judge, not on account of the set, but of the trunk, lest, if you amputate it whilst the juices are in circulation, it should bleed to death. He has planted in the first week of October, and the sets appeared to remain torpid for the remainder of the year; about Christmas he took up several of them, and was much pleased to find that they had struck root, although they had given no outward appearance of vegetation from the time of planting. It is probable that the earth retains a sufficient portion of the summer heat until the autumn, to give life to plants at the root, when the atmosphere may at that time be so cold as to discourage any exertions above-ground; and perhaps nature may be more vigorous when her operations are confined to one point. He adds that, when you plant in spring, the set seems (if he may speak so figuratively) to have its attention distracted by two operations not very homogeneous, the one upwards, the other downwards. It is impelled to shoot its radicles into the earth, to form its stability, and procure sustenance; and it is called upon at the same time to put forth its leaves and branches. To speak without a figure, the prolific sun and air induce it to exhaust the juices, in extending the shoots before the roots are sufficiently strong and large to supply the drainage; hence it is that, contrary to the commonly received opinion, a warm and dry spring is always injurious to the young plantations. If there be not sufficient rain to convey sustenance by the leaves and bark, in aid of the small quantity procured by the root, the plant must die or dwindle; and it is very observable, that the first vigour of the late-planted set is a sure prognosticator of its decline or dissolution. In the autumn of 1795 he made a small plantation, and on the remainder of the piece he planted in March following. In the beginning of May, those last planted were the forwardest, which, for a time, staggered his opinion of the most proper time for planting; but in June, those planted in the autumn had much the advantage, and have continued to grow well: those that were set in the spring, decayed in summer, and many of them died. When the fibres have been formed before the winter, or when a tendency to form them has been observed, by the swelling of the bark, and particularly at the eye, the plant is enabled to charge itself with a sufficient portion of the juices to answer the demand of spring; the rule therefore, which he lays down for himself, where no obstructions are raised by the water, is to plant as early in the autumn as he can cut the sets, without endangering the parent stock."

In the trial of another cultivator detailed in the Transactions of the same Society, "the soil is a strong clay, resting on a retentive clay subsoil of great depth. It has long been in a state of tillage, and is enclosed by flourishing woody hedges. The soil is naturally of a weak nature, has been much impoverished by bad management, and, as arable land, is not worth five shillings per acre. The greater part of the plantation in the year 1800 consisted of oats, and received only one ploughing of a mean depth,

previous to planting. Nine acres were wheat in 1800, after the summer-fallow. Three acres in the same field with the nine, were sown with grass-seeds in the autumn of 1800, and were planted at the same time with the rest, without any preparation whatever, except that of harrowing once in a place. Eight acres, which were last planted, were in various states of tillage: some were a good fallow in 1800; some were sown with grass-seeds in the autumn of that year; and some were very grassy, and had lain all the summer without ploughing. The grassy part, and the part sown with grass-seeds, were ploughed once before planting; but the part which was summer-fallow was not ploughed. The planting was begun on the 9th of February, 1801, and continued till the whole was finished, which was on the 23d of March. The sets were large cuttings, of about eighteen inches in length, thrust into the ground by hand, having from four to six inches of their length above the surface. They were all planted in rows from twenty-two to thirty inches asunder, and the sets from twelve to twenty-four inches asunder in the rows: but few were planted at the widest distances."

He adds, that "the plants made a more vigorous shoot in spring than they did afterwards: but they are allowed by judges to look uncommonly well. Very few sets have failed, perhaps not above a hundred on an acre, except in the field last planted, where the dead sets are more numerous. This may be owing more to the treatment the sets received, than to the time in which they were planted. They were brought round the North and South Forelands, were put out of the ship into a barge, and from thence into a waggon, and then remained some time before they were planted. Those plants that succeeded wheat are much the best osiers: and those planted on the seeds, without ploughing, are much the worst. They are invariably the best where the ground is cleanest: and from this circumstance he is led to think, that summer-fallowing before planting would be judicious management. A neighbour of his, he says, planted 350 sets in his garden, 341 of which produced osiers: the rest died. The soil of the garden is clay. They were planted the latter end of March, in rows, thirty inches by twenty-one inches asunder, with beans between the rows. These 341 sets have produced a bundle of osiers of about thirty-eight inches in circumference; and some of them are upwards of ten feet in length. This, he thinks, proves that the soil is congenial, and the tillage favourable to the growth of osiers. In the plantation already mentioned there are several sorts, but principally those known by the name of the *new-kind*." This experiment was made by Mr. Cherry at Newwood-farm, Stoke D'Auberton in Surrey.

The following method is practised, as stated in the fifth vol. of the Farmer's Magazine: in the fens many holts (as they are provincially called,) or plantations of osiers are raised which beautify the country, keep the stock warm in the winter, and provide much useful wood for baskets, cradles, and all kinds of wicker work, and also for cribs for cattle to eat straw or hay out of, and to make stows or hurdles to fence in stacks, part land, &c. &c. or they make hedges that will last four years well, and if allowed to grow five years many of them would make fork shafts for hay or corn.

These holts or plantations of osiers are commonly made in the middle of the land, in the north and east corners, and sometimes at any end, side, or place, that appears most easy, or in any respect, the most desireable.

The situation and size of these holts vary exceedingly. Sometimes they are made in the middle of lands, from 10 to 60 yards square, and in others, in the sides or ends of, from 1 yard wide to 11, and from 10 to 100 yards long.

The mode of planting is very simple; it is, first to dig the land from 6 to 12 inches deep, and then to prick down cuttings of 4 years growth, and 18 inches long, at about three feet distance from each other. The soil should be moor or clay, or any that is low and wet; if drowned half the year it will be but little the worse.

These holts or osier plantations must be fenced round, either with dikes which is most common, or with hedges as is most convenient. The proper season for making them (they seldom fail of growing at any time) is from the fall of the leaf till very late in the spring, and the sets are very cheap. Such plantations are cut annually for baskets, skeps, scuttles, cradles, and all kinds of wicker work, but when the osiers are kept for sets or to make hedging wood, or for stows or hurdles, they are cut only once in four years.

Wherever the farmer has lands that are suited to this sort of cultivation, as there is a constant demand for such articles, he should never neglect making plantations, as nothing that he can put upon such land will probably pay him so well.

It is observed by Mr. A. Young, that "the late Mr. Forby, of Norfolk, knew the value of these plantations well for various purposes. Osiers planted in small spots, and along some of his hedges, supplied him with hurdle-stuff enough to make many dozens every year, so that he supplied himself entirely with that article, as well as with a profusion of all sorts of baskets, especially one kind that he used for moving cabbage-plants, for which purpose they were much better than tumbling the plants loose in a cart. The common osier he cut for this purpose at three years, and that with yellow bark at four."

OSKIN, a provincial word used to signify an ox-gang; or a quantity or share of common field land, proportioned probably to the size of the fields and number of messuages in the given township, at the time the fields were set out or appropriated among the houses.

OSSELETS, in *farriery*, are little hard bony excrescences on the inside of the knees of horses. According to some, there are three kinds which are of the nature of splents, and some think them the same thing; but there is this difference between them, that splents come near the knees, and osselets near the fetlocks. Their seat, in the opinion of some, is indifferently within or without the leg. The first is the simple osselet, which does not grow

near the joint of the fetlock or the nerve; which need not hinder a person from buying a horse, because it puts him to no inconvenience, and very often goes away of itself without a remedy. The second is, that which descends into the fetlock, and hinders the motion of that joint; this occasions a horse to stumble and fall, and with a very little work to become lame. The third has its seat between the bone and the nerve, and sometimes upon the nerve: it so much incommodes a horse that he cannot stand firm, but limps on every little occasion.

According to Gibson, "it arises from strains while a horse is young, before his joints are well knit. They are not common, however; and if observed in the beginning, a little oil of origanum rubbed on the part every other day, is sometimes found to dissolve them: but if they are of long continuance, they require firing, which is the most certain method to effect a cure in such cases.

OST, a term applied to the kiln for drying hops. See *Kiln* and *Oust*.

OTTER, a destructive animal of the amphibious kind.

These animals are great devourers of fish, and will travel ten or twelve miles in the space of a night. Mr. Marshall thinks, that they are greater enemies to the grown salmon, than their young. Their chief haunts are under the roots of trees near the water. Some take them with hunting-dogs; some by means of snares; and others kill them with spears.

The shortest way of destroying them is to lay, near their haunts, an eel, slit on the back, with ratsbane put in the slit, then sewing it up again. Place the eel, from the navel upwards, out of the water, and the otter will eat it so far, but seldom farther; and his destruction is certain.

If he wants prey in the waters, he will quit them for the land; and if by painful hunting on shore he cannot fill his belly, he will feed on herbs, snails, or frogs; neither will he take less pains in the water to satisfy his hunger; for he will swim two miles together against the stream, that when he has filled his belly, the current may carry him down again to his designed lodging, which is always near the water, very artificially built with boughs, sprigs, and sticks couched together in excellent order, wherein he sits to keep him from the wet.

In the hunting of fish, he often puts his nose above water to take breath: he is a creature of wonderful swiftness and nimbleness in taking his prey; and for greediness takes more than he knows what to do with. They should always be destroyed as much as possible.

OVER-DONE, in *horsemanship*, a term applied to a horse or other animal, when too much exhausted with fatigue.

Over-land *Farm*, a provincial word used to signify a parcel of land without a house to it.

Over-*reach*, in *horsemanship*, a fault in horses, in which they bring their feet too far forward, and strike the hinder toes against the spunges of their fore-shoes; it is caused by habit, weakness in the back, and by being suffered to bear too much upon the shoulders. In this way, a disagreeable clinking noise is often produced. It also signifies a wound in the fore-heel of a horse, made by the point of the hind-shoe.

When this wound is only slight or superficial, it is, in general, very easily cured by washing it clean, and applying the wound-ointment. But, where the blow has been smart, it differs widely from a common cut; the part being both torn and bruised, consequently requires to be properly digested or dressed.

For this purpose, after washing out any dirt or gravel with soap-suds, &c. the wound should be digested, by dressing it with dossils of lint dipped in an ounce of Venice turpentine, divided with the yolk of an egg, to which half an ounce of tincture of myrrh may be added: over this dressing, it is sometimes advisable to apply the turnip poultice, or that with strong-beer grounds and oatmeal, three or four times, or oftener, till the suppuration is procured, and then both these dressings may be changed for the precipitate medicines, or the lime-water mixture, observing always to apply the dossils carefully to the bottom, to fill up the sore with the same, even to the surface, and to bind all on with a compress and roller: where any cavities appear that cannot conveniently be dressed to the bottom, they should always be laid open. The hoof also should be kept supple, or pared away, when the growth of it interrupts this end, as is sometimes the case.

Over-*ridden*, in *horsemanship*, a term used to signify a horse being exhausted by too hard riding.

Over-*sweat*, a term sometimes applied to haystacks, when they sweat too much.

Over-*wrought*, a term applied to horses or other animals that are worked beyond their strength.

Over-*years*, a provincial word applied to such bullocks as are not finished in fattening at three years old when homebreeds, or the first winter after buying in; but kept through the following summer to be finished the next winter.

OURTS, a provincial term applied to the leavings of fodder by cattle. It is sometimes written oughts.

OUST, a term applied to the kiln used in drying hops. These kilns are built with fire places, in the nature of malt kilns; and at a proper distance over the fire is an hair-cloth strained upon laths; and thereon the hops are laid, and raked even, to the depth of about six or seven inches, for the better conveniency of drying them equally: and when they are properly cured on the under side, they are carefully turned; and by that means the upper side becoming the under, the whole shares the fire alike. The person that performs this part is called the dryer, whose business it is to manage the fires. The fuel commonly made use of is charcoal, on account of its freeness from smoke, and affording a steady heat. Great nicety is required in this part; a small fire being to be made, at first, that they may heat gradually, and so raised as they dry, that it may be done without scorching; and the fire is to be lowered by degrees, against they are ready to be taken off: the time required is about eight hours. From charcoal

being dear, many people have adopted the method of drying with sea-coal, upon what they call cockle-ousts, which are square iron boxes placed upon brick-work, and a flue and chimney in the back part of the building for the smoke to go off. The computation is, that a chaldron of sea-coal, at about twenty-four shillings, will dry a load of hops, and that a load of charcoal will do no more. It is indeed expensive to erect such ousts, as there must be no timber near them; and an iron beam and iron laths are to be used, and they covered with plates of tin or iron properly fastened together.

A new method of drying hops with sea-coal, or any kind of fuel whatever, by means of a moveable iron furnace has lately been invented: it is in the form of an horizontal cylinder, stopped at both ends: it lies on an iron carriage, which rolls on four iron wheels: in the fore end of the cylinder is the furnace door, and a hollow iron flue runs in an horizontal direction along the upper surface of the cylinder from the back, till it reaches the fore end of it, when it takes a vertical direction, and is carried as high as is necessary to convey the smoke out of the oust. It is a sort of rolling furnace.

OUT-HOLLING, a term provincially applied to the shovelling out a ditch for the use of the manure it contains.

Out *field-land*, a term applied to a sort of land in Scotland, which is similar to the uninclosed common field-lands in this country. Lord Dundonald remarks, that, that part of the farm, called the out field-land, never receive any manure. After taking from it two or three crops of grain, it is left in the state it was in at reaping the last crop, without sowing thereon grass-seeds for the production of any sort of herbage. During the first two or three years, a sufficiency of grass to maintain a couple of rabbits per acre, is scarcely produced. In the course of some years, it acquires a sward, and after having been depastured for some years more, it is again submitted to the same barbarous system of husbandry.

It was a sort of distinction that existed prior to the date of inclosures, and was likewise general throughout England. It is wearing out fast in Scotland from the same causes which have operated in England.

Out-*house*, such a building as belongs to, and is placed adjoining to the dwelling house.

OUZE, a sort of deposit made by the sea, which is often very sterile and unproductive.

OWCE, a provincial word applied to the ox.

OWER-GATE, a provincial word signifying a stile place, or imperfect gap in a hedge, and also a stepping place over a brook.

Ower-welt, a provincial word applied to a sheep, which gets laid upon its back in a hollow.

OX, the name of a well known animal, produced from the male of the cattle kind by castration. See *Cattle*.

Oxen, like other domestic animals, vary much in colour; but whatever be the colour it should be glossy, thick, and smooth to the touch; for if it be harsh, tough, or thin, there is reason to suppose that the animal is out of order, or at least not of a strong constitution.

Mr. Marshall made several experiments on the utility of oxen in the plough, and strongly recommends the use of them for most draught purposes, as no horses draw better. He remarks that full grown oxen in general are much longer made than horses, too long for common shafts, not having room to back the cart; for which reason the shafts should be made long enough to admit them. Ox-collars are strongly recommended. See *Collars*.

The comparative merits and demerits of beasts of labour, depend, he says, on their first cost, their keep, their work, and their value after working. A powerful, handsome, six-years-old ox, may be purchased for ten or twelve guineas; but a powerful, handsome, six-years-old horse will cost from twenty to twenty-four guineas. Suppose that ten guineas ahead are saved by purchasing oxen instead of horses, and that a farmer has occasion for three teams, he will have an addition, every ten or twelve years, of one hundred and twenty guineas to stock and manage his farm with. Their keep depends in some measure on the prices of hay and corn, and on the size and voraciousness of the beast to be fed. Taking into the account the unavoidable pilfering of carters, perhaps, on an equality of time, an ox may be kept at two thirds of the expense of a large cart-horse. In their work, it is unnecessary here to contend for superiority, but you may aspire at equality. Oxen are equally tractable and equally versatile. Their strength depends upon their age and breed, and their activity on their make and strength. A two-years-old ox is as worthless in work as a two-years-old horse; and the working of either is unpardonable. An ox does not arrive at full strength, especially if worked while young, until he be six years old. At that age, a large deep-chested ox is equal in strength to a strong well-made cart-horse. Mr. Marshall adds, that he is not so partial to oxen as to imagine that they can do whatever horses can do: he is nevertheless nearly positive, that whatever farming-horses do, oxen (of a proper age and properly managed) can do. On the road they are, beyond all doubt, equal to horses, and at plough they are not inferior, except their work be very heavy. In heavy work they will not strive like horses, but will in defiance keep their steady pace. In this point of view, and in this only, he thinks, oxen are unequal to horses. Indeed he never worked oxen all the year round, as horses are done, but he has always given a month's marshing in the spring, and they have generally had some idle days in winter; their fodder however, in this case, has been proportionable.

In the Rural Economy of Yorkshire, he observes, the long agitated dispute about the superiority of oxen or horses, as beasts of draught, may here be considered with singular propriety. But he is afraid even this country will not furnish sufficient evidence for a final decision.

"Formerly, and from time immemorial, four or six oxen in yokes, led by two horses, also double,

were the invariable draught or team of the country; not only upon the road, but in ploughing. Even in stirring a fallow, four oxen and two horses were generally considered as requisite. And in breaking up a fallow, two men and a boy were the common attendants of this unwieldy, expensive team.

"At present, there is not perhaps, throughout the Vale, a single ox employed in tillage: two horses with whip reins, without a driver, is now the universal plough-team for all soils, in almost every state.

"Upon the road, however, that is to say, in farm carriages, oxen are still in use: but seldom more than a single pair to a carriage; generally at the pole, with two or three horses at length before them. Beside, a number of entire horse-teams now travel upon the roads; things which formerly were unknown in the country.

"Even the timber-carriers (an industrious, wary set of men) continue to use them; though their sole employment be upon the road. They not only find them able to stand working every day, provided their feet do not fail them: but, what is much in their favour, they are found to stand long hours better than horses going in the same pasture. An ox in a good pasture soon fills his belly, and lays himself down to rest; whereas a short summer's night scarcely affords a horse time enough to satisfy his hunger.

"Another advantage of oxen is here held out. In stiff pulls of every kind, most especially in going up steep hills, a pair of oxen are considered as a sheet-anchor. Horses, it is argued, are fearful, and soon lose their feet in a steep slippery road; while oxen, where they are unable to proceed, will always stand their ground. Indeed, oxen seem to be considered as essentially necessary in an aukward hilly country.

"If we had no other species of animals adapted to the purpose of draught in the island, nor any one which could be naturalized to the climate, cart-horses would be truly valuable; they being much superior to the breed of saddle-horses for the purpose of draught.

"But it appears to him evident, from the experience he has had, and the observations he has made, that were only a small share of the attention paid to the breeding of draught oxen, which now is bestowed on the breeding of cart-horses; animals equally powerful, more active; less costly; equally adapted to the purposes of husbandry, (if harnessed with equal judgment); less expensive in keep and attendance; much more durable; and infinitely more valuable after they have finished their labours, might be produced."

An ox is to draw the plough only from his third to his tenth year, when it will be adviseable to fatten and sell him, as being then of a better flesh than if he was kept longer. The age of this creature is known by his teeth and horns. The first fore-teeth, which he sheds at the end of ten months, are replaced by others, larger, but not so white; at six months the teeth next to those in the middle, fall out, and are also replaced by others: and in three years all the incisive teeth are renewed. They are then equal, long, and pretty white; but as the ox advances in years, they wear, become unequal and black. It is the same in the bull and cow: so that the growth and shedding of the teeth are not affected by castration, or the difference of sexes. Nor is the shedding of the horns affected by either; as both bull, ox, and cow, lose them alike at the end of three years; and these also are replaced by other horns, which, like the second teeth, remain; only those of the ox and cow are larger and longer than those of the bull. The manner of the growth of these second horns is not uniform, nor the shooting of them equal. The first year, that is the fourth of the ox's age, two small pointed horns make their appearance nearly formed, smooth, and towards the head terminated by a kind of button. The following year, this button moves from the head, being impelled by a corneous cylinder, which also lengthening, is terminated by another button; and so on; for the horns continue growing as long as the creature lives. These buttons become annular joints, which are easily distinguished in the horn, and by which the age of the creature may be readily known; counting three years for the point of the horn to the first joint, and one year for each of the other intervals. See *Age* of *Neat Cattle*.

It is stated by the writer of a late Treatise on Cattle, that "as a labouring animal, for agricultural purposes, he is, on the whole, far superior to the horse. This important position has been so repeatedly and irrefragably proved, he says, that it ought, at this period, to be fully sufficient to make the assertion to be no otherwise disproved than by a fair adduction of equivalent and contrary facts. If we can, continues he, produce, in the ox, strength and weight enough for the heaviest, with speed sufficient for the lightest soils, and those joined with the highest degree of docility and resolution, what would the husbandman more? Let him under these circumstances make his calculation between the value of those benefits to be derived from the labour of the horse and the ox, taking into the account the less expensive keep of the latter, even when corn-fed, and that the profits of breeding and training for sale the labouring ox would probably equal the similar transactions with the horse." He adds that the blundering absurdities published by theoretical advocates for ox-labour have served to mislead many, and to bring infinite prejudice to the cause. We have, he observes, been gravely instructed, that the ox is fitted for the labours of tillage 'by the unwieldy magnitude of his body, the slowness of his paces, and the shortness of his legs!'—the very qualities which render him so totally unfit for the purpose, any otherwise than as a wretched substitute, and which afford the horse so manifest a superiority over him. Oxen of this description could only be advantageous for the labours of the field, in times anterior to the great improvements of horses, and the present character of the British labouring ox, is a direct reverse of the picture." And we may, he thinks, even go farther, and assert without the smallest impropriety, that we possess breeds of neat cattle in this country, well qualified, from their considerable powers of progression,

for the ordinary purposes of quick draught, carrying of burdens, or even for the saddle. Such are the Devons, Glamorgans, and the lightest of the Sussex cattle. It is not improbable, that some of these are able to trot seven or eight miles within the hour. Three or four years since, he adds, a Sussex ox ran four miles over Lewes course, for a hundred guineas, which he performed after the rate of fifteen miles per hour. Custom alone renders the use of bullocks for the saddle and the coach approved and unnoticed, or strange and ridiculous. Over great part of Asia, immemorial usage has established the propriety of employing oxen in both these capacities. They have, it is true, in those countries, the bison and the zebu, a species of oxen superior to ours in activity and facility of progression, but the comparison only proves these inferior, by no means useless, even for quick draught. Were it really an object with us to make use of bullocks in this way, there can, he thinks, be no doubt of its success, if aided by an increased attention to their breed and training, and a due measure of that liberal treatment which they are accustomed to receive in India, where their travelling oxen are curried, clothed, and attended with as much solicitude, and much greater kindness, than we bestow on our best horses. The Indian cattle are extremely docile and quick of perception, patient and kind; like the horse, their chief travelling pace is the trot, and they are reported by those who have ridden them, often to perform journeys of sixty successive days, at the rate of thirty, to forty-five miles, per day. It ought not to be forgotten in favour of the ox that, like the generous horse, he is honest to the last, and never stops, or shews mulish or asine restleness and disobedience."

The same writer further states that "much is said in favour of the mule and the ass, on account of the duration of their labour to so late a period, and a superiority thence challenged for the mule, even over the horse; but with the ox, age seems to form no question, he may, with the utmost truth, be said never to grow old, since his last value is superior to his first, and since the keeping of his successor is, in every view, a benefit to a man, being an animal which exhausts not like the horse, but manures and improves the land on which he is fed and supported." See *Team.*

OX-BOOSE, a stall or place where oxen stand in the winter to be fed or fattened.

OXEY, a provincial word, signifying like the ox, or of mature age, not steerish.

OX-FEET, a term applied to the feet of horses, when the horn of the hind feet cleaves just in the middle of the fore part of the hoof, from the coronet to the shoe: they are not common, but very troublesome, and often make a horse halt.

OX-GANG, a quantity of land measuring fifteen acres, being as much as a single ox is supposed to be capable of ploughing in a year. It is sometimes wrtten *Ox-gate.*

OX-HARROW, a term applied to a very large sort of harrow called in some counties a drag.

OX-LEGS, a term applied to an imperfection in some horses, which, though they have the back sinew of their fore-legs somewhat separate from the bone, yet their sinews are so small, and so little set off, that their legs become round after slight labour.

OX-SHOEING *Machine*, a simple contrivance employed by Mr. Young, in executing the business of shoeing these animals. It is thus brought to the attention of the public in the twenty-sixth volume of his Annals.

It is, he says, almost twenty years that he has been in the habitual practice of using oxen for both plough and cart, and from the beginning was averse from making any trials by *casting* them for shoeing. The late Lord Nugent used, he observes, many at Gosfield in Essex, and from his machine for this purpose, he took the idea of his present one, which is represented at *fig.* 4 and 5 in plate XIII. but the stumps for the fore-legs, and the moveable roller for the hind ones, he has added since, as well as altered the head apparatus and added the hinder strap.

a, Is the top piece of the sliding plank, to sink down and confine the head.

bb, Are broad strong straps of leather fastened by links of iron, to prevent the ox from lying down on his belly, which they are apt to do; and the hinder strap is to prevent his drawing back to the injury of his head and neck.

cc, Are two stumps strongly fixed in the ground, to tie the fore legs to.

dd, Is an iron that lets up and down, to confine the roller to which the hinder legs are tied for shoeing.

eee, Are holes (with others corresponding not seen in the plate) for the roller to be shifted according to the length of the ox.

It is added that the whole is so simple that it is presumed any country carpenter may be able to build it without any difficulty from inspecting the plate."

It is well remarked that the shoeing of oxen is generally so ill done, that the shoes are perpetually coming off, which is a great objection and expense. And he has never had a blacksmith that did it well: so that upon land not flinty or gravelly, he should not shoe at all if they did not go upon the high roads.—Whatever improvement can, by any means, facilitate the use of oxen in husbandry, deserves, he says, much attention, the importance of substituting them for horses rising with the price of meat, and it is with that view he has inserted this plate and explanation." See *Shoeing of Oxen.*

OXYGEN, a term applied by modern chemists, to the base of pure or respirable air, as being one of its most general properties to form acids by uniting or combining with different substances; a process which is termed *oxygenation.* Its union with the matter of heat or caloric constitutes *oxygen gas*, or vital air. It is a material that has much influence in promoting the germination and growth of seeds.

OXYGENATION, the act of uniting oxygen, with different substances: when it is combined with earthy materials, such as mould, clay, &c. they are found from experience to be more proper for the nutrition and support of different sorts of vegetables as crops. See *Aeration of Soils.*

P

PABULUM *of Plants.* See *Food of Plants.*

PACE, in *horsemanship*, the peculiar manner of motion, or progression, in the horse, or other animal. The natural paces of the horse are, a walk, a trot, and a gallop: to which some add an amble, as some horses have it naturally. Such horses as mix their paces, that is, shuffle betwixt a walk and an amble, trot or gallop, are seldom of any value.

This impropriety in their paces may proceed from different causes, as habit, fretful temper, and sometimes weakness in the loins, legs, &c.

To have a good pace, the horse should move with steadiness in these paces, without, as it were, mixing them.

PACK-HORSE, such a horse as is employed in carrying heavy loads on the back in the manner of a pack.

For this use, horses should be close, well made, and strong.

PACK-*Saddle*, a saddle adapted to the carriage of heavy packs or burdens.

PACK RAG-*Day*, a provincial term, signifying the day after Martinmas Day, the time of changing farm-servants.

PACKWAY, a provincial word, signifying a bridle-road.

PAD, a term applied to a sort of stuffed cushion, a foot-path, and also an easy paced horse.

PADDLE-STAFF, an implement used by ploughmen to free the share from stubble, earth, clay, &c. which impede its action.

PADDOCK, a small field or inclosure. It also signifies a large toad.

PADS. See *Peds.*

PAIGLE, a provincial term applied to the cowslip.

PAIL, a wooden vessel in which milk, water, or other fluids are commonly carried.

PAIL-*Brush*, a sort of hard brush furnished with bristles at the end to clean out the angles of the vessels more fully. These ought to be in every dairy, though in many districts their use is scarcely known.

PAIL-*Stake*, a simple contrivance for drying dairy utensils upon, being merely a bough of a tree furnished with different small branches, which is fixed with its thick end into the ground in the dairy-yard. The several small branchlets being lopped of proper lengths, the stumps afford pegs for hanging the pails upon, or for other utensils, by which they are not liable to be blown down and thereby burst or injured.

PAIT, a provincial term, applied to the badger.

PALE-FENCES. See *Fence.*

PALING-FENCES. See *Fence.*

PALATE, the upper part or roof of the mouth in animals.

In a horse, it should be lean, for if it be full and high, so as to be nearly level with the extremities of the upper teeth, the least height in the liberty of the bit will be troublesome, and make him either check in the bridle, and be always throwing up his head, or otherwise carry it too low, which, besides the unsightliness, much annoys the rider's hand.

PALMS, the male flowers of the willow.

PALSEY, in *Farriery*, a disease, prevalent in horses and other animals, wherein the body or some of its members lose their motion, and sometimes their sensation or feeling.

Gibson considers it as having an affinity to the apoplexy, epilepsy, &c. in so far as the nerves are affected in both, but with this difference, that in cases merely convulsive the muscles are strongly contracted by involuntary motions; whereas in paralytic disorders the nerves seem to have lost their sensibility. "In a palsy," he thinks, "the use of some part of the body, or sometimes, when it derives its origin from the head, the use of one whole

side is taken away, the parts are flaccid and relaxed, without any capacity of motion, and sometimes without sense or feeling, in which respect the palsy affects the body in a manner quite different from an epilepsy. When the palsy seizes one whole side, it is called hemiplegia, and when single parts or members are only affected, it is called local palsy. It is known by the use of some particular member in a horse, being totally, or in part lost; particularly the limbs, sometimes only one, sometimes more, and especially the hind legs. This kind is pretty usual, and tremors or shakings sometimes attend in such cases; but horses are seized with the hemiplegia, or that kind of palsy that seizes all the muscles on one side.

When the disease seizes a limb only, it is not often dangerous, and is less so when there is a continual shaking and an involuntary motion; but when it seizes both limbs behind, the case is troublesome, and the horse is not able to stand, only when supported by some means or other. In an hemiplegia, the horse falls suddenly; and though at first he will strive very much to rise, it is neither in his own power nor in the power of man, to raise him up so as to stand; for though he can move his limbs on one side, he has not the least power on the other, and the muscles are so flaccid and relaxed on the paralytic side, that when he falls, his limbs double under him. This case is so desperate, that there is scarcely any way of recovering him.

Horses that lie out late at grass upon cold clayey grounds often come up with numbness in their limbs, which they in some degree lose the use of for a season; but this is not a true palsy, unless the head be also affected, being rather a case of rheumatism.

In a true palsy there is generally a very sizy state of the blood, proceeding for the most part from high feeding and want of sufficient exercise, from bad provender, from noxious fumes, or from bad air. But on the contrary, it sometimes arises from too hard working and want of good keeping, and not unfrequently from mere old age, which last is the most irremediable. When paralytic disorders happen to old horses that have been delicately kept, or on the contrary, have been in bad keeping and hard worked; if the disease seizes one whole side, it is scarcely worth while to attempt a cure. If the palsy seizes only particular parts in old horses, the cure will be difficult, and for the most part only palliative; for there will always remain somewhat of numbness and insensibility in those parts, which render such horses of little use. But paralytic symptoms in young horses proceeding from other causes, are often removed without much difficulty.

In curing the palsy, the same author advises the same internal remedies as those made use of in apoplexy and convulsive disorders. He also thinks it proper to bleed, rowel, and use outward applications, such as warm stimulating embrocations, &c. The use of the lancet should however be carefully had recourse to. The following has been employed with much advantage as a stimulating liniment:

Take of Oil of turpentine, four ounces;
Oil of bays, four ounces;
Camphor rubbed in a mortar, one ounce;
Oil of amber, three ounces:
Incorporate these together into a liniment; to which may be added, if needful,
Tincture of cantharides, one ounce.
Mix them well together.

The affected part should be first well rubbed with a woollen cloth, that the liniment may penetrate with the more ease; then a sufficient quantity of the liniment rubbed on the part with it, working it well in with the hand, and as fast as it sinks in, renewing it. This method should be continued till the numbness goes off, and the horse shews that he has recovered the use of his limbs. It is observed, that "if the numbness and lameness be chiefly in the hind parts, in that case the liniment may be also rubbed into the spine of the back and loins, from whence the principal nerves that go to the limbs derive their origins; but in this case the tincture of cantharides should be omitted. Rubbing the parts often is of great use in all such cases, and ought never to be neglected. If the head be affected on one side, so as to draw the horse's mouth awry, the forehead, temple, and cheek on that side ought also to be well rubbed and embrocated with it.

When this is the case, internal remedies ought not to be laid aside; as it may be supposed with good reason, that the distemper has taken its rise from the head. If a vertigo happens, or if the lameness be universally on one side, without an universal deprivation of sense and motion, as in the hemiplegia, all those things that have been recommended for the cure of apoplexy are proper, in the first case with rowels and outward applications; but, in the latter, mild purging, and a liberal use of embrocations. A mixture of mustard seed, fresh ground, with camphorated spirits, frequently rubbed into the diseased limbs, will be of great use, viz. an ounce of the mustard seed to half a pint of the camphorated spirits, and towards the latter end of the cure oppodeldoc may be used with good success. If a lethargy happen, which is not unusual in the distempers of the head, few evacuations will be required, besides now and then a clyster, with rowels on the neck and under the jaws, and the use of cordials and cephalics, such as castor, assafœtida, salt of hartshorn, sal ammoniac, and other volatiles.

The following is an useful remedy both in this case, and when there is a local or general affection.

Take of Snake-root,
Contrayerva,
Valerian, of each bruised, half an ounce;
Mustard seed, and
Horse-radish root scraped, of each two ounces;
Long-pepper, two drachms:
Infuse in three pints of strong beer or wine.

A pint of the infusion should be given frequently.

When the horse is recovering from any of the above disorders, the following alterative purge may

be repeated two or three times, as it operates very gently:

Take of Succotrine aloes, one ounce;
Myrrh, half an ounce;
Assafœtida, and
Gum ammoniacum, of each two drachms;
Saffron, one drachm:
Make into a ball with syrup.

Where a retention of dung is supposed to be the cause, the great gut should be first raked thoroughly, after which plenty of emollient oily clysters should be thrown up, and the opening drink given, till the bowels are thoroughly emptied of their imprisoned contents.

The diet should for some days be opening, and consist chiefly of scalded bran, with flour of brimstone, scalded barley, &c.

This disorder has been little attended to by modern veterinary practitioners: probably from the circumstances of its not occurring very frequently, and the animals when attacked with it being of little value.

PAN, a term applied to the bed or flooring upon which the cultivated soil lies or is placed. Mr. Marshall, in speaking of the Norfolk soils, remarks, that "immediately under the cultivated soil, a hard crust, provincially 'the *pan*,' occurs universally. And under this substrata of various qualities an unfathomable ocean of *sand* may be considered as the prevailing substratum. In some places a hungry *gravel*, but more frequently an absorbent *brickearth* is the immediate subsoil.

"*Marle* sometimes rises to near the surface, but seldom so high as the pan. This seems to be universally considered as a distinct something, poisonous in its nature, and partaking neither of the soil nor the subsoil. It is not his intention to ridicule this received opinion, it may be well founded, but, to him the pan appears to be a production, not of nature, but of art, or, to speak more accurately, a consequence of the Norfolk culture carried on time immemorial with the Norfolk plough, whose broad flat share, being held invariably in a horizontal position, and (unless in fallowing) invariably at the same depth, the surface of the subsoil becomes formed by the action of the share, the pressure and sliding of the heel of the plough, and the trampling of the horse, into a firm even floor upon which the soil is turned and returned in the same manner, it would be, if spread on a floor of stone or other material. But, be this as it may, and whether the pan be a natural, or a fictitious production;—it is a fact well established, that breaking it up by ploughing below the accustomed depth is very injurious to succeeding crops." He further observes, that "two reasons may be offered in explanation of this effect; the pan, year after year, and, perhaps century after century, has been a receptacle of the seeds of weeds, which, by being trodden, or otherwise pressed into it, have remained there, locked up from the sun and air, and thereby deprived of the power of vegetation. But no sooner are these seeds released from their confinement by being brought to the surface with the plough, than they vegetate in myriads to the annoyance of the crop. The other reason is, he says, this,—the firm close contexture of the pan renders it in a degree watertight, it is at least a check to the rain-water which sinks through the soil, prolonging its stay in the sphere of vegetation. But the pan being broken the filter is no more: and the rain which is not immediately retained by the soil, escapes irretrievably into an insatiable bed of sand,—or some other absorbent subsoil."

In many cases of tillage, it is highly injurious to break or destroy this crusty layer, which preserves the manures and contributes much to the production of good crops.

PANIC-GRASS, a sort of grass which cannot be cultivated to advantage. See *Panicum*.

PANICUM, a genus of grasses of which there are several species, but none of which can be cultivated, except for bird-seed.

PANNAGE, a manorial term applied to the food which swine consume in woods, as acorns, and the mast of beech. It also signifies the money taken by the king's agistors, for the privilege of feeding hogs in the king's forest.

PANNEL, a low stuffed saddle. Also the stuffed part or cushion of a common saddle.

PANNELS *of a saddle*, the two cushions or bolsters, filled with cow, deer, or horse hair, and placed under the saddle on each side, so as to touch the horse's body, and prevent the bows from galling or hurting the back.

PANTON-SHOE, in *farriery*, an old invention contrived for receiving narrow and hoof-bound heels, Its spunges are much thicker on the inside than on the outside, so that the part which rests upon the horn or hoof, runs sloping to the end, that the thickness of the inside of the shoe may bear up the heel, and throw or push it to the outside. They are advised by Guillet as proper for horses that have false quarters.

PAP, a provincial term applied to the teats of cows or other animals that give milk. The paps distend after the young is produced, and as the bodies of them contain the terminations of the tubuli lactiferi, where they are tortuous, and act as valves; they are distensible, as they are squeezed becoming straight, and thus the milk has a free passage, whether the pressure be caused by the mouth of the young animal in sucking, or the hand in the act of milking. See *Teat*.

PARALYSIS, in *farriery*, a term applied to signify a palsy of a particular part. It is distinguished as affecting some particular muscles on one side of the body longitudinally, one half of the body transversely, as both legs and thighs, and as arising from too powerful sedatives, applied externally, or taken internally.

In the beginning, the paralysis caused by an excess of blood is acute; but it soon becomes chronical: the others are always chronical. See *Palsy*.

PARAPHRENITIS, in *farriery*, an inflammation of the lower part of the membrane that separates the two lobes of the lungs; accompanied often with an inflammation of the whole diaphragm. Horses are frequently subject to these inflammations, which howe-

ver are not to be distinguished, in them, from pleurisy or peripneumony, and may be treated in the same manner.

The only difference, Gibson observes, consists in this, that when the diaphragm is highly inflamed, a horse is some imes what is called "jaw set," and his mouth so firmly closed, that nothing either of physic or sustenance can be got into it.

The principal remedies in this case are those of bleeding and purging.

PARING AND BURNING, the process of paring off the surface of lands in the state of grass, in order to convert them into tillage, by means of fire.

It has been remarked by the author of a late practical work that "the practice of bringing land into a suitable condition for the growth of grain or other crops by means of fire, by paring and burning the surface or sward, is probably a method of cultivation that was adopted at a very early period. It is a process, he thinks, by which various changes are produced in the materials of the soils on which it is employed; some of which would seem to lessen rather than improve their fertility, while others have obviously the power of promoting and augmenting it in a very considerable degree." He adds, that "the action of the fire during the time of the combustion, especially when carried to a great height, by forcing off and dispelling much of the moisture and elastic principles that they contain, as well as by reducing the proportions of vegetable and animal matters which may be mixed and incorporated with them, must have the effect of producing some degree of deterioration; while, by its conversion of the fresh vegetable products, as the different kinds of coarse plants and grasses, into ashes of an alkaline, saline nature—which possess the property of quickly rendering the portions of vegetable materials which may remain, proper for supplying the nutrition of plants—and by combining oxygen with the argillaceous, earthy, or other particles contained in them, in such a manner as to be easily parted with during the incipient stages of vegetation, great advantage and improvement must unquestionably in many cases be produced. It would seem, he thinks, to be chiefly on the former principle that the crops are generally found to be so abundant after land has undergone this process; as the saline substance contained in the ashes, though frequently small in quantity, by bringing such parts of the soils as were not before in a fit state for the purpose of being applied to the support of vegetables, suddenly into that situation in which they may be taken up by the absorbent roots of the plants, a vast immediate fertility may be given, but which must soon have the effect of exhausting the ground, if grass or some other kind of green crops be not cultivated in due rotation upon it. That some effect of this sort takes place, in such cases, is shown, he says, by the general experience of the most correct practical agricultors." But besides this there is also another way, he says, "in which the saline or other matters thus formed may be conducive to the purposes of vegetation, which is, by the great stimulus which it is known to afford to the roots of growing plants, by which they may be induced to take up a larger proportion of nutritient matters from the soils on which they grow. And on lands prepared in this manner, especially where they are of the clayey kinds, it is probable that in some instances so much oxygen may be combined, by means of the fire, with the particles of the clay, as, in particular situations and circumstances, to render it capable of forming nitrous acid;—as is the case with imperfectly-baked bricks, according to Dr. Darwin, which, where lime is made use of at the same time with the ashes, may constitute a sort of calcareous nitre;—a substance which experiment has shewn to be highly favourable to the process of vegetation," or the growth of plants.

It is supposed that "in the method of cultivating lands, by means of paring and burning the surface, such losses or deteriorations of soil as may be sustained, must evidently be produced by the quantity of vegetable or animal materials which may have been consumed or dispersed in the state of carbonic acid or other aërial forms; as it is sufficiently known, that not a particle of the real earthy matter of the land can be destroyed or carried away by the process; it being left in most cases where the business has been properly performed, probably in a much more mellow and friable condition than it was before the commencement of the operation, and perhaps more suited to the absorption of elastic principles from the surrounding atmosphere." It has however been stated by a late ingenious writer, the Earl of Dundonald, that "the disadvantage in respect to vegetable matter is nineteen parts out of twenty; but, says the above author, as he has not informed us what is the degree of loss of such matter by this process, where it is incorporated in the state of soil, or the nature of the experiment from which his conclusion was drawn, we are at liberty to believe that in this mode of preparation it is not by any means so great, whatever it may be where the vegetable matters are themselves simply submitted to the action of the fire; especially as in the trials which he has made by burning such soils as contained a large proportion of vegetable materials, so as nearly to resemble that of garden mould, consequently having considerably more than is usually met with in the lands that are subjected to the operations of paring and burning, it has not been nearly in such a proportion even under a high degree of heat, which ought in every case to be as much as possible avoided." It is further conceived by the same noble author, he says, "that as it is only from the ashes of fresh or growing vegetables that saline matters, such as fixed alkaline salts, can be procured, none being produced from the burning of dead or decayed vegetable substances, the proportion of alkaline or other saline matters obtained by the process is so small, that if the utility or advantage of the practice depended materially upon them, it would be more economical to purchase them." "Experience has however, shewn, the first writer observes, that whatever may be the proportion of saline matter which is formed in this way, a great deal depends upon the ashes which are produced; as it has been found by those who have been largely en-

gaged in the practice of this husbandry, that on those parts where the ashes were spread out upon the land as soon as the process was finished, the crops were highly luxuriant and productive; while on those where they had been from necessity taken away, they were very mean and inferior, not being worth more than from an eighth to a tenth of the value of the others."

With respect to the nature of the saline substances that are formed during the process of paring and burning, they have been found to be the fixed vegetable alkali and vitriolated tartar: in the latter case the alkali of the consumed vegetable matters uniting with the sulphuric or vitriolic acid, which is frequently found to exist in some state of combination or other in soils. These substances have been found, by the experiments of Dr. Home, to be capable of promoting the growth of vegetables in a considerable degree.

It is further stated that "in addition to these modes, in which the practice of paring and burning may be beneficially employed in the cultivation of land, there are some others which seem of a more mechanical nature; such as its reducing the various kinds of coarse vegetable productions, as heath, furze, different sorts of dwarf shrubby plants, tough benty grasses, rushes, and many other aquatics, into such a powdery carbonaceous state, as that, by the ready action of other substances upon them when thus reduced in the soils, they may become useful in promoting the growth of proper kinds of vegetables; but which, without undergoing this process, could not by any means, from their great elasticity and almost indestructible properties, be prevented, for a very considerable length of time at least, from rendering the ground too light and porous for growing any sort of grain crops. And the state or condition of the soils, in so far as respects their textures, as already suggested, must likewise, he supposes, in many cases, be greatly improved, being by such means, when properly performed, rendered much more mellow and powdery, and thereby more proper for the admission of the fibrous roots of the growing plants, as well as more capable of minutely dividing the particles of the manures, of whatever kind they may be, that are afterwards applied to them, and consequently of affording a more full and equable supply of nourishment to the crops that may be cultivated" upon such lands. And further, "from the process radically destroying, in most instances, when well performed, all sorts of plants of the weed kind that may have established themselves in the soils which are subjected to the operation, the lands are left perfectly clean, and therefore in the most proper situation for affording the whole of the nutritious properties which they contain to the support of the crops that may be grown upon them."

It is supposed by the same practical writer, "from this view of the manner in which this process may contribute to the improvement of land, the nature of the products that are formed by it, and the effects which they produce on the soils, that it would appear to be a mode of cultivation more adapted to some sorts of land than others; as where they are light or thin, and there is much vegetable matter accumulated within the soil, whether from the decay of successive crops of different sorts of plants, for a great length of time, or the repeated applications of manures, without their having much sward or coarse vegetable products, such as have been mentioned, growing upon the surface, it may do harm, especially when a great degree of heat is not carefully guarded against, and judicious modes of cropping introduced, by lessening the quantity of useful vegetable matter which they contain, without supplying any thing as a compensation. But where they are more stiff and heavy, and there is a thick matted sward, (disposed to the production of moss, or covered with any sort of rough sour plants, whether of the grass or other kinds,) it must, when cautiously practised, be a highly beneficial, and perhaps, in many cases, an indispensable mode of cultivation; not only by rendering them more open and porous in their textures, and reducing the coarse vegetable mass into that sort of form in which it can be readily turned down and incorporated with the earthy materials, but also by supplying a portion of saline or other matter, that may operate still further in promoting their fertility and productiveness." These, the writer considers as the effects of the process, and the cases in which it should be made use of, or rejected, as is fully shown by the experience of the most exact and careful practical farmers. It has been observed by Mr. Donaldson, he says, "an intelligent inquirer, who seems to have paid great attention to the effects of the different modes of practice that are employed in different districts in the cultivation of land, that such soils as are light and friable, are every where considered as unfit or improper for being treated by means of this process." And, an experienced writer, who appears to have cautiously examined the nature and effects of the operation, assures us, he says, that "he has many doubts about the propriety of extending the practice to such soils as have been already fertilized and brought into a proper state of tilth, by the application of manures."

And he suggests that there is also another sort of soil on which the process of paring and burning must be practised with equal caution, or perhaps in some cases be wholly rejected, from the danger there is of its reducing the materials of which it is constituted in too great a degree. This is that of the peat or mossy kind. "In this case," says the able author mentioned above, "it is not the plants which grow upon it, but the very substance itself that served as a soil on which the plants grow, that is totally destroyed by incineration. This substance is," continues he, "by burn-beaking, amazingly diminished in quantity; and the little that remains, instead of soil, after this destructive process, is an inert earth, which is more unfit for the purposes of vegetation than any other that has ever fallen under his observation." There cannot, however, be any doubt but "that in some cases mossy soils may be subjected to the process of paring and burning with much benefit to the cultivator, provided that it be performed

with proper care and attention. And it is unquestionably practised in various districts without any injury being produced by the destruction of the materials that constitute such soils."

Where the soils are of the sour, heavy, stiff, and fenny kinds, and where overgrown with such coarse vegetable productions as have been already mentioned, there cannot be the least doubt of the propriety of adopting such a method of practice in breaking them up and bringing them into a state of cultivation.

On the contradictory opinions that have been held on this subject, Mr. Young has well observed in his useful Calendar of Farming, that "by one set it is pronounced, contrary to every principle, that it is a wasteful extravagant operation, which dissipates what should be retained; annihilates oils and mucilage; calcines salts, and reduces fertile organic matter into ashes of very weak efficacy; that the vegetable particles which are brought into play at once, for the production of a single crop, by less desperate management might be husbanded to the support of many. On the contrary, the advocates for this management, he says, assert, that these objections are all founded on vain reasoning and philosophical theory; that practice the most decided, and experience the most extended, pronounce it to be an admirable system; and that the mischiefs often quoted as flowing from it, are to be attributed merely to the abuse of the method, and by no means necessarily connected with it." And he "must without the least hesitation, he says, declare, that the latter of these opinions is that to which he must subscribe. To trust to reasoning in matters of agriculture is, he thinks, a most dangerous reliance. He shall leave others to detail their philosophical speculations, and rest what he has to offer solely on the practice, various and extensive, of numerous agriculturists, and on the common husbandry of many spacious districts. These agree, he says, in declaring, and it is most particularly to be had in remembrance, for the enemies of the practice admit it, that by paring and burning you may command two or three good corn crops in succession. The fact cannot be denied; for whether you examine the peat of the Cambridge fens, or the shallow chalk soils of the downs and wolds of Hampshire, Gloucester, and the East Riding, it is known, that bad farmers do act thus absurdly. They get great crops, but they too often take them in succession, to the injury of the soil, though not to its ruin, unless that can be esteemed the ruin of land, which enables the tenant to pay a double rent for it. Such farmers have been in the habit of burning for wheat, and then taking two crops of spring corn; all good. Now, it might, he says, be asked, how is it possible, that that husbandry can have all the philosophical evils detailed above, of annihilation, dispersion, conversion, and destruction, which enables a soil naturally poor and weak, to give two or three good crops of corn? Their argument evidently proves too much. The effect shows, that there is a powerful cause or agent in burning, which they do not understand; which escapes from the retort of the chemist, and from the *rationale* of the theorist. That operation or manure which will give a good crop of wheat, wil give a good crop of turnips or cabbage; and he, who having made this commencement for the food of sheep on the land, and knows not how to go on preserving the advantage he has gained, is, he observes, a tyro in the art of husbandry. The farmers that are railed at, know it as well as their philosophical instructors; but avarice, united with the baneful effect of short, or no leases, make them practice against their judgments." It is maintained, that "paring and burning will, on all soils, give turnips or cabbage; these fed on the land by sheep, will secure barley or oats, and seeds; the seeds fed with sheep, whether for a short or a longer duration, will secure another crop of corn adapted to the soil; and in this stage of the progress the soil will have gained much more than it has lost. To instance cases which he has seen, and to quote authorities for these assertions, would be tiresome. He could produce instances, he says, from more than half the counties of the kingdom, in support of it."

He further remarks, that "it has been often contended that burning lessens the soil. If this happen any where it must be in peat, yet in the fens in Cambridge, this husbandry has, he says, been repeated once in eight years for a century and a half, and the proofs of a loss of depth are extremely vague, in every instance he has met with, and hardly to be distinguished from that undoubted subsidence which takes place in drained bogs of every description. In all other soils the assertion may be safely and positively denied. He has calcined pared turf, not calcareous, after careful separation and weighing, and in a heat far exceeding what is ever given in denshiring heaps, and re-weighing, found the loss too minute to be attributed to any thing but loss of water intimately combined, but driven off by heat, and re-exposing the earth to the atmosphere, free from rain, found an increase rather than a diminution of weight. The vegetable particles, he thinks, only are reduced to ashes. These, in any method of putrefaction, would dissolve, and combining with water, be exhaled by heat, or absorbed by the vessels of plants. In ashes, these are in a more fixed state, relatively to the influence of the atmosphere. That plants feed on them, the great crops which succeed offer abundant proof." It is added in conclusion, that "there are men who are timid in acknowledging truth, who admit the practice to be good, in poor soils, and in peat, and sedgy bottoms, but fear it on better land. Experiment is, he says, against them, for in Yorkshire, land of 20s. and 30s. an acre, has been thus broken up with great success: but in what manner do they reason? Rich soils are full of vegetable fibres. Then there will be the more ashes. These are in proportion to the organic matter. Peat, which these men admit to be burnt, is the richest soil in the world, and therefore burning the most universally practised on it. The soil itself is not reduced; if it was rich before burning, assuredly it will be rich after it." And "in addition to these circumstances is, he says, the capital one, of destroying insects, grubs, and weeds. These are apt to abound most in the richer

soils, no reason for abstaining from this husbandry on such. He ventures therefore to conclude, that paring and burning, with a proper course of crops, is safe on any soil; and essentially necessary on some. He however well remarks, that very rich ones will do exceedingly well in many cases without it. This distinction, therefore, should be made. There is, in some cases no *necessity* for it: there *is* in others."

It has been observed in the twelfth volume of the Annals of Agriculture, that on inclosing the waste lands in the parish of Bows, in Yorkshire, large portions of the ground were subjected to the process of paring and burning; but the few persons who ploughed up the ground without previously employing this method, had great reason to regret it." And, it has been stated " by an able writer, in speaking of bringing into cultivation the chase lands in the county of Middlesex, that the impropriety of breaking up this kind of land, without paring and burning, is manifested in the neighbourhood of Beech-hill, where land, after twenty years' inclosure and cultivation, is in a worse state than it was originally. Well would it be for the owners of such allotments, says he, if they could now pare and burn it; but it has been ploughed, and not reducing more than what the vermin destroyed, laid down in so rough a state to grass, as to be incapable of being pared and burnt; the original wiry bent and dwarf shrubs are now growing in full vigour: and that on the inclosure of Stanwell, in the same county, the allotments on Hounslow-heath succeeded well under the perfect practice of paring and burning, and ill, where the turf was ploughed without the application of fire. In the former case the land was immediately fit for turnips, tares, barley, and clover: in the latter, the tough, wiry bent, heath, and dwarf furze, kept the land too light and spongy for any crop. Even rolling, he asserts, cannot keep it down, for its elasticity raises the soil soon after the roller has passed over it, and it is of so imperishable a nature, that it is likely to plague the farmer for many years. The difference between the two methods of breaking up rough ground, is, he thinks, more than the value of the freehold in favour of paring and burning, which immediately opens a source of great profit: whereas the other proceeding leads to nothing but expense and disappointment." It is likewise added that " paring and burning has more merit than any other manure, in its property of converting heath, furze, shrubs, and wiry bent, into coal, most fitly prepared for the food of plants; and that it will pulverize such a soil as much in two years as all other means can effect in twenty." And others contend, " that on any sort of soil which has not before been reclaimed from a state of waste, and where furze, broom, brambles, ferns, rushes, &c. abound, these operations, when properly performed, are productive of the most beneficial consequences. That there is perhaps no other method that could be devised, so well adapted for preparing land in a state of nature, and incumbered with such productions, for valuable crops with expedition and certainty; and that, on this account, paring and burning might well be considered by Virgil, and other ancient writers as a sure means of improvement."

And " that in such cases they are so at this period, may, it is thought, be proved by the concurring testimony of those to whose lot it falls to cultivate the common or waste lands in many of the new inclosed districts of the kingdom. It is further stated, that instances are frequently met with of great advantage resulting from this mode of management; and that wherever land is rendered unfit for cultivation by the incumbrances that have been mentioned, the Devonshire mattock and the paring-spade may be used with the greatest propriety and the best effects."

It has been remarked by the writer of the Agricultural Survey of Suffolk, that " in that district they could not cultivate without this capital assistant. It is scarcely possible, profitably, to bring boggy, moory, and peat soils, from a state of nature into cultivation, without the assistance of fire, which is the most effective destruction of the spontaneous growth, and never fails, but because the men employed do not pare deep enough."

It is observed, however, that " of late years an opinion against it has prevailed much in some countries. Several of the nobility and gentry of very large estates, have interdicted the practice, not allowing their tenants to pare and burn under any pretence whatever. The reason assigned for this conduct is an apprehension, that the depth of the soil decreases from it, that you burn *the land* and reduce half an inch to half a line, a great evil when the land is perhaps only three or four inches deep on a lime-stone rock. But this reasoning, many very sensible and experienced farmers know to be false. They on the contrary urge the universal circumstance of no land ever being pared till it has acquired a turf which with natural grasses will be from 7 to 20 years, and with sainfoin the duration of the crop which is from 10 to 20 years; that it is not the *soil* which is burnt, but the bulbs of the plants, the roots and net work of grass roots; the earth which is intermixed is not burnt, it is calcined but not reduced to ashes, all of which arise from bulbs and roots: hence the fact that the staple of the soil rarely suffers from paring and burning. If this reasoning be not true, whence the known fact that soils not four inches thick, and which have remained at the same thickness as long as the oldest man can remember, have yet been pared and burnt regularly four or five times in a century? and as the same husbandry is known by record to have been practised for ages, in the same land, the staple must have left three inches every hundred years; in other words, it must have been totally gone long ago, and nothing but rock remained; all which is evidently false, the soil at this day being as thick as ever. We may hence conclude, what such farmers assert to be true, that the earth suffers no diminution, those roots and bulbs only being reduced to ashes, which in breaking up by the plough alone would rot away."

And in speaking of the objections which have been made to this practice in fen districts, from the idea that it has the tendency of reducing the soil greatly,

as is shown by the sinking of drained lands that have been pared, the same writer adds, "that it has been found that a series of ploughing and cropping stiffens, concentrates, and diminishes the lighter kinds of fen soils; and that the stratum of black peat earth, which on their first breaking up was considerably deeper than the plough ran, has been within the memory of the present occupiers, without any fresh paring and burning, so far reduced, that without taking more mould, or ploughing deeper than they formerly had been accustomed to do, they have not only passed the whole of the black peat stratum, but have ploughed up two or three inches of the clay beneath it; and that if it be granted, which, he thinks, will scarcely be denied, that the surface of the adjacent depastured fen lands, from the decay of vegetables, dung of animals, and the soil brought thither by the waters from the neighbouring high lands, has been continually, though slowly, increasing, there will then appear other reasons for their present different level than mere paring and burning" It is well known, says he, "that earth is not to be dissipated by combustion; it is more likely this appearance proceeds in the first place from the light peaty earth of a fen soil being gradually consolidated by alternate cultivation and pasturage, so as to sink below the level it formerly preserved in its uncultivated state; and in the next place, may it not proceed from the commons gradually rising higher by the accumulation of mud and soil deposited by the upland waters?"

All these facts, which obviously rest upon the foundation of practical experience, sufficiently demonstrate that little danger is to be apprehended from the destruction of the soil when the process is properly performed, and a correct method of management pursued with the land.

But the effects of the process may be examined a little further as they stand in respect to the different sorts of soil.

In regard to clayey soils, Mr. Young says, that many appropriate reasons have not been brought against the practice; "the only one that merits the least attention, is the assertion, that it converts what is properly soil, into pieces of infertile brick. The fact is not so, for every one that ever burnt clay for manure, knows that though there are many lumps of the substance which they allude to, yet, that the mass of the heaps consists of ashes, properly so called; but when the tenacity of this soil, which is one of its greatest evils, is considered, it will be found that bricks are an excellent addition to the soil, to loosen and open its stubborn adhesion. He has seen and examined carefully heaps of clay-ashes, amounting to many hundreds of loads, that have been burnt and applied to great profit on this soil. By paring and burning you have therefore, he thinks, on it the common manure found in vegetable ashes, and you have in addition a substance which acts mechanically. Hitt, he says, who wrote from practice, and whose writings abound with many just observations, remarks: "I recommend burning of the surface as the cheapest manure, and most effectual of any; for it not only adds salts to the soil, which the burning of grass-roots produces, but it opens part of the stratum of clay next the soil so much, that the roots of vegetables can afterwards feed therein; for when the turf of a piece of land has been burnt in heaps, at four or five yards apart, though all the ashes be taken away, with some of the earth, and spread over the other parts of the land, yet neither corn nor turnips will grow so vigorously there, as on those places that were only opened by heat."

Near Guilford, Mr. Birbeck has found this practice highly useful on clayey soils. After remarking that by the process, that portion of the turf which contains from three-fourths to four-fifths of the undecayed fibres, is at once converted into a substance the most favourable to vegetation; he says he has had the most decisive proofs of the preference of paring and burning, to fallowing and to sowing on the fresh turf on both clays and loams, and that he has never had occasion to notice the impoverishment from the former, which he had suspected; on the contrary, the "reverse has been so obvious as to amount, in his judgment, to very strong evidence, if not demonstration." And he believes, that if the crops on equal quantities of land subjected to these different processes, were accurately weighed for two, or perhaps three years, it would be found that the produce of the pared and burnt land would exceed that of the fallowed, by more than the amount of the whole turf consumed.

Mr. Moss, near Beverley in Yorkshire, likewise gives an instance within his own knowledge of a farmer breaking up several closes of old sward, one of the best of which (about twelve acres) he ploughed out, and pared and burnt the rest. "The first year he lost 100l. the second 100l. and the third 50l. for want of paring and burning; the whole loss 250l. being more than 20l. per acre, at that time about two thirds the value of the land. This was, he says, a fine sweet sward, and has not been superior since to the pared and burnt land, on account of cropping about twenty years."

On poor clay near Horncastle, Mr. Elmhurst, "after properly draining such as wanted it, pares an inch, or an inch and a half thick, about Lady-day, and gets it well burnt. So soon as all or a good part of the piece is burnt, he spreads all the ant-hills as level as possible upon the ground betwixt the ash-hills. He then has the ashes all evenly spread, and as soon as a tolerable rain comes, he has the whole well harrowed, and ploughed shallow furrow for turnips; and for the most part has had very good crops; which he always eats off with sheep. As the land is not broken up too deep, as soon as the turnips are eaten off, and the land is dry enough, he has it ploughed up again into small lands, about two inches and an half, not more than three deep; and with two more ploughings and harrowings in good time for sowing it with cole-seed, and then barley. He has often had more than six quarters per acre, and the next year from five to six quarters per acre of wheat, upon poor land by this process; and in various parts

of the country, where he has for many years occupied such lands, paring and burning such sort of land is the very best practice that can be used, as it tends to the enriching of it, by the greatest quantity of manure that can be possibly obtained."

On poor cold clay, the same thing has been experienced by Mr. Maxey, in Bedfordshire. "Thirty years back, he broke up a piece of sward of this description, one part of which he pared and burnt, another he ploughed with horses, and a common plough, ground sharp, as thin as it could be, which part he also burnt; the remaining part was fallowed the succeeding winter. The part that he ploughed by horses, which was about five acres, abounding with ant-hills (which consisted entirely of clay), he was under the necessity of burning in large heaps, whereby a great portion of the essence was destroyed. On this he had more ashes than could be used to advantage thereon, and from which, after spreading a double portion, he manured eight acres in an adjacent field. Now, were burning so prejudicial as has been represented, this piece must, says he, have been utterly ruined. The two pieces thus burnt were prepared for wheat, and in due season sown therewith; the other with oats, which was a very poor crop, owing in some measure to the grub and other insects, to which this kind of land is subject, and which, in a great measure, are destroyed by the preceding process; the wheat on both pieces was very fine, but that which was ploughed by hand was somewhat better, which he ascribed to the superior quality of the ashes, they being the product of the surface only, and burnt in small heaps. In the course of cropping that followed, the parts burnt were so much superior to the other, that he shall not exaggerate if he says, he had more profit from an acre of that burnt in three years, than in five from the other part. It is worthy of remark, says he, that those spots where the large heaps were burnt, on which the whole surface or staple quite to the clay was consumed to ashes, yet by their situation not to that degree as was the bulk of the heaps (the fire not being so strong next to the ground), but so as to retain its essence, not only produced the most luxuriant crops at first, insomuch so that he has been under the necessity of mowing them down twice, and yet has had so much at harvest; but continued for a number of years superior to any part of the field. When he has manured this field, he has avoided laying any dung thereon, and yet it is at this time, after a lapse of thirty years, equal to any part of the land. This confirmed him many years back of the propriety of burning, as it is a demonstrative proof of its efficacy and advantage, and a full refutation of all the objections which he has heard advanced to that practice. The advantage in burning in many instances is much greater than he has described, as much depends upon the season. If it should prove a fine dry time, the turf may be burnt much more quickly, and in smaller heaps, whereby the quality is rendered far superior than it can be, in wet unfavourable seasons, when it cannot be burnt in such small quantities. He particularly recommends it to be burnt in as small quantities as the season will admit; if only scorched the better. For the above reasons, he recommends paring by hand in preference to that by the plough. In further proof of the advantage of burning, he states a recent experiment of two neighbours in an adjacent parish, where an inclosure took place five years back, at which time they had each a portion of waste or common laid to their allotments adjoining to each other of equal quality: the one who is the proprietor pared and burnt, and sowed in succession with cole-seed, barley wheat, wheat, barley: all of which were good crops. The land is at this time under winter tares, which he proposes feeding off with sheep, and sowing it with wheat again in the autumn. Although he cannot recommend such a course of cropping, yet he doubts not, as the prices of the produce have been, but that he will profit very much thereby; and that its own produce of dung, will more than compensate the expense. The other farmer who is a renter (probably, like the majority of renters, under some injudicious restraints laid down by some farmer's land *taster*), fallowed his land in the winter, sowed barley, oats, cole-seed, and barley, all of which were very poor crops. The former calculates that he has made a profit from fifteen to twenty pounds an acre more than the latter, and that his land is in a far superior state for any succeeding crop. It is objected that land which is burnt will not bear clover, the fallacy of which he has proved in many instances, having always found the clover on such land to be equal to that on land which is not burned; but this he has also discovered, that no land of this description whilst new, either burnt or not will bear clover to advantage; it must first go through a course of cropping of at least five or six years, when it will be of a better texture for that purpose."

With respect to loamy soils, these are, Mr. Young, says, especially when good, those upon which the practice has been most condemned; but here we have some experiments to recur to, which, in his estimation, set the matter in so clear a light, that nothing more is necessary than to recite them very shortly. Mr. Wilkes, of Measham, in Derbyshire, has, he says, for many years been in the practice of ploughing old rough pastures (the soil a stiffish loam), eight or nine inches deep, and burning the old furrow in heaps of thirty or forty bushels each, the fires lighted by a few coals, and coal-slack; the effect was very great, and the improvement immense and durable. Mr. Wilkes is of opinion, from the experience of many years, that even this burning, which is twenty times the depth of common paring, does not waste the soil in the least, but does no more than break the texture of stiff soils, expelling a great quantity of water; that by exposition to the atmosphere, the land re-absorbs its water, and by the great immediate fertility, fills itself presently with more vegetable particles than it had before. Thirty years ago, his father burnt at Overseal, exactly in the manner described, a field of ten acres, which was not then, and has not since

been treated with any more favour than the fields adjoining, yet it has ever since retained a superiority." And the writer, "in 1790 hollowdrained an old grass-field of four acres and a half, of cold, wet, poor loam, on a clay marle bottom; the rent 9s. an acre, and not worth more in its then state, perhaps, than 7s. In 1791 he ploughed four acres of it four inches deep, which was the whole depth of the soil, or surface, of different colour from the stratum beneath, between that surface and the clay marle, and burnt the whole furrow of the part so ploughed. Having no coal-slack, and wood being dear, he made but four heaps in the field; the consequence was, the heat and degree of calcination were far beyond what is ever practised in common, and many persons who knew and approved of paring and burning in the common way, pronounced the field completely ruined. The ashes were spread, and ploughed in with a shallow furrow, and turnip-seed sown, and very slightly bush-harrowed. The crop was very fine, worth, to sell for feeding on the land, at least 50s. an acre. The crop on the burnt part double to that of the half acre."

And "after feeding them with sheep, the land was ploughed thrice, and sown with oats, and grasses. The oats produced above seven quarters an acre, and the grass has ever since been much better worth 20s. an acre than it was worth 5s. before. The oats on the half acre were not threshed separately, but judged by those who viewed them, to be much inferior to the rest. About half the field has been since dressed with earth and road sullage, and once dunged slightly. It is remarkable, that in three years crested dog's tail, an excellent grass, common in the country, the seed heavy, and which, therefore, could not be carried by the wind, began to appear, and has been increasing ever since. There is at present, he says, no perceptible difference between the part burnt, and the other not burnt; if any thing, the burnt is best. These two experiments prove, if any thing can, that paring and burning does not lessen the soil, in its most excessive application, and that it works a very great improvement on loams."

On stone-brash and light loams near Bristol, the Rev. Mr. Swayne has experienced the advantage of this process; he, "indeed, has remarked, in more instances than one, the beneficial effect of combustion, in promoting the growth of vegetables on red or yellow ferruginous clay or till, which have long been ranked among the most infertile of soils. It is that the mineral oil, with which these soils abound, and which in its natural state may be the cause of infertility, is by the action of the fire wholly dissipated in the case of the clay being burnt red, and converted into carbonaceous matters when that is burnt to a black cinder:—Or, is this effect, he asks, produced chiefly from the mere admission of water owing to the alteration made by the fire in the contexture of the clay? However unable he may be chemically to account for it, he is well assured of the fact."

"But the following detail of a field pared and burnt, may possibly, he says, be thought of more consequence to the present inquiry, than the before-mentioned small and unfinished experiment. A small close of old grass lay of between two and three acres; the soil a lightish hazel loam of about eight inches staple upon a clay subsoil, underneath which at the depth of two or three feet several strata of stones which will burn to a brown lime, was let, in the year 1796, to a common labourer, for the term of five years, at the rate of five guineas per acre per annum, to be ploughed up for potatoes, or any other crop he might choose to raise. In the month of February the turf was pared with a breast plough, and burnt in the month of March, the ashes then spread, and the ground immediately ploughed. In the months of April and May it was planted with potatoes. The summer being rainy it was found, that the potatoes had been planted too thick. The strength of the fresh ground manured with the burnt sward, caused them to run too much to haulm. However, fifty-six sacks of potatoes were dug from fifty perches of ground. The second year it was again planted, the greater part with potatoes, some part with wheat. The produce was not ascertained. After the potatoes were dug up, part of the ground, exactly half an acre, was sown with wheat, in the beginning of December. The wheat was hoed in; that is, drills were opened with the potatoe hoes, at about nine inches apart. When one drill was opened the seeds were scattered therein as evenly as possible by hand, after the rate of about one bushel to an acre. In making a second drill, the earth hoed thereout covered the wheat sown in the first, and so on. The crop of wheat, owing to the uncommonly wet season, run much to straw; but its produce was sixteen bushels; or after the rate of thirty-two bushels an acre; a very large crop in that unpropitious season. The rest of the field was planted with potatoes; no account taken of their produce. The fourth season, which was last year, two roods and an half were sown with wheat, the sort red lammas, in the same manner as in the former year; the produce nineteen bushels. A better crop by fifteen bushels an acre, than any farmer's in the neighbourhood. The straw was purchased by the writer at two guineas and a half."

In relation to sandy soils, it is remarked by Mr. Young, that "Hitt, a practiser of this husbandry, observes that it improves sandy soils as much as any other;" and he has seen some fields thus worked in Suffolk and in Cambridgeshire, and improved by it, though under a course of crops by no means admissible. There is not the least reason, from analogy, he thinks, to doubt the effect on this, or indeed on any soil."

In Sussex, Mr. Baldock found vast advantage from the use of this mode of breaking up poor sandy soils on an extensive scale. In the course of twelve years the land broken up in this manner has cost near sixty pounds per acre, but the produce which has been afforded has been fairly estimated at £. 120 per acre in the same time.

On thin skinned warren land near Spilsby, Lincolnshire, Mr. Kershaw has found this practice beneficial.

"In the year 1782, he entered upon a farm of

nearly seven hundred acres of land, which had chiefly been in a warren, and was at that time of very small annual value. A considerable portion of this land was pared and burnt, and found to answer his most sanguine expectation. The crops were full as much more as from the land which was broken up and sown in the common course of husbandry. In order to prove this assertion, he mentions two or three circumstances of the process and conduct. At Michaelmas 1782, he entered on the largest part of the farm; he had, amongst other lands, a walk containing forty-five acres, valued to him by the quitting tenant, from that time till May-day 1783, at forty shillings. He mentions this to show the poverty of the land, which was so thin skinned, that to have pared and burnt it, was not practicable; he therefore, the year following, ploughed it up and sowed it with oats, the crop of which was scarcely worth the labour. The summer after working it well and getting it into good condition he sowed it with cole, and it produced but a scanty crop. The spring following he laid thirty acres of it down with sainfoin, of which he had good crops for several years. When it was worn out, having a good deal of rough grass upon it, he pared and burnt it, and got a good crop of turnips, considering that it was a very dry season; after which, he sowed it with oats, and had a remarkably good crop for that kind of land, more than six quarters per acre. The year following he sowed it with turnips and cole, which were decent crops; eat them off at Michaelmas, and sowed the land with wheat. The middle of February he laid about three quarters of soot per acre, and the latter end of April laid it down with a stone of white clover and two bushels of rye grass per acre, and harrowed the seeds in upon the wheat; the latter yielded near a chaldron per acre, and a finer crop of seeds could not be seen. He has continued to graze them ever since, and the land has kept three times the stock it was ever known to do before. This clearly shews the utility of paring and burning; in proof of which the thirty acres so cultivated, part of the forty-five valued at fifty shillings, are now worth from six to eight shillings per acre, for the same period of time.

The other fifteen acres of the best land he worked in the common way, without being able to get any turnips; the crops of corn were scanty, and the seeds did not afford more than a proportion of two thirds for the feed of sheep. In the year 1791, he pared and burnt another piece of sainfoin, about eighteen acres; also a piece of grass seeds twenty-five acres, on both of which had remarkably fine crops of turnips."

On poor, gravelly heath land, Mr. Wright, in Rutlandshire, has found this practice to answer perfectly.

"In March, 1799, he began grubbing, paring, and burning a twenty-four acre piece of this heathy land: in June, sowed it with turnips on one ploughing, not suffering the plough to exceed the depth of two inches, lest the ashes should be buried, and out of reach for the turnip to taste. As harrowing this tough sod would have made it lie worse instead of better, the seed was sown, and only bush-harrowed. The plants came up true and well, but, after hoeing, the places where the fires had been, grew, if possible, ten times as fast as those where there had been none, notwithstanding there were no ashes left on those spots. This shews, he thinks, the amazing fertility of fire, and is a lesson to him, and all future burners, to make their heaps as small as possible, so as to enable the fires to cover as much of the surface as may be; for, if all the ashes be swept off, and even some of the surface pared off, it will still be superior to the ashes, as he fully experienced. Another advantage arises from making the heaps small, which is the quality of the ashes; the larger the heaps, the more intense the fire, and the centres of such heaps get too much burned, as may be seen by the redness of the ashes; those on the outside being perfectly black, and very little inferior to soot. This ground produced a most excellent quality of turnips (as indeed all burnt ground does), £.2 10*s*. per acre. He afterwards sowed with barley on one ploughing, in March: a finer crop he never saw (quality of land considered); it was estimated at five quarters per acre, throughout the piece, but not yet thrashed; clearing to him as much in one year (and consequently a proportionate benefit must accrue to the nation), as it would have done by pasturage, in its original state, in a century."

With regard to chalky soils, Mr. Young observes, we have a much more ample field of experience, for it has been, and is the common method of breaking up downs in every part of England. On the Cotteswold hills, in Gloucestershire, it is the common husbandry, and often repeated. The sheep walks and warrens on the wolds of the east riding of York, and of Lincoln, have thus been brought most profitably into culture, though not with the attention in cropping that ought to have been given. In Hampshire and Wilts, the same husbandry prevails. In these counties he has been shewn lands that have been pronounced ruined by this husbandry. The cropping was bad, but still the rent had been doubled by the practice. It is stated in his Eastern Tour, that, "in the west riding, Colonel St. Leger remarks, that if burning wasted the soil, his lime-stone lands, only four inches deep, would have been gone long ago, as it had been pared and burnt for ages."

In Kent, he lets Mr. Boys speak for himself. Who observes that, "if any persons who condemn paring and burning, should come into Kent this summer (1795), he can shew them several scores of acres of wheat, barley, oats, and sainfoin, now growing on land which has several times undergone that operation. The crops of sufficient value to buy the land at more than forty years' purchase, at a fairly estimated rent before the improvement." It is humbly presumed that Messrs. Kent, Claridge, and Pearce, the great enemies of paring and burning, will not pronounce this land *ruined* by that *execrable* practice."

In the experience of Mr. Birbeck, near Guilford, in Surrey, on a chalky soil, "two fields, making together about fifty acres, were laid down in an exhausted state. When they had acquired a turf; one received a summer's and winter's fallow; the other was pared and burnt; and both were sown with bar-

ley and seeds. The effect was strikingly in favour of the latter, both in the barley and seeds which followed."

"Another field of the same quality, twenty-two acres, was pared by the plough in the spring of 1799; and about half of it was harrowed repeatedly during the summer: the wetness of the season prevented the burning; but as the turf was completely killed, and much broken by the harrow, this part of the field became a good fallow. The remainder, not being disturbed, set again; and the following spring was nearly as green as before. In the succeeding summer the operation of burning was thoroughly performed: where it had not been previously broken by the harrow, the entire turf, down to the chalk, was subjected to the fire; and in the other, though nearly decomposed by two years fallowing, enough was burnt to produce a tolerable sprinkling of ashes, to stimulate vegetation if that were their property. This field affords a fair opportunity of deciding betwixt the two modes of reducing old turf to tillage. He expected that, in this instance, the fallow would have taken the lead by the help of the ashes; but in the turnips now growing, the seeds are very much in favour of the pared and burnt land."

In respect to peaty soils, Mr. Young says, that, whatever variety of sentiments there are on this method, for other soils, here there can be none. The universal practice, from the flat fens of Cambridge to the swelling bogs of Ireland, the mountainous moors of the north of England, the rough sedgy bottoms, in almost every part of the kingdom, when they are broken up by men of real practice and observation, are always done by paring and burning. Registered experiments of doing it by fallowing, are to be met with in various works. The Board's Reports of the North Riding of York, and of Somerset, detail some; others are to be found in his Tours, and the result is either loss, or a profit so very inferior, that the question ought to be considered as settled and done with. Let it, says he, sleep for ever, except for the wrong-headed individuals who will, upon every question, arise in every age to contradict the common sense of mankind."

It has been stated by the author of a late practical work that in "the method of performing the process there are some slight differences in the practice of different districts; and that perhaps in managing this business, an attention to the nature of the lands may be as necessary as in other cases of husbandry; as it would seem that some, as those of the more clayey and heavy kinds, would be most benefited by having the fire to come as much as possible into contact with the whole of the superficial parts of them, without being carried too far, as by that means they may be rendered more proper for the reception of the roots of vegetables after being slightly ploughed, as well as more suitable for supplying nourishment to them; while in others, as those of the more light and thin descriptions, it might be most advantageous to merely consume the thin paring of sward after being piled up for the purpose; without permitting the fire to exert its influence upon the mould or soil immediately below, as in this way there would not probably be so much danger of injuring the staple by destroying the vegetable matters contained in such soils. Of course, that in the first of these modes of burning the sward, the sods or parings should be piled up as little as possible into heaps, the advantage of a suitable season being taken to apply the fire to them in the state in which they lie, or are set at first after being cut up, or after a few only have been placed together, as happens in some instances where they are immediately after being cut, set on edge to dry, and placed in serpentine directions, in order to prevent them from falling over; but in the latter cases they should be formed or built up into little circular heaps or piles, somewhat in the form and size of the little cocks made in hay-fields, the sods being placed the grass-side downwards, in order to admit air; but the openings both at the bottoms and tops, after they have been fully set on fire by some combustible substance, such as straw, &c. are to be closed up, as well as those in other parts covered by an addition of sods; so as that the combustion may proceed in a slow, smothering manner, such as is practised in the making of charcoal. When the whole of the earth in each of the piles has been acted upon by the fire, the heaps may be suffered to extinguish themselves by slowly burning out."

The same writer likewise farther states that, "there is another method of practice of this kind, which is much in use in some districts, as in Devonshire and Cornwall, for breaking up and preparing grass lands for the reception of what have been termed fallow crops, which is that of skirting; in performing which a part of the sward or surface is alternately left unturned, upon which the next thin furrow slice is constantly turned, so that the swards of each come in contact, by which means the putrefactive fermentation is speedily excited, and the greatest part of the grassy vegetable matter converted into manure; what ultimately remains undestroyed being, after repeated cross-cuttings with the plough, and harrowings, all the mould or earthy matter having been previously well removed from the roots of the plants by shaking, collected into small heaps, (which is done either by the hand, or with iron-headed rakes, constructed for the purpose,) and burnt, the ashes being then spread evenly over the land. The operation, when managed in this way, is, he says, termed beat-burning, and would appear to be the most proper and useful on land where the turf or sward is not very tough or matted together, and where there is little or no coarse vegetable products growing upon the surface of it."

In performing the business "of separating the sward from the surface of the soil, different implements are made use of in different parts of the island: that which was the most employed in the infancy of the art, was a kind of curved mattock or adz, about seven or eight inches in length, and five or six in breadth; and which, from its shape, would appear to have been better adapted for cutting up the roots of brush.

wood, furze, broom, or other coarse shrubs, than for paring off the surface of a field free from such incumbrances. This instrument is, however, it is said, common in the south-western districts; and that, though it no doubt retains in a great measure the shape of the instruments first used for the purpose in that part of the country, when the lands were in very different state, yet the labourers who are in the practice of using it, are able to pare off the sod with great dexterity and dispatch. But in other districts, where the sod is pared off by manual labour, the ordinary breast-spade—in some places called the breast-plough, and in Scotland the flaughter-spade—is mostly employed. The iron, or cutting part of this implement, is about eight or nine inches in length, and from ten to twelve in breadth, having frequently a kind of edge rising up a few inches at the right-hand side of the turf, next the unmoved sward. This instrument, which is formed with a fine edge, is forced forward by the strength of the arms of the person using it, and by pressing the breast against that part of the frame or shaft which is held in the hand. In working the tool, the labourer generally cuts the sods at about an inch or an inch and a half thick, and from ten to twelve broad; and when the spade has run under the sod to the length of about three feet, he throws it off, by turning the instrument to one side, and proceeds in the same way, cutting and throwing over the sods, the whole length of the ridge. In this way of performing the operation the labourers, by following each other with a slice of the sward or surface of the land, accomplish the business with much ease," and in an expeditious manner.

It is added that there is another implement that is sometimes used for paring the sod, which is the *horse-paring-plough*, and is made of different constructions, according to the circumstances of the ground to be pared. "In the fenny districts on the eastern coasts, where paring and burning is practised on a large scale, they have ploughs constructed for the purpose of a particular form, but which vary from the common ploughs chiefly in the breadth and sharpness of the share or sock. They are admirably calculated for paring off the sward or sod of such grounds as are level, and where neither stones, brush-wood, ant-hills, nor other impediments obstruct their progress; but where such obstructions present themselves, the breast-spade, or common team-plough, with a small alteration of the share, will be found preferable, both in respect to the extent of ground that can be pared, and the superior manner in which the work in such cases can be performed." It is conceived that "ploughs, from their great expedition and regularity of performing the business, should always be made use of where the nature and situation of the land will admit them, in preference to such tools as require manual labour. In some of the western counties the common plough only is used. There the old grass fields, when it is proposed to burn the sward, are rib or slob furrowed about the beginning of winter; and being again cross-ploughed the following spring, the sods are collected and managed in the manner mentioned in speaking of skirting. In these cases the plough has, however, a wing turned up on the furrow side of the plough-share, by which the furrow is cut any breadth required. The work is also sometimes done by means of the spade, mattock, and breast-plough, in such cases."

It is observed by Mr. Young that, "in the fens of Cambridgeshire, upon a peat soil, free from large roots and stones, the work of paring is always done with a plough, which they make on purpose for the work, and which executes it in the completest manner that can beimagined. It turns off a furrow, from 12 to 16, and even 18 inches broad, and not more than an inch deep. The use of this admirable tool, he says, brings down the whole expense of paring, burning, and spreading the ashes, to 9s. or 10s. per acre. But upon those soils, when they have not been in a state of cultivation, such a plough would not work."

But "in old meadows and pastures, this sort of work is, he says, done with the breast plough, as it is called, which is pushed on by strength of body, the thighs being armed with wooden guards. It is hard work, and now commonly paid for, including burning and spreading, from 25s. to 40s. per acre. An inch, or an inch and a half, is the common depth; but some farmers prefer two inches, for the sake of more ashes. The thinner it is pared, the more certain the burning, should the weather prove unfavourable." It is added that "considerable tracts of heath and down land, on a weak, thin, loamy sand, with a calcareous bottom, have, within the last five years, been thus broken upon Newmarket Heath, at the expense of 36s. per acre, and immense crops the consequence. And the moors and mountains of the north of England, Wales, Devonshire, &c. when broken up for cultivation, are often, and ought always to be reduced by this practice. It has long been common husbandry in those counties, and is, therefore, done cheaper, from 24s. to 30s. an acre." It is observed that "draining should precede it."

In regard to the season for performing this sort of work, it may be observed that "the months in which the greatest quantity of land is pared and burned are April, May, and June: the particular period must, however, always depend much on the state of the weather, the nature of the crop, and the farmer's convenience." When the east winds prevail, in February and March, this sort of business may sometimes be carried on. "But for accomplishing the work with the greatest dispatch, and also with the least trouble and expense, a dry season is obviously the best. The prudent farmer should not embark in the undertaking, unless there be a reasonable probability of his accomplishing it while the weather keeps dry and favourable. The latter end of May or the beginning of June, when the hurry of the spring seed-time is over, in the more northern districts, when a number of hands can be most easily procured, may upon the whole be considered as the best and most convenient season; as at this period the green vegetable products are in their most succulent and full states, and of course may

probably afford more saline matter; but in the more southern counties either a much earlier season must be taken, or the interval between the hay season and the harvest time must be fixed upon, the latter of which is, on the principle just stated, evidently the best, where the extent of ground to be burnt is not too large. In other seasons it would frequently be impossible to procure a sufficient number of hands for performing the business. In bringing waste lands into cultivation, where an extensive tract of ground is to undergo this process, the autumn may, in many cases, afford a convenient opportunity for the operation."

It is added that, "as the crops that are sown after paring and burning are various, and as the season for performing the process in many cases depends, in some measure, on their nature, it may be observed, that when rape or turnips, which are the most prevailing crops in such circumstances, are to be cultivated, the end of May, or the beginning of June, will be the most proper time: but if barley or oats be to be sown, the paring and burning must be completed as early in spring as the nature of the season will admit; and when lands are pared and burned as a preparation for a crop of wheat, July, or even the beginning of August, may, in favourable seasons, answer;" but it is better to have the ground ready sooner if possible.

In respect to "the depth to which lands of different qualities may be pared with the most advantage, it is obvious that, as it can hardly be proper to pare light, thin, stapled soils, to the same depths as those of the more deep and heavy kinds, it should, in some degree, be regulated by their particular nature, and their differences in respect to depth and heaviness. Mr. Boys, however, it is observed, who is in the habit of breaking up thin chalky soils, and such as have been in tillage in this way, observes that, in Kent, where the method of paring most in use is with down-shares or breast-ploughs, they take off turfs as thick as the nature of the soils will admit, from half an inch to two inches; the thicker the better, provided there be a sufficient portion of vegetable matter contained within them to make them burn well." The most usual depths of paring are, from about one to three inches.

It is stated in the work quoted above that, "when the season is not very wet, the turfs will commonly be sufficiently dried in about a fortnight or three weeks, even without being turned; but in rainy weather they require a longer time, and must be turned more than once to prevent their striking out roots and shoots, which might hinder them from burning. And that as soon as the turfs have fully undergone the process of burning, and are reduced to the state of ashes and a powdery earthy matter, the whole should, as soon as possible, be spread out over the land in as regular and equal a manner as the nature of the work will admit of; for without great attention in this respect, great inequality in the crops may take place; besides the soil will be made lighter in some places than in others, which may be disadvantageous in the same way. The spreading, where it can by any means be accomplished, should always be performed before any rain falls; as where this point is not attended to, a great loss may be sustained by the saline matters being carried down in a state of solution, and their beneficial effects in a great measure lost before the crops are in a condition to receive them. In order to secure the full influence of the ashes, the land is frequently slightly ploughed over immediately after the ashes are spread out. And it is stated by Mr. Donaldson, that "those who are more than ordinarily attentive in this respect, only rib or slob furrow the field, so that the ashes may be got covered up with the greater expedition and dispatch." By this mode they cannot probably, however, be so equally mixed with the soil as by that of ploughing the whole field with a very slight furrow, so as just to cover them." It is remarked by Mr. Young, that in this business, the heaps should not be made large, twelve or fifteen bushels of ashes are large enough; twenty may be admitted, but, if much larger, the turfs will be too much burned. This must, however, depend in some measure on the weather, for the worse that is, the larger the heaps must be. It will also depend on the thickness of paring. Thin flags will burn in smaller heaps than thick ones."

It is evident that the expense of the operation of paring and burning must vary according to the nature and situation of the land, the method in which it is performed, and the customs of the district in regard to the price of labour. "On the thin sort of chalky soils it is stated by Mr. Boys, who is accustomed to have such lands prepared by this means, that the expense for paring at a moderate thickness, where the land is not very flinty, is twenty shillings per acre; for laying it up in heaps and burning, ten shillings; and for spreading the ashes, three shillings; and that a coat of manure is thus produced on the land of from eighty to one hundred and sixty cart-loads per acre, for the trifling expense of thirty-three shillings. A hundred cart-loads of dung purchased from neighbouring towns and villages, at the distance of three miles from the land, would, he says, cost, carriage home included, ten times the price of down-sharing, and yet would not improve the land more. But that, where the land is well covered with turf, it may be ploughed for burning about two inches deep, with a common plough, drawn by a pair of horses, early in the spring, and as soon as a drying wind sets in, the turf be laid in heaps and burnt by labourers for one pound one shilling per acre, which will produce near two hundred cart-loads."

And in some fen districts, where the original surface is rough and unequal, from great tufts of rushes, &c. called hassocks, Mr. Young states, that some persons cut them with spades at the expense of five or ten shillings an acre, and others with the plough. Paths for the horses are in that case to be cut by hand, and the plough made on purpose, and called a hassock-plough, cuts laterally much beyond the line of its draught. But opinions are said to be in general, that the hand-work is the cheaper; in either case, the hassocks are dried, heaped, burnt, and the ashes

spread. After this they go over it again with a very complete and effective tool called a fen-paring plough, the furrow of which is burnt: the expense of this business in different cases has been shown above.

It is remarked that in the management of land by means of paring and burning it is "necessary to attend to such a mode of cropping as will tend to its improvement, whatever may have been the manner or kind of soil in which the process was performed. Without a nice and exact attention in this respect, much injury may frequently be done, and an useful practice be brought into disrepute. Where the nature and situation of the land will admit of them, as in the lighter sorts of soils, the growing of turnip or rape crops to be consumed on the ground would seem to be most proper for the first year; then a white or grain crop, as oats, or wheat; after that, turnips again, or in some cases, peas, beans, or some sort of green crop, to be eaten off, if possible, by sheep; and lastly, a grain crop with grass seeds: but on the heavier sorts of land, where the turnip husbandry cannot be so well introduced, cole, clover, and bean crops, may often be interposed between those of the grain kinds with the most propriety and advantage. And it would seem that the interposition of green crops ought on the whole to be more frequent in the former sorts of soil than in those of the latter, on account of their containing, in general a less proportion of vegetable matter. It is often attended with great advantage to apply some sort of manure, such as lime, with the second crop of turnips in cases of these kinds." It has been observed by Mr. Young, that "upon high moors, in undertaking new improvements, it may be of singular importance to gain straw. In that case, to sow oats upon the first burnt lands, may be admitted, but in general it is much more correct to leave the ashes ploughed in for sowing turnips, upon all the land burnt in March, April, or May. This preparation is unexceptionable for potatoes, so that if this root be wanted, it may be planted in April on the land burnt in March."

It is stated to be the practice "in some of the western districts, where the method of paring and burning is much practised, and in high estimation, that old sainfoin leys, and all such swards as are of a sufficient texture, are usually broken up in this way. Turnips are frequently the first crop; and from the freshness of the land, and the good effects of the ashes, a large crop is mostly produced. But as in those cases the time is too short to get the land in proper tilth for the succeeding crops of barley, grass seeds, and other similar crops, it is often adopted as a better method to sow wheat in the first instance on one ploughing; after which from the ashes being still fresh in the ground, a crop of turnips may be as certainly depended on, and there is a sufficient length of time to get the land into a complete state of tilth." Mr. Young speaks of this as the best method on account of the danger of grain crops being destroyed by the red worm which abounds much in such layers. "Wheat stubbles, of the more grassy kinds, which will produce a tolerable quantity of ashes, are also frequently pared and burnt for turnips with a considerable degree of success. In short, when this practice is properly followed up with the turnip and clover husbandry, its good effects cannot, it is conceived, be disputed in any respect. And in other districts cole seed is sown on a shallow ploughing, and never harrowed, in order not to disturb the whole furrow; but rolled, or lightly bush-harrowed. This is intended either for a crop of seed, or for sheep-food: in the latter case, it sells in some places for a guinea an acre; in the former, for two or three guineas. Oats are then sown; the crop is productive, and the land, if well laid down to grass, becomes good meadow. But the management in this respect is frequently, it is observed, very bad, only clover and ray grass being sown, and after six or seven years pared and burnt again; instead of which, if proper seeds were sown, the land would be ever after in a state of improvement."

On the above Mr. Young remarks, that, "one peculiar circumstance attending the breaking up of grass lands, whether old turf or sainfoin lays, in this manner, is the bringing them into order for turnips with only one ploughing; and it is a general and very just observation, both in the north and west of England, where this husbandry is most common, that turnips scarcely ever are known to fail on burnt lands: the fly on such, is nearly unknown. Now any farmer must be sensible of the vast importance of thus bringing turf land by only one ploughing to a turnip crop; much tillage is thus saved as well as a great expense, and the turnips are generally a crop that repays the expenses of the operation with profit. In a word, this husbandry deserves the warmest praise."

It is stated by the author of Practical Agriculture that "where there are poor, wet, cold, hungry pastures and neglected meadows, overrun and filled with all sorts of rubbish, and abounding with too few good plants to render their improvement easy without breaking up, that these should be pared and burnt; not to keep under the plough, to be exhausted and ruined, which is infallible, and the land left in a worse state beyond all comparison than it was before, but to be laid immediately to grass, that is, as soon as the course of husbandry necessary will admit. This, it is conceived, ought to be without variation, under any pretence whatever, in this course of crops: 1st. Pare and burn for turnips to be fed on the land with sheep: but in moist-bottomed lands, rape will often succeed better than turnips: and the sheep feed better with rape upon such lands. 2d. Oats; and with these oats the grass seeds should be sown. The oats and the turnips, it is asserted, would more than pay all the expense of a previous hollow draining, should that be necessary; of the paring and burning, and every other charge; and the change, from a very bad pasture to a very fine one, would all be neat profit. The tenant, it is contended, would be greatly benefited, and the landlord find his estate improved, if let as farms ought to be let, with an absolute exclusion of selling a lock of hay under any pretence whatever." And that "this method is practised with great success in the fen land in Lincolnshire, the business being performed by means of the plough, and cole seed afterwards sown. In

some cases, horses and ploughs are found, and the labour put out, which, including a ploughing in order to turn in the ashes, is done at seven shillings an acre: the cole is fed with sheep, and is worth three pounds an acre; but the selling price, forty to fifty shillings. Then oats, eight quarters an acre, and ten quarters has been had; then cole and oats again; being laid down with fourteen pounds of white clover, and one peck of ray-grass, lets at twenty shillings. It is found to be a great and lasting improvement of the land. This is conceived to be a low estimate, from the land keeping five sheep an acre, from Lady-day to Michaelmas, and one and a half on the acre in the winter. Where then, it is inquired, is the supposed mischief of this practice?"

And "there are other sorts of lands, as dry, rough sheep-walks, covered with ling, furze, broom, &c. which should also be broken up in the same manner, but universally to be laid down again with the grasses suitable to the soil and to sheep. On weak, thin, stapled land, two crops of corn, after paring and burning, may often be pernicious. Perhaps they might be well laid down without a single one, which would be a better method of management. It is also supposed by some able agricultors, that it would be better to take, in such cases, two or three successive crops of turnips, in order to completely eradicate all the seeds of the ling, furze, and broom, before the land is laid down to grass, as otherwise these plants may appear with redoubled vigour. These observations seem just, and to be founded in good sense, reason, and experiment; they place the absurdity of indiscriminately condemning this mode of agricultural improvement in the clearest point of view; as the injury that may take place in some cases may be occasioned by an injudicious and improper method of cultivation." In the Report of the Agriculture of the county of Kent, Mr. Boys observes, "that, of all the improvements in the cultivation of land that have hitherto been made use of in that district, this stands foremost; some of the very worst land having been made to produce excellent crops; and poor chalky downs, of scarcely any value in their original state, are by it made to produce good turnips and clover, and crops of corn often equal in value to double the fee simple of the land. Instead of the land being injured by the operation, as some theoretical writers have imagined, provided it be under a proper system of management and fairly dealt by, it is, he says, put into a progressive state of improvement from the time of its surface being burnt. It has frequently, says he, happened, that land after burning has been sown with corn four or five years in succession without being folded with sheep, or any part of its produce ever returned in manure; even charlock and other weeds have been suffered to remain, by which it has been annually burthened with a double crop: hence it has been left in an impoverished state, and the burning is unjustly condemned for the mischief done by the negligence and rapacity of the cultivator. Let the land when burnt, says he, be perfectly cleaned from charlock and other weeds, by growing turnips until the weeds are totally eradicated by hoeing, &c. Let the turnips be fed off the land, by sheep lying on the land day and night; then sow it with barley and clover: the latter to be fed off with sheep, folding them on the land for wheat. Lastly, return the straw produced upon the land in manure, mixed with clay or loam, or any other fresh earth that is near at hand, for a second Norfolk rotation, which may be repeated; or the land may be sown with sainfoin, to remain till a turf is formed fit for paring and burning again. This plan being pursued, the practice of burning the soil will not, he says, give any cause of complaint either to landlord or tenant. Theorists, says he, exclaim that by paring and burning, the staple of the land is reduced, and the soil is wasted; which may be somewhat true: but all this is very immaterial, if fine crops of corn can be produced where none ever grew before, and the land at the same time be improved."

It has been very strongly remarked by Mr. Young, in speaking of cropping repeatedly with white or grain crops after paring and burning, "that if a dung-hill were given to a bad farmer, and it was used on similar principles, it would almost equally exhaust the soil: yet who has found out that dunging land is bad husbandry? Paring and burning gives, says he, a dung-hill also: it is bad management alone that converts it into an evil. Make it the preparation for grass, and all is safe." It has also been stated, "that the practice of paring and burning is so advantageous in some cases, as to render lands, the produce of which was not worth two shillings and sixpence, in the course of four years capable of producing two valuable crops of corn, and as many of turnips, and to be rented at twenty shillings per acre."

The following is a statement given by an able cultivator, in the fifteenth volume of Mr. Young's Annals of Agriculture, of "the expences and returns of breaking up fresh land of a stiff loamy quality, and cropping with oats and peas. The summer being lost in preparing the land for a wheat crop, the crops are charged with two years' rent and taxes.

Oat Crop.

	£.	s.	d.
Rents for two years per acre	1	0	0
Poor rates - -	0	3	0
Road levy - -	0	1	0
Striking the bushes -	0	6	0
Paring and burning -	1	9	0
Levelling hillocks -	0	4	6
Spreading ashes - -	0	1	6
Once ploughing - -	0	10	0
Harrowing - -	0	2	0
Four bushels of seed oats, at 29s.	0	11	0
	£.4	8	0
Sold seven quarters of oats, at £.1. 1s. per quarter -	7	7	0
Seeds and expenses -	4	8	0
Profit per acre £.	2	19	0

Straw, not charged, more than detrayed the expenses of mowing and threshing.

Pea Crop.

	£.	s.	d.
The expenses the same as for the oat crop, with the addition of 5*s.* for four bushels of seed, at 3*s.* - - -	4	3	0
Sold four quarters of peas, at 32*s.* - - -	6	8	0
£.	1	15	0

"From the ameliorating nature of pea crops, and the excellent state in which they leave the land for a crop of wheat, they will, it is supposed, be on the whole more advantageous than the oats."

And "the expenses and profits on cold, mossy, old meadow land in Yorkshire, with a north-east aspect, cultivated in this way for turnips, as given in the twelfth volume of the same work by Mr. Middleton, is as follows:

	£.	s.	d.
Paring - - -	0	9	0
Drying and burning - -	0	5	0
Spreading the ashes - -	0	1	0
Ploughing once - -	0	6	0
Harrowing - - -	0	2	0
Seed, ¾ lb. and sowing -	0	0	6
Weeding (in pared and burnt land little necessary) -	0	0	6
£.	1	4	0
Rent, tythe, taxes, and assessments - - -	0	18	0
£.	2	2	0
The turnips, a plentiful crop (large sizes, about a foot distance), estimated in feeding stock by the acre, at -	5	0	0
Profit per acre £.	2	18	0

It is further stated that "in that neighbourhood the usual agistment price is six pence a week for fattening wethers, and three pence a week for hogs (lambs of the preceding season) to eat the broken turnips and shells left by the wethers."

In regard to the kinds of grass-seeds that may be proper after this operation, they must probably be different according to the nature and quality of the soil. In the light sorts of land, those kinds of grasses that cover the earth well may be the most suitable. On chalky soil sainfoin may frequently be employed. In the fenny sorts of soil, marl-grass with a little meadow fox-tail grass, will often be found beneficial. And a small mixture of the finest ray-grass, or darnel, is likewise found to answer well. "Marl-grass, though it has some resemblance to red clover, is materially different in its effects; the former being found unfriendly to all natural grasses, while the latter is quite the reverse. This is a fact that has been established by extensive experience. One other very material advantage resulting from the cultivation of marl grass, is, that neat cattle are not so liable to swell by eating it in moist weather, as they are with red clover; nor is its hay so dangerous to the horses' wind as clover." And it is added, that "the heavy or clayey soils will in most cases require the largest proportion of grass-seeds to be sown upon them, in laying them down after being prepared by the process of paring and burning."

In fact, it may be concluded, that "from the great ease and expedition with which all those coarse sorts of land, which have been mentioned as proper for being broken up by this means, are rendered fit for the growth of crops of different kinds, such as those of grain, rape, turnips, &c. as well as from the very abundant produce, which is generally the case after such preparation, that where proper attention is paid to the process and the method of management afterwards, it must be highly beneficial, and probably the best that can be adopted. It has indeed been remarked, in the able Survey of the North Riding of Yorkshire, that "when the husbandry that succeeds paring and burning is judicious, no mode of improvement can be compared with it; for it is *certain* to produce *great* crops of turnips and grain, and these are *certain* means of future fertility in the hands of a judicious farmer."

Paring, in *farriery*, an operation performed on the horse's foot with a view to adapt it to the shoe. It is done with a butteris, and frequently to the great prejudice of the foot. The design of shoeing horses is undoubtedly to preserve the hoof, and defend the sole. It cannot therefore be necessary to pare away what is wanted to be preserved. It is of course a practice that should never be permitted, but in cases where the horny sole is so uneven, that the shoe will not otherwise bear equally upon the foot, which would take off from its necessary firmness. In such a case, perhaps, it may be proper, but otherwise, it is very absurd and injurious, being often the cause of much mischief and inconvenience to the horse.

Paring-*plough*. This is an implement of great utility in many cases, where the system of paring and burning is practised. At *fig.* 1 and 2 in plate XIV. are two side views of a paring plough, recommended by Mr. Young for rough land. It has the share six inches in width, by means of the pivot *a*, which screws into the holes *b*. It is said to be capable of performing its work in a good manner, where the fen paring plough cannot stir at all. It is said to have been in use at Sheffield Place, the seat of Lord Sheffield, thirty years ago, having been obtained from Cheshire, where it had been made use of on the farm of Sir George Warren. See *Paring and Burning*.

Paring-*spade*, a sort of spade which is made use of in paring land for burning, being made with a

crooked handle, so as to be pushed forward in using. It is sometimes termed a breast plough, and is seen at *fig.* 3 in plate XIV.

PARING *the sole*, an operation in shoeing horses. See *Shoeing Horses.*

PARMESAN *Cheese.* See *Cheese.*

PARSLEY, a well known tap-rooted biennial plant. It has been observed, in the twenty-second volume of the Annals of Agriculture, that Mr. Fleet of Hampshire, famous for curing the rot in sheep, cultivates it largely with success; he sows half a bushel to the acre, with a bushel of rye-grass, with spring corn; and he finds that it lasts in the ground till it is permitted to seed. He feeds it constantly, it being excellent for sheep, and when suffered to get a-head pigs feed wonderfully upon it in the autumn. After September, it will not, he says, run to seed. When it was ploughed up he obtained good oats. The land was poor, and in the next round of the course, the clover was much the better for the parsley having been sown or the clover omitted; for in a field half parsley, half clover, when the clover came again to be sown, it was excellent on the parsley half, but bad on the clover part. In laying down land to grass, Mr. Hoyte, in the fourth volume of Communications to the Board, advises the sowing with twelve pounds of white clover, two pounds of red clover, and two pecks of rye-grass, two pounds of parsley to the acre, as the parsley stands two years, and by its diuretic qualities, prevents the sheep from dying of the red-water, which too luxuriant seeds are apt to produce.

The following trial with this vegetable, is stated in the fifth volume of the Farmer's Magazine, printed at Edinburgh.

"A friend of mine, says the writer, having occasion to observe the partiality of black cattle for the garden parsley, and their preference of it, when growing, to almost any other green food, took it in his head to try how it would succeed in a field that he was going to sow down for pasture. He accordingly sowed two or three ridges with parsley seed, and the rest of the field with clover and rye-grass. As soon as the field was ready for pasture, he led his cattle into it, and it was perfectly evident that they preferred that part which was sown with the parsley to any other part of the field, insomuch that they never touched the rest while there was a single blade of parsley to be had. Horses were equally fond of it. He had not an opportunity to try sheep upon it; but the probability is, that they would, if possible, have been fonder of it, and thriven better, than any of the other two. This, therefore, seems worthy of a farther trial. We know that black cattle, sheep, horses, and indeed every other animal, always prefer that food (when they have it in their power to make a choice) that is most agreeable to them, and most conducive to their health. We know also that parsley is a most wholesome vegetable for the human species. It is a powerful antiseptic. If we were to reason from analogy, we should suppose that its beneficial properties should extend to the animal creation in general. As it is a perennial (biennial) plant, it will answer well for fields that are to be laid down for pasture for a considerable while. Sheep in particular, being of a tender and delicate constitution, and especially subject to bowel complaints, its antiseptic quality may be of great use to correct these. The difficulty may be at first to get the seed in any considerable quantity; but that may soon be remedied, if the experiment be thought worth while. He would suppose that the ground upon which it is sown must be good, in good condition and clean, otherwise it will not have a fair trial."

It should probably be sown early in the spring, and be kept constantly closely fed down with stock, where it is intended to be preserved in the ground for any great length of time, as probably, by preventing its sending up seed stems, this may be effected.

More experiments are wanting to fully ascertain the value of this vegetable in field culture.

PARSNEP, the name of a tap-rooted plant, cultivated for the sake of the root. This sort of crop requires a rich, mellow, and deep soil, in order that the roots may have full room to thicken and run downwards.

It is the garden parsnep that is made use of in field culture, which has a long fleshy root much larger than the carrot, and equally sweet, nutritious and juicy. And it has been suggested, that from its being more hardy, it is probably better suited to the northern parts of the island than the carrot. Its easy culture and the large produce which it is capable of affording, should render it more an object of the farmer.

The soils most adapted to this sort of crop are those of the rich, deep, friable, loamy or sandy kinds, in which the roots can get down to a great depth, and become large. It is observed by Mr. Young, that of "all the roots which a farmer can cultivate, this is the most valuable; but it demands a better soil than any other crop he can put into the ground. If he has not land of an extraordinary quality, he had better not venture on the attempt." They love a very rich, dry, putrid, sandy loam, worth 40 or 50s. an acre, which should be ploughed as deep as possible about the end of the autumn, and left for the frosts to exert their influence upon.

This fine deep pulverization of the land is effected in different ways in different districts. In some it is given by ploughing the ground with a light plough, which is regulated in the fore part by two wheels being fixed to it, one of which runs in the furrow, and the other on the unploughed land, the former being fourteen or fifteen inches higher than the latter, and which opens down and turns the mould to the depth of about five inches; after which, the furrow is dug down with a spade, so as to form a trench of about sixteen inches in depth proceeding in the same way till the whole of the field is prepared: but the latter, which is by means of two ploughs of different kinds, one following in the same track after the other, is by much the most expeditious and economical.

The light plough just described answers very well in performing the first part of the operation; but in the second, one of the trench kind must be made use of, by which the mould is raised from the bottom

of the furrow made by the first, and applied over the slice it had turned up. In this way the soil is not only broken up to a great depth, but the surface left in a fine state of mould. Where this sort of tillage is practised, the work is generally performed in the more dry sorts of land about the middle of February; and in those that are retentive of moisture, towards the latter end of March. The ground, after being thus exposed to the influence of the atmosphere for a week or a fortnight, is harrowed lightly over in order to render it fit for the seed. In some cases, however, a slight ploughing is given to the lands intended for this crop in September, the use of the other ploughs being had recourse to in January in the succeeding year. The principal object in this business is that of loosening and rendering the soil mellow to as great a depth as can possibly be done."

And though "the use of manure is not in general so necessary for this crop as some others; where the land is not in tolerably good heart, it should constantly be employed in such proportions as may be sufficient to render it rich. Well-rotted farm-yard dung is the best adapted to this crop, being turned into the soil by a light ploughing immediately before the time of putting the seed into the ground.

In the cultivating of this sort of crop, great care should be taken to have good perfectly ripened seed, and which should always be made use of while perfectly fresh, old seed frequently either wholly failing, or coming up with great irregularity, or in a straggling manner.

In respect to the proportion of seed that may be employed, it must be different according to the nature of the soil and other circumstances; but in general about five pounds to the acre may be sufficient for the purpose.

In respect to the time of sowing, the most usual period is the early part of the spring, as soon as the frosts will admit of it; as about the beginning or middle of February, or in the following month. "It is, however, sometimes sown in the autumn of the preceding year immediately after it has been ripened and collected from the plants, as about the beginning of September." And it is contended by some that in this way the plants will appear more early in the following spring, and of course become large and strong before any weeds rise to injure them: and that as the plants are in little or no danger from the severity of the winter season, this is, on the whole, the most eligible period. Where the soil is, however, in a proper state of preparation, as there can be no apprehensions of their being inconvenienced by the growth of weeds, the former must be the most safe and convenient season for the purpose.

It is observed that the most usual method of sowing the parsnip seed is in broadcast over the land, being afterwards covered in by means of a light harrow. It is probable that this sort of crop might be sown in rows, either by means of the drill machine, or by having small furrows made in the land and sowing the seed over it in the broadcast method, afterwards lightly harrowing it into them. In this mode, by having the rows at sufficient distances, the crops might be kept more clean and at less expense than in the simple broadcast method. But in this way they have not been found to answer so well.

It is stated by the author of Practical Agriculture, that, "in districts where parsnips are much cultivated as a field crop, it is the common practice to have beans at the same time with them either planted in single rows, at the distance of four feet and a half, and about eight or ten inches from each other, or double ones at the distance of twelve feet and eighteen inches in the rows. In this manner two crops are obtained from the same piece of ground; but unless care be taken to remove the beans in good time, great injury may be done to the parsnips. As though there may have been much leaf and stem before the roots of these plants begin to swell out and acquire their size towards August, the beans ought never to be suffered to remain longer than that period upon the ground."

In respect to the management of these crops, after they have been put into the ground, it is obvious that, as they "require to be kept perfectly clean and free from weeds during the early parts of their growth; frequent hoeing and weeding are, therefore, to be practised. Where cultivated in rows at sufficient distances, the intervals may be cleaned by the plough or horse hoe. It is sometimes usual, where this sort of crop forms a part of field husbandry, to have recourse to the harrow before the process of hoeing or weeding is begun. This must be performed about the time the seeds first begins to germinate; as by harrowing too soon the weeds will not have risen, and if deferred too long, there may be danger of destroying the buds of the parsnips. This is supposed more necessary on the stiffer sorts of soil, as it renders them more easily weeded. The first weeding may be performed about the beginning or middle of May, according to the forwardness of the plants, being at this operation only partially thinned out where they appear to stand much too close together. The same operation is to be again performed about the beginning of July; when the plants must be carefully set out to the distance of six inches. This sort of work is executed either by means of a small fork with two prongs, or a kind of very small spade having a short handle; the labourer, in making use of it, kneels on one knee, and, holding it in his right hand, digs and turns the mould, while with his left he pulls up and removes the weeds. After this second weeding nothing further is found requisite in the parsnip culture."

It is further remarked, that, "as this sort of root strikes downwards to a great depth, and of course draws much of its nourishment from below, it may with propriety be introduced after most sorts of fibrous-rooted crops. And that, "there is little hazard in the cultivation of parsnip crops, except from the falling of too much rain immediately after sowing, by which the seed may be in danger of being washed away; or when dry weather succeeds, from the baking of the land rendering the plants incapable of pushing their roots sufficiently down. They are seldom injured by frosts or other causes during the winter season, or liable to be destroyed by any kind of insects."

It is stated, that the produce of this sort of crop, when cultivated on a proper soil and in a suitable manner, will, from the great size of the roots, be equal if not greater than that of those of the carrot kind.

In respect to the methods of application of this root, they are much the same as that of the carrot. In the fattening of cattle it is found equal if not superior, performing the business with as much expedition, and affording meat of exquisite flavour and a highly juicy quality. The animals eat it with much greediness. It is reckoned that thirty perches, where the crop is good, will be sufficient to fatten an ox of three or four years old when perfectly lean, in the course of three months. They are given in the proportion of about thirty pound weight morning, noon, and night: the large ones being slit in three or four pieces, and a little hay supplied in the intervals of those periods." And, "when given to milch-cows with a little hay in the winter season, the butter is found to be of as fine a colour and as excellent a flavour as when feeding in the best pastures. Indeed the result of experiment has shewn, that not only in neat cattle, but in the fattening of hogs and poultry, the animals became fat much sooner, and are more bulky, than when fed with any other root or vegetable. And that, "besides, the meat is more sweet and delicate." In these applications, in the trials of an experienced farmer in Surry, as stated to the Society of Arts, the results were these:

"He in the first place put up sixteen hogs to fatten upon them. The method he took in giving them to the hogs, was throwing the parsnips on the ground whole. This he continued for about a month, when finding his hogs grow heavy, he observed they did not go on so well with them as at first. Upon this he boiled the parsnips, and made wash of them: thickening the wash with half a bnshel of barley-meal every day. He gave it them in a trough, and continued this for two months, when he killed them, and found them to be very good meat; weighing from 28 to 33 stone per hog. One of them being very large, weighed 58 stone. The neat value of his hogs when killed, amounted to 52*l.* 17*s.* 4*d.* The whole expence of his barley meal with which he thickened the wash, amounted to 3*l.* 18*s.* 9*d.*; of the firing to boil them, at 6*d.* per day, 1*l.* 10*s.*; of a boy to look after them for three months, at 6*d.* per day, 2*l.* 5*s.* which sums, added to the expences attending the parsnips, prime cost of the hogs, &c. amount in the whole to 35*l.*: so that his profit upon this article only, is 17*l.* 16*s.* 8*d.* which remains to be carried to the account of the parsnips. After his hogs were killed he kept four dairy cows upon the remainder of the parsnips for three months, which, at 1*s.* 6*d.* per week, amounted to 3*l.* 12*s.*; and this sum, added to the 17*l.* 16*s.* 8*d.* before mentioned, makes the neat profit on the one acre of parsnips to be 21*l.* 8*s.* 7*d.*" But he says, he "must observe, that giving his dairy cows the parsnips, answered his purpose greatly, by increasing their milk and making the butter much richer and finer than turnips or carrots, which he had given them long before: the manner in which he gave the parsnips was, cutting them in pieces. On finding the parsnips to agree with his hogs and cows so well last year, he now determined to give them to his horses; and having five that were making up for sale, he begun with them by giving them a very few the first week. He observed then that they agreed with them extremely well, and he therefore gave them a larger quantity, which made them thrive very fast, and determined him to continue giving them the parsnips, which saved him a great deal of hay, as he found they had occasion for very little of it. He kept them in this manner for ten weeks, when he sent them to Mr. Bever's repository, where they were sold for forty guineas each horse. The manner in which he gave them the parsnips was, cutting them in small pieces, and throwing them into the manger. He calculates the expense half a guinea per week, for the parsnips for each horse, which amounts to 26*l.* 5*s.* to be carried to the account of the parsnips for this year." And he adds, that "at the same time he began fattening an ox, which cost him 4*l.* 10*s.* from the plough. He was thirteen weeks in fattening, and ate nothing but parsnips the whole time. He then sold him to Job Spratley a butcher at Guildford, for 2*s.* 8*d.* per stone, weighing 102 stone 6lb. which amounted to 13*l.* 14*s.* 4*d.*: exclusive of the above, he had within him 22 stone 6lb. of loose fat, which was more than ever was known to be taken out of a bullock of that weight in the town of Guildford, and it was remarked by many, that finer beef never was eaten. He mentions these particulars, in order to shew the great use of parsnips, as he is convinced by experience, they are preferable to carrots or turnips. But to proceed on in his account: the profit upon this bullock amounted to 9*l.* 4*s.* 4*d.* which he also carries to the account of the parsnips." And, "the remainder of his parsnips he gave to seven dairy cows eleven weeks, at 1*s.* 6*d.* per week each, which amounts to 5*l.* 15*s.* 6*d.* So that the net profit (after deducting 6*l.* 12*s.* per acre for the necessary expences attending the parsnips, as per the calculation for last year) amounts to 28*l.* 10*d.* besides a great many of the parsnips that he gave occasionally to his store hogs and cattle, which he valued at 3*l.* 10*s.*" This statement fully shows the vast advantage of cultivating this sort of crop, where the farmer has a soil proper for it.

It has been remarked, that when chopped and used with dry cut meat, horses eat them freely, and are kept in good condition with them.

Parsneps are also found an excellent, wholesome, and very nourishing food for cattle in other countries.

In France they have been used to great advantage to fatten cattle. Hogs have no other food in winter, and bullocks and oxen thrive well upon it. Cows fed with parsneps, give more milk than with any other winter fodder, and it yields better butter than the milk of cows nourished with any other substance. Horses fatten with this food: though some pretend that it renders them less mettlesome, and hurts their legs and eyes.

"Cattle eat these roots raw at first, sliced lengthwise; and when they begin not to relish them, they are cut in pieces, put in a large copper, pressed down

there, and boiled with only so much water as fills up the chasms between them. They then eat them very greedily, and continue to like them."

And in addition to their advantages in these ways, the tops afford a large proportion of green food for these sorts of live stock, either by having them cut off when taken up, or by being consumed in the field. In the last method the most proper period of having them eaten is at the period when they begin to shrink and get dry.

In respect to their being taken up and preserved, they may be dug up with three pronged forks in the beginning of the autumn season, and be packed up in dry sheds in the same manner.

On this plant it has been remarked by Mr. Young, that when the soils are suitable the inducement to the cultivation is very strong, as they fatten bullocks, as well as oil cake, and are of great use with hogs. They have also the valuable property of preparing the land in an excellent manner for grain crops.

To save the seeds of this plant in the most advantageous way, some of the longest, straightest, and largest roots should be singled out and planted about two feet asunder, in a place where they will be defended from the strong south and west winds; for the stems of the parsneps generally grow to a great height, and are very apt to be broken by strong gusts of wind, if they are exposed thereto. The ground should also be kept clear from weeds; and if the season should prove dry, watering the plants moderately, twice a week, will increase the quantity, and improve the quality of their seeds, which will be ripe about the end of August or the beginning of September, when the heads should be carefully cut off, and spread upon a coarse cloth for two or three days to dry. The seeds should then be beaten off, and put up for use. But neither these nor carrot-seeds should be depended on after they are above a year old.

PARTERRE, a level division of ground, which, for the most part, faces the south and best front of the house, and is generally furnished with evergreen shrubs, flowers, &c.

There are several sorts of parterres; as plain grass with borders, and parterres of embroidery, &c.

Plain parterres are more beautiful in this country than in any other, by reason of the excellency of the turf, and that unaffected simplicity that it affords to the eye of the spectator. Other parterres are cut into shell and scroll work, with sand alleys between them; which sort of parterres are esteemed finest in France.

As to the general form and proportion of parterres, an oblong, or long-square, is esteemed the best: a parterre should not be less than twice as long as it is broad; twice and a half is accounted a very good proportion; and it is very rare that three times is exceeded. As to the breadth of a parterre, it should take its dimensions from the breadth of the front of the house: if the front of the house is one hundred feet long, the breadth of the parterre should be one hundred and fifty feet; and if the front of the house be two hundred feet, the parterre should be fifty feet broader: but where the front exceeds the breadth of this parterre, it will be a good proportion to make the parterre of the same dimensions with the front.

There should be a terrace-walk on each side of the parterre, for an elevation to afford a proper view; and therefore, the flat of a parterre between terrace-walk and terrace-walk, should never be above three hundred feet; nor can it be well made less than one hundred and forty. As to the adorning and furnishing these parterres, whether it be plain or with embroidery, that depends much upon the form of them, and therefore must be left to the judgment and fancy of the designer.

PARTRIDGE, a game bird, highly valuable for the table.

The places that partridges most delight in, are corn-fields, especially while the corn grows; as that is a safe retreat, where they remain undisturbed, and under which they usually breed. They frequent the same fields after the corn is cut down, with an intention of feeding on the corn that has fallen from the ears, and find a sufficient shelter under covert of the stalks, especially of those of wheat stubble. When the wheat stubbles are much trodden down, they retire to the barley stubbles, and will there often hide themselves in coveys of twenty or thirty. When the winter comes on, and the stubble fields are trodden down or ploughed up, they then retire to the upland meadows, where they lodge in the high grass, and among rushes; sometimes they resort to the low coppice woods, especially if there be corn-lands near them. The time of shooting these birds is in September.

PARTURITION, in *Farriery*, the art of bringing forth their young in animals. This process, in different species of cattle, is distinguished by different names. Thus, in cows, it is termed *calving*, in mares, *foaling*, in ewes, *yeaning*, &c.

In the periods when they are delivered of their burden, there is also great variety and difference in the different sorts.

The process of parturition demands the concurrence of several agents. The cause and determination is the first, which is in the womb itself; which contracts and compresses whatever it contains, in such a manner as forces it to escape by the part which makes the least resistance, which is constantly by the shape or passage. The womb is, in all quadrupeds, muscular, and reticulated; some of its fibres run uniformly parallel upon the inner surface of the womb, from the bottom to the neck; others diagonally crossing upon these, and others again horizontally interlaced, and closely woven towards the bottom. In short, it is capable of dilatation and contraction, like the bladder, and acts in the same manner, though more forcibly; the diaphragm and the abdominal muscles co-operating. The irritation which the womb suffers at the end of pregnancy is what determines its action, and is the true cause of the expulsion of the young animal. Before conception the cavity of the womb accords with its natural shape, which, in cattle, is *horned*, or branching into two parts. But the expansion once begun, continues

with the growth of the fœtus until the whole assumes a shape corresponding to its contents. At this period, the volume of the young animal still augmenting, the womb stretches beyond its limited dimensions, becomes irritated, susceptible of pain, and hence expulsion proceeds. The process begins with gentle efforts of short duration; the womb essays its force, as it were, exactly filled, and meets with equal resistance on every side, except towards the orifice, where the sensation of the first pain begins. The contraction of it acting on the orifice distends its fibres, and causes pain; when the orifice is sufficiently dilated to let the head pass, the pain ceases; but it is renewed when the head enters the shape or passage and stretches the fibres of these parts.

The breaking the communicating vessels between the womb and membranes that contain the young animal, causes a fluid to transude, which becomes the source of the mucous discharge in the beginning of the process. The separation of the after burthen is effected almost immediately after the young is produced.

In cows and other animals, assistance in this process, sometimes becomes necessary, especially in the first, in the northern short-horned breed.

The natural presentation of the calf is with the head and fore-feet, the nose being between them, and the back upwards.

A modern writer on this subject, Mr. Downing, enumerates seven preternatural positions: as,

1st. The reverse presentation, or tail first.

2dly. The fore-feet, no head appearing.

3dly. Sideways, the belly being upwards, the head reversed over one shoulder, and the legs appearing.

4thly. The fore-feet, with the head under the brisket.

5thly. The head, either alone, or with one fore-leg only.

6thly. The head and one leg, or the head alone.

7thly. The calf lying on its back, its fore legs folded nearly together, and close up to the cow's back or spine, the head appearing, or doubled back, even with the ribs, on either side; one hind-leg, perhaps, presenting.

It is recommended in these cases to procure timely assistance, before the cow is exhausted: extraction being never to be attempted but in a proper position. The operator, before he begins, should supple his hand and arm well, with warm water and fresh lard. Examination is advised, as best made when the cow is standing, and in the intervals of the pains. In pulling at the feet, it is suggested, as proper to inclose the claws in the hand, that these may not bruise the cow in passing along. The navel string bursting, and the attendant flux of blood, are considered of no consequence. Instruments are directed to be used only in the last extremity, and only by experienced persons. The proper hook by which to assist in extracting the calf, is of iron, four inches long, with a loop for a cord at the straight end.

The following are his directions in the different cases.

He observes, that "in a *natural position*, if the cow should want help, the position of the calf may be ascertained after the waters have been seen. A cord ought to be in readiness, to attach to the fore-legs of the calf, in order to assist in each natural exertion. The head ought to be kept clear of obstruction."

In the *first unnatural or preternatural position*.

"No attempt should be made to turn the calf (this position being favourable for extraction), but expedition should be used, for fear of its being suffocated. Press the haunches back with the palm of the hand, take hold of the bend of the hock of one leg, pull at it, and reach the foot; both feet may thus be brought forth."

In the *second*, "reduce the head to its proper situation between the fore-legs, either by taking hold of the nose or jaw-bone. A long arm is needful, which must be kept to the full extent in the body, that instant advantage may be taken of every pain, the fingers being properly fixed."

In the *third*, "gently move the calf back, and bring the head forth to the legs."

In the *fourth*, "push the calf back to find the head; pull at the nose: this requires address, but it is useless to employ force until the head be in its proper place."

In the *fifth* and *sixth*, "push the calf back against the shoulders and brisket; the feet will be found folded under the belly; bring the feet forward, one at a time, the hand being gently placed on the bend of the knee. Should the head be too much swelled and bruised to be returned, it must be skinned and amputated. Dissect in a straight line, from the poll to the nose; force the skin back over the first joint of the neck; divide the head from the body, pushing the latter back to obtain hold of the knees. The loose skin must be previously wrapped over the ragged bone, and an assistant should have fast hold, in order to guide it clear of the haunch-bones of the cow; should it hitch there, put it back instantly."

In the *seventh*, "if one hind-leg appear, put it back; the calf cannot be brought with a hind and fore-leg together, and the difference between the knee and hock will be immediately discovered. The head being doubled back, must of course be reduced to its proper place. The cow being strong and quiet, the business may be effected with care and patience; but should the hook be positively necessary, hold must be taken, either in the sockets of the eyes, cavity of the ears, or in the jaw. Keep steady until fair hold be taken." In case of difficulty occasioned by dropsy in the calf, which will be sufficiently apparent from its preternatural size, it is directed to use the knife carefully, and with it to pierce the belly of the calf, by which means the delivery may afterwards be effected.

These directions have been found successful in actual practice.

PAR-YARD, a term provincially applied to the straw, or fold yard.

PASTERN *of a horse*, the distance that intervenes between the joint of that name and the coronet of the hoof.

This part should be short, especially in middle-

sized horses, as long pasterns are weak, and cannot so well endure hard labour. Some have pasterns so long and flexible, that the horse in walking almost touches the ground with them, which is a great imperfection, and a mark of little or no strength, such horses not being fit for any kind of hard labour.

PASTERN-JOINT, the joint above the pastern, which serves for a second knee in the fore legs, and a second ham in the hind. It is also termed *fetlock*. A horse is long or short jointed, according to the shortness or length of the pastern, and the short-jointed is the best. See *Foot*.

Where the pastern joint swells after travelling, it should be chafed every morning and evening with a mixture of two parts of brandy and one of oil. And if the swelling be large and hard, a poultice of rue boiled in thick wine may be applied.

PASTURE, a field kept fed down by cattle, sheep, or other animals.

These differ considerably according to the modes in which they are managed, some being almost wholly appropriated to the fattening of animals, under which system they are termed grazing, or fattening pastures; while those which are almost solely applied to the support of such animals as afford useful products, such as cheese or butter, are denominated dairy pastures.

The situations and inclosure of pastures, have also some effect in the manner of employing them, the lower and more inclosed kinds being in general more adapted to the fattening system, while the higher are more suited to sheep pastures. The state of the sward may likewise have some influence in the same, as the new lays are said to be more proper for the store stock, while the old grass lands are better for feeding. See *Pasture-Land*.

PASTURE-*Land*, a general name for all sorts of land reserved for the purposes of pasturing and feeding cattle upon.

Pasture ground is of two sorts: the one is low meadow land, which is often overflowed; and the other is upland, which lies high and dry. The first of these will produce a much greater quantity of hay than the latter, and will not require manuring or dressing so often: but the hay produced on the upland is much preferable to the other; as is also the meat which is fed in the upland, more valued than that which is fed in rich meadows: though the latter will make the fatter and larger cattle, as is seen by those which are brought from the low rich lands in Lincolnshire. But where the people are nice in their butcher's-meat, they often give a much larger price for such as has been fed on the downs, or in short, upland pastures, than for the other, which is much larger. Beside this, dry pastures have an advantage over the meadows, that they may be fed all the winter, and are not so subject to poach in wet weather; nor will there be so many bad weeds produced; which are great advantages, and which, in a great measure, recompense for the smaller produce of grass.

It has been stated by the author of a late practical work that "the grounds that are the most perfectly adapted to this use are all those which have a considerable depth of good mould, and, at the same time that they afford a good herbage, are so dry in their nature as to admit the animals to feed upon them at almost all seasons without injury by poaching. Coarse rushy lands may, however, in many cases be converted into good pastures, by proper attention in draining, and cutting over the rushes in the early part of the spring, as by this means the water enters their stems and the plants decay, the young shoots being afterwards eaten by young stock, and the good grass plants allowed to flourish." He likewise adds, that "there is also another sort of land that may be employed in this way, which is that of the moory kind, consisting of much imperfectly reduced vegetable matter proceeding from the leaves and roots of various decayed vegetable productions, that require to be brought into a suitable condition for the support of grass plants by proper drainage and the application of substances of the fossil kind." And he proceeds to observe, that "pasture lands should likewise, as much as possible, possess properties in the nature of their grasses that are the most advantageous for the particular method of management under which they are to be conducted. In this view, some may be more adapted to the producing of milk or butter, others of cheese, and others again of feeding or fattening animals. It is in some measure on this account, as well as that of local convenience, that different modes of management are employed on grass lands" in different situations.

And, it is observed, that "the difference of situation in pasture lands has likewise much influence in directing the uses to which they may be applied with the greatest benefit. The higher or more elevated grounds being, in general, more proper for sheep, while those of the lower and more inclosed kinds are mostly better suited for the purpose of neat cattle or other animals under the fattening system. And besides, the age of the lay makes a difference in some cases: new laid down pasture lands being commonly found more proper for the support of young store animals, while those that have been long in the state of sward are in general better adapted to the feeding or fattening stock. It is also obvious, he says, that "the mode of inclosing has some effect in the same way; as when the inclosures are of a moderate size, they are found more suitable for the purposes of feeding than where the contrary is the case," as has been well remarked in the Report of Perthshire.

It may be observed, he adds, that "this sort of grass land, as well as that of the hay kind,, is subject to be overrun and much injured in its produce both by moss, coarse plants, and ant as well as mole-hills. These should therefore be constantly removed, or spread about as soon as possible, and prevented from obstructing the complete pasturage of the lands," in the manner that is recommended under these different heads.

He suggests that "on the marsh grazing lands in Kent, where ant-hills frequently occur, they have a mode of extirpating them in an easy and expeditious way, and of bringing the surface level at the same

time, which is by the use of an implement, eight or nine feet in breadth, which is armed with a sort of strong cutting blade. When in use, it is drawn by a horse directed by a boy, and guided behind by a man, and is capable of often cutting off several of the hills at one stroke, and of course of clearing a number of acres in a very short space of time." There are various other implements in use for this sort of work, in different parts of the island, which answer the intention in a very perfect manner.

It is evident that pastures when not well attended to must frequently be prevented from being properly fed, by various kinds of low shrubby plants, such as those of the alder, brier, broom, furze, and other sorts that spring or shoot out upon the surface, and which should always be extirpated as soon as possible, as by remaining upon and shading the ground they render the herbage sour, coarse, and improper for the food of cattle. This sort of work may be performed by cutting them closely down as they rise in the early spring months, by a strong scythe ; but a better practice is to dig them or plough them completely out where it can be done, which should be the case while it is under the state of tillage, in order to its being laid down to the condition of sward.

" The shrubby, black, and other thorns and briers that spring up from suckers on the sides of the hedge-rows of pasture grounds, should likewise be exterminated, especially where sheep are pastured, as they do great mischief by pulling and entangling their coats. Besides, much ground is often lost in this way, and the appearance of the hedges is disgusting. In many cases, after the plants are stocked up, the earth about them might be thrown up into a compost with a small proportion of well rotted dung, and spread upon the land with much benefit ; and at the same time the land thus cleared be brought into a proper condition for being sown down with the grass seeds."

And in cases " where pasture lands are productive in grasses of the more sharp coarse bladed kinds which rise into tufts or tussocks, and such as are known to agricultors under the titles of pink or carnation grasses, and there are other sorts of aquatic plants presenting themselves, it is a certain indication that the soil is too retentive of moisture, and not only stands in need of draining, but also of being kept in a close state of feeding by different sorts of stock," so that every part of them may be kept quite pared down.

It has been well suggested by the above useful writer, that " the manuring of pasture lands is a business much less in practice than ought, perhaps, to be the case, as where the soil is not good, and they are kept in a constant state of feeding or pasturage, it would seem probable that their fertility must in some measure decline, if proper means be not taken to preserve and keep it up, even though they should be fed down with sheep, which is unquestionably, in this view, the most favourable sort of stock. It is indeed hardly to be supposed, he says, that the small proportion of excrementitious matter that is dropped at random during the feeding of the animals, especially the larger kinds, under an exposure to the dissipating and washing effects of the atmosphere, at different seasons, where no other sorts of food than that of the natural grass of the pastures is consumed, can in such sorts of land be adequate to the restoration of the great degree of fertility that is constantly conveyed away in the time of pasturing. In the better kinds of pasture lands, where the produce of grass is considerable, improvement may, and undoubtedly does, he observes, take place by feeding them, especially by sheep, as the discharges of the animals are not only more abundant, but a proportion of old grass is left to decay during the winter season, and in that way make an annual addition to their fertility. It appears probable to him, however it may differ from opinions that have been held on this subject by some cultivators, from much close attention to the management of grass lands of the less rich kinds in the state of pasture, that in such cases, unless attention be paid to improve their condition by some other means than merely that of the manure dispersed over the land by the animals in simply consuming the herbage, they must in time become gradually deteriorated, and the quantity of pasturage be lessened so as to support smaller proportions of stock than was formerly the case. This supposition seems indeed, in some degree, supported by the condition of downs, and other uninclosed lands that have been in a state of pasturage for a great length of time ; as in these cases, if feeding had rendered them more fertile, they must long since have been enabled to carry a vastly increased proportion of stock ; which is certainly not the case" as has been strongly remarked long ago, by Dr. Anderson in his useful Essays on Rural Affairs.

It is in addition well remarked," that feeding down pasture lands, of these as well as other kinds, in a judicious manner, has the effect of rendering the herbage more fine, and better for the support of stock in general, there cannot be the smallest doubt ; but it does not certainly follow that the fertility of the land, in such cases as have been just mentioned, is thereby really improved, as has been supposed by some employed in the business of grazing in particular situations and circumstances. Where the pastures, as has been just observed, are in such heart as to afford a large quantity of herbage for being converted into manure, and sufficient to permit a portion annually to revert to the state of vegetable mould by its undergoing the process of putrefaction, a considerable progressive improvement must, he says, without doubt, be the case under the pasturing system, especially where sheep constitute the principal stock. And in most cases the fining of the herbage by this practice must be advantageous. It seems, therefore, not improbable but that the bettering of the condition of the herbage by feeding the lands with sheep may have occasionally led to the supposition that the fertility of the grounds was thereby, in all cases, really improved. That an increase of fertility is produced, in most instances, by the pasturing of lands with sheep, is not disputed ; it is only in particular circumstances that the contrary is contended.

to take place. And in all cases the injury that may be sustained in this way must evidently be very small, when compared with that which takes place from repeated mowing without the application of suitable dressings to the lands," at suitable periods or distances of time.

In regard to "the improvement of the fertility of pasture grounds, it may, he says, be effected in different ways, as either by the direct application of manure in its natural state, such as that of rotten dung, lime, marl, or in that of earthy compost, occasionally over their surfaces in a thin even manner; or indirectly by the folding or confining of sheep upon the land during the time they consume other sorts of green food, such as turnips, &c. The latter mode is unquestionably the most advantageous and convenient, as it is in but very few situations that the former can be practised without injury to the arable or hay lands. By proper attention in this way the more poor pasture grounds might soon, and at little expense, be brought into a good state of pasturage;" which could seldom or ever be the case without some such means of increasing their fertility.

It is stated by the writer of the Report of Salop, that "upon upland meadows, the manure from the chaff at the barn-doors mixed with soil, ashes and shovellings, is very properly applied. But that the farmer's pastures, he thinks, are more neglected than any other part of his land, as very little manure is ever put upon them; they consider it as more wanting elsewhere. All grass lands at a distance from towns are, in general, too much neglected. The barn-door muck and ashes, mixed with the shovellings of roads and cleanings of ditches and ponds, should be more frequently applied to such as cannot be watered. Ponds may be frequently made on the sides of roads and water-courses, to catch the fine soils that are washed down by the rains in winter: this should form part of a compost." It is added, for the hay fields which are shut up for a crop at Candlemas, or before; "the best time of manuring them is immediately after hay-harvest. Some farmers do this work in winter, when the ground is sufficiently hardened by the severity of continued frost. For the purpose of manuring, the diligent husbandman provides a large compost mixen. With this view he cleanses his ponds, he scours his ditches, he shovels his fold, he collects his ashes, he sends to the lime-kiln, he provides fern, weeds, stubble, &c.; in a word, he amasses all materials that will increase the bulk and promote the fermentation of a general dunghill. Melioration of soil is best obtained by an unremitted attention to this business of manuring. Hereby the quantity of grass is greatly increased, and the quality of it much improved. Two tons of hay per acre are produced instead of one, and trefoil and white clover flourish and abound instead of moss and rushes." And for the improvement of pastures as well as meadow lands, it is advised to "suffer no weeds to seed, nor mole or ant-hills to continue; the land to be either mowed or grazed bare once in every year. Such as is mowed should be manured in the autumn of every second year, with dung, or compost consisting of dung and earth or mud, at the rate of about 10 cubic yards to the acre. Close attention should be paid to examining the streams of water, by the assistance of the spirit level, for generally the water from the summits will be found to cover much more land than is expected; and where it takes its course through several properties, it may be agreed to be used to the mutual benefit of the owners, by stipulating the times for each to use it, in due proportion to the quantity they respectively have suitable to that purpose. He knows of no improvement upon grass-land (after being drained when necessary) greater than this, though but little attended to in comparison of the large tracts that may be so improved." See *Meadow* and *Aftergrass*.

Stocking of Pasture *Land*, the art of eating them down with the greatest economy and advantage by one or more sorts of live stock. This is a point of management in grass husbandry that has hitherto been but little attended to by farmers in general. It is obvious, however, that a great deal must depend upon its being judiciously performed, both in respect to the improvement of the stock, and the lasting of the grass, as under some circumstances, much more waste will be incurred than under others.

It has been well observed by a practical writer, that, "the most proper period for turning the stock into the pastures in the spring season has been a matter of dispute among those employed in the management of grass lands; some contending that it should be done early, before the natural grass has risen to too great a bite, while others maintain the contrary opinion." And that "there are probably inconveniences attending each of these extremes, as in the first the stock, especially when of the fattening kind, may sustain injury from the want of a sufficient bite to permit the animals to fill themselves in an expeditious manner; and in the latter there may not only be much waste by the stock not being capable of keeping it under, but great loss and inconvenience from its running up in tufts to seed, and by that means rendering the pastures patchy and unevenly fed down, by which the extent of real pasturage is lessened." And he adds, that it has been also observed, by Mr. Marshall in his Rural Economy of Yorkshire, "that, by turning the stock upon the pastures when there is a full bite, the better sorts of grasses are only consumed, the more coarse herbage being rejected and let run up to seed, by which the lands are greatly injured at the time as well as in future; while, on the contrary, if the stock be allowed to enter during the time such coarse plants are in their more tender early growth, and before the pasture is covered with better herbage, the whole of the other plants will be fed down in a regular manner with the grass." And that "it is likewise remarked by the same writer, that the want of a full bite on the first turning out of store stock is of advantage to the animals, as they become more gradually accustomed to the change from dry food to succulent herbage. And it is supposed that fattening stock only require a full bite on being at first put upon the pasture." The first writer further states that, "in answer to the objection that has been made, that early turning upon pastures exposes them more

to the effects of drought in the spring months, it is said that it is in a great measure ill founded, since cattle milk and thrive well in such cases." It is not, Mr. Marshall remarks, "the length of grass, but the quantity of nourishment which it contains, that makes cattle pay for their pasturage. And it is not supposed improbable but that the richness of the herbage may in some degree depend on the sun or heat of the season." Facts and observations are however here much wanted, as little till within these few years has been attempted in respect to the most advantageous system of feeding down pastures. The former of the writers which we have just mentioned, has observed that, "as the state of grass which is the most favourable to the feeding of the stock, and their expeditious filling themselves and taking their rest, as well as that of their wasting the least possible proportion of the food, would seem to be that of a middle degree of growth, it is not improbable but that that may be the most proper and advantageous period for breaking the pastures; the exact time of which must obviously be regulated by the nature of the soil, the situation of the land, and the state of the season," as well as the circumstances of the farmer; but that "from the end of March to the latter end of April, or beginning of the following month, according to the forwardness of the season, may be the most advantageous in the southern districts," while, "in those of the north it may be deferred a week longer or more" with propriety and advantage in many cases.

It is likewise added that, "in regard to the general eating down of pasture lands there is much difference of opinion, some advising that it should be done in as close a manner as possible, others that this should never be the case. It would seem, however, that the closeness or degree of feeding that is the most proper should be directed by the nature of the grass and the time at which it is performed, as where the herbage is of the coarser kind and consumed in the autumnal season, it may be done much more closely than in the contrary circumstances, as such sorts of grass must always be improved by such close feeding, and no injury can be sustained at such seasons from the roots of the grasses being left so much exposed, which would be the case in the later spring or early summer months, from the constantly increasing heat at such periods." He thinks that "the advice that has been given by an intelligent observer on this subject may in general be adopted with propriety, which is, to be cautious not to overstock, as by that means great loss may be sustained," as "land when fed too bare is apt to burn in the summer and to be chilled in winter. Besides, the necks of the roots are so injured by very close biting that they do not afford so quick or free a spring or growth to the succession of blade as there would otherwise be." But, on the other hand, it is not recommended to leave a long bite of grass on the land: a middle degree will suit all lands the best, and afford the most benefit to the persons who occupy them. This advice of Mr. Kent's deserves to be well attended to, as being founded in practice.

It has been further stated on this subject, that by "the too thin stocking of pastures, though loss may be sustained in their not supporting the proper number of animals, as well as from the injury which is done by the grass plants running so much up to stems, the broken grass, in such cases, can be mown when in sufficient proportion for hay; but the disadvantages of overstocking are scarcely capable of being repaired, according to Mr. Marshall, as besides the lands being often exposed to much injury by the crowns of the plants being so closely pared down, especially in the finer kinds of grass, the cattle from suffering a check in their feeding are long in regaining their former thriving disposition; that, of course, almost the whole of the produce of pasture lands may in this way be often thrown away, and that it is an error that young farmers are extremely liable to fall into" in various situations.

It is therefore obvious that the medium degree of stocking, which has been advised above, is in general to be carefully adopted from the experience obtained upon the land: in the procuring of which it is best to begin by an under proportion of stock, that the effect may be the better perceived.

There has been a considerable difference of opinion in respect to the manner of stocking, or feeding down such lands; some contending that it should be done with only one sort of stock, while others suppose that they should be mixed in order to produce the best effects both on the lands and stock: Mr. Kent has supposed "that the more various the kinds of cattle are that are fed upon the pastures at different times the better. But it has not been shown, the author of Practical Agriculture says, on what principle this advantage depends. If the different modes of feeding in the different animals be attended to and minutely examined, it will be found that though some sorts may consume grass when in a more luxuriant state of growth than others, they are all fondest of pasturing on that which is the most sweet and tender." This is rendered extremely obvious by the observations of an attentive inquirer, who has found, that although horses "appear partial to particular patches of sward, he has never been able to discover any peculiarity in the soil or the herbage of such barely eaten spots." It has been supposed that they have been fed down by such animals at first in so close a manner merely by accident, but that afterwards they are kept in such a close state of feeding from "their peculiar sweetness" depending on the "peculiar shortness of the herbage." It would, however, seem more probable, he thinks, from the circumstance of the animals being almost wholly directed by the taste in the choice of their food, that the sweet or tender nature of the herbage in these parts first induces them to feed upon and consume them in so close a manner, as well as the continuing the close eating them down afterwards. The same thing is observed to happen in the vicinity of preserved covers, with hares and rabbits, from their keeping spots of barley or other grain crops closely fed down. And sheep are well known to ramble over the whole of the pastures in order to nibble and pick out the most sweet and delicate morsels. The feeding of neat cattle is, perhaps, less particular and delicate in this respect; but where not forced by hunger they mostly appear

to fix upon such parts of the land as possess the most sweet and palatable herbage, rejecting the coarser spots where it is less tender and agreeable." It is contended that, "if the conclusion be therefore well founded, that stock of all sorts prefer the best, sweetest, and most tender herbage, it is evident that no mixture of animals can insure the even and regular feeding down of pastures, as they will in some degree be all attracted by the sweetest and most tender parts, and those of the more coarse sour kinds be in consequence almost wholly rejected. An agricultor of great experience and nice observation, (the Rev. Mr. Close) has, he says, remarked, that "in pastures, stock naturally pick the most palatable grasses first, leaving the others to run up to bents; and though it is admitted that one sort may have a preference for one species of grass and another for another, there is no mixing the animals in such a manner as to prevent this circumstance from taking place. It is wholly impracticable to proportion each kind of stock in such a way to the species of grass that may be most agreeable to it, as to prevent the scarcity of one sort and the abundance of the other. It is of course obvious, that there are therefore not only difficulties in the regular feeding down of pastures, from the cattle being more fond of some sorts of herbage than others, but also from the inability of the grazier to proportion them in a way that may fully answer the purpose" which he has in view.

It is added, that "these observations, at the same time that they show the difficulty of the business, convince us of the advantage and importance of keeping pasture lands regularly and evenly fed down, which is perhaps only to be fully effected by one sort of stock properly succeeding another, till the want of the finer sorts of herbage obliges them to feed upon those that are of a more coarse nature. In this, as well as other views, the fattening stock should be first turned into the lands, and kept upon them so long as they continue to improve in a proper manner; these may then be succeeded by the older sorts of cattle that require to be brought into condition, and the more young store stock may consume the remainder of the grass, according to the intentions of the farmer. That great utility and advantage may be derived from often shifting the cattle, by having recourse to a *head* stock and proper *followers*, there can be little doubt. The few writers that have touched upon the subject of grass husbandry, have, he says, in general, indeed recommended the practice as highly beneficial both in respect to the pasture and the stock. And Mr. Marshall, in his Rural Economy of Yorkshire, speaks of this being a defect in the grass land management of that district. The correct grass farmer should, therefore, he thinks, be more attentive to this part of his management than is commonly the case, taking care that the changes of his stock are made in a seasonable and judicious manner," and without either the stock or the land suffering any injury from it.

It is further suggested, that "this is probably a practice from which greater utility may be derived than that of permitting many different sorts of stock upon the ground at the same time, as, besides their not answering the intention of feeding the pastures down with more regularity and evenness, they are inconvenient and disadvantageous in other respects. For where the pastures are fed down with a mixed stock, the animals seldom thrive or fatten so well as where the contrary is the case. They are too much driven about and disturbed by the different kinds teasing each other, especially where horses and neat cattle are put together. A mixed stock is also improper in another point of view: many sorts of animals feed closer and more expeditiously than others; of course, when there happens to be any scarcity of feed, some of the kinds may be greatly injured from the want of proper support. The horse, like the sheep, feeds close and quick, while the contrary is the case with the cow: it would of course seem improper to mix horses with neat cattle in the pasturing of grass lands, though the practice has been prevalent in many places. It has indeed been observed, that sheep and horses may feed and thrive best together, both from the similarity of their manner of eating and that of the former consuming the rich luxuriant herbage which springs in consequence of the manure dropped in the season, while the latter prefer the less vigorous but the more clean grass. It is a practice, however, that has sometimes been found useful to mix sheep with neat cattle. The notion of deriving advantages from the mixing of stock, from the circumstances of some sorts having a greater dislike to feed near their own dung and less towards that of others, is probably not founded on just observation, as all animals have a fixed aversion to both their own and that of other animals, and none of them will feed near either till compelled by the scarcity of food. This aversion does not perhaps depend wholly on the dung, but is in some measure avoided in consequence of the grass becoming rank and coarse about such places, and of course more sour and unpalatable to the animals."

Little attention has till lately been bestowed upon the manner or state of feeding down grass lands, the business being mostly left to chance, accident, or the caprice of the farmer. It is, however, obviously a matter of vast importance, not only in so far as it respects the economy of the pastures, but the success and proper progress of the stock that consume it; as by improper management that proportion may be wastefully eaten down in a short space of time without the stock being brought more forward, that under a better system would last out a longer time with a greater increase or progress in the animals that feed upon it. It is remarked, that, "as it is a matter of consequence to keep pastures and grazing-grounds as even as possible, a proportion of stock fitted to produce this purpose should always be put upon the lands. On the rich and more fertile kinds where the grass springs quick and in great abundance, more stock will be necessary to effect this purpose than where the contrary is the case. It has been found, the writer says, on the marsh lands in Lincolnshire, that where the most grass is left in the autumn the herbage is the coarsest and

the worst in the succeeding year. In the extensive feeding tract of Romney Marsh, the close feeding system is also found to answer in the most perfect manner. These facts shew the necessity of hard stocking on the richer descriptions of land. In other parts of the first of the above districts, on turning upon a full bite in the spring, they stock in such a manner as to prevent the grass from becoming coarse by running up to stem. The necessity of sweeping over the rough tufty parts by the scythe is thus avoided, except in very wet seasons." And it is, he says, "a practical remark of a cautious observer, on describing a field not sufficiently stocked, that on the marsh just mentioned, the grazing farmers would be ruined if they suffered so much grass on their lands. It seems to be a bad practice, he thinks, to allow the grass in pastures to advance to such a state as to require being swept over by the scythe, though it may be right to do it under such circumstances, in order to prevent the greater injury that might otherwise be produced." In his opinion, "it appears extremely probable, indeed, that by permitting the grass plants to run up to seed-stems, the pastures may sustain vast injury not only by the exhaustion of the soil that takes place during the efforts of the plants to form and fill the seeds, but in consequence of their whole vegetative powers being directed to that purpose, from their sending forth few or no leaves. This is extremely evident in all the coarser sorts of grass plants, and fully explains, he supposes, the utility of keeping them closely fed down, as by such means a more abuntant grassy herbage is provided for the support of stock. There are various observations that seem to support this opinion. Thus it has been recommended to stock pasture lands in such a manner as will keep the grass in a young succulent state ; as in this way there is a benefit, by the whole of the produce being consumed, and at the same time the stems of the grass plants are prevented from seeding, which exhausts the roots and the lands : the soil is of course preserved in a better state of fertility, more shoots are thrown out, the sward is rendered more close, and a more constant verdure kept up," as Mr. Price has well stated in the Annals of Agriculture.

"The true principle of grazing," in the opinion of this writer, "is to eat *all*, and particularly at those seasons when vegetation is rapid, that it may not weaken the turf and soil, but by keeping the grass in a young state, have the shoots more vigorous."

It is practically remarked, by Doctor Dickson, that, "as for the purpose of feeding the larger sorts of neat cattle, it is necessary for the grass to have grown to a pretty full bite before they are turned in, and of course numerous seed-stems to be formed; it seems not improbable, but that the superior benefit of feeding with sheep may depend upon the circumstance of their eating more closely, and thereby preventing such effects from taking place." And that of course, in "the stocking of pasture grounds, the growth of the grass should be particularly attended to, and the proportion of stock adapted to it ; care being always taken to have a full proportion during the summer months, from May to August ; a proper reserve being then made for the winter season ;" as Mr. Price has well suggested, in this business, that the farmer should be as careful as possible to neither over or under stock, as by either means he must sustain loss and inconvenience, in the different respects that have been hinted above.

On this interesting point of management, there is another matter, upon which farmers have differed very considerably in their opinions, each contending, as in many other cases, for the propriety of their practice on the ground of experience. It is that of giving the stock, of whatever sort it may be, the whole range of the lands, however extensive, at *once*, or by having them divided so as to let it have the grass at *different* times in a fresh unbroken and untrampled state. This is a question, which, from its involved nature, and from few experiments having been made directly in respect to it, that is not readily decided ; yet much in the economy of feeding down grass land depends upon it. The observations of Mr. Young may perhaps throw some light upon it.

"When cattle, whether cows, fatting beasts, or young stock, are turned out to grass, it is requisite, says he, to consider the best method of feeding. There are two opinions on this point directly contrary to each other : first, it is asserted, by one set of graziers, that let the grass to be fed consist of ever so many acres, that the cattle should have it all at once : if it is divided into eight or ten fields, the gates of all to be set open for the stock to feed where they like. Secondly, the other set advance, that large fields, of fifty, eighty, or an hundred acres, should be divided, that the farmer may change his stock from one to the other, and give the grass fresh and fresh. And each of these parties assert, he adds, that they know themselves to be right from experience. But that is impossible, one must undoubtedly be wrong. Let us, says he, consider the point from reason : it is one that will never be decided *fairly* from experiment; for two pieces of grass, each of eighty or an hundred acres, contiguous and *perfectly* alike, are not to be met with in the king's dominions ; and, if they were, two sets of stock, exactly similar, would not be found. The divisions into fields by hedges and ditches, for the purposes of draining and shelter, is not the inquiry, the comparison not being fair ; as such divisions may be fed at once by setting all the gates open, as well as one field. The inquiry is, whether the cattle will spoil the grass more in one way, than in the other ? and whether the grass will go as far in one as in the other, by fattening or feeding the beasts as well ? The argument of giving the grass fresh and fresh, appears to be rather vague ; for it supposes that the cattle will not eat it fresh, if they have the whole range at once, which may be a mistake : they will not be seen in the evening where they were feeding in the morning, but vary their food in the manner most agreeable to themselves ; and we may in general observe, that the sagacious animals, when left to their own conduct, manage such points better than we can for them. As to the treading and spoiling, it is, he says, an equal objection to both methods; the legs of the beasts are not tied in small closes, any more than in large ones. In case all the smaller

pieces have not water, the objections to feeding them separate are much greater.

"On the other hand, it must be admitted that there are disadvantages attending this way of pasturing: for a time the trampling may be greater, as cattle are disposed to beat a sort of march around the fields on first turning in, and also on some kinds of disturbance: but a greater evil is that of disturbing a large herd instead of a small one: this a dog may effect in one inclosure unseen from others, and consequently the stock in them left without interruption; and, perhaps a motive greater than this is, its having been observed that cattle, and sheep also, do better when well proportioned to their pasture, when divided into small lots rather than large ones."

He here leaves the matter without any decision. There are, however, a variety of circumstances that would seem to show the mode of feeding in divisions to have the superiority over that of turning upon the whole at a time. There can be no doubt but that much greater waste of grass is made in turning upon the whole at once, especially if the full proportion of animals for the land be put in, as it must be well known to the practical farmer, that when grass has been once trampled upon, stock of all sorts reject or eat it with great reluctance. And in cow farming, where vast numbers are often turned upon the land at one time, in order to procure the greatest possible abundance of milk for a short period, as is frequently the case near London, and other large towns, no one can have avoided observing the uncommon loss and destruction of food that is the consequence. The writer has attended to many circumstances of this nature, in which he is convinced that the same proportion of stock might have been equally well kept for one fourth of the time longer by having the grass consumed by the same stock in suitable divisions.

A writer in the third volume of the Farmer's Magazine says, that "in the management of pasturage, he would recommend a succession flock, and a series of pasture fields, so as to give three shifts. Thus, the fattening stock is to get the top of the pasture first broken upon. Before the pasture is eaten too bare, this stock is to be removed into a second field of fresh grass; and is to be followed on the first field by the keeping stock. Before the second field is too bare, the fatteners are to be removed into the third, and the keepers into the second. While these two stocks are employed in this shift, in eating the second and third fields, the first field has time to get again into full herbage. It is certainly, he thinks, needless to enlarge on this course, as the principles and practice are both sufficiently obvious."

And it is observed in a late practical work that, "the experience of a writer, who has examined grass husbandry with much minuteness and attention in different districts, would seem also, in some measure, to favour the same conclusion, while it shows the benefit of one sort of stock following another; as he advises that in all cases where fattening cattle or dairy cows constitute a part of the stock, and where soil, situation, and water will admit, every range of grazing lands should have three divisions; one for the head stock, as the cows and fattening animals; another for followers, such as the rearing or other lean stock; and a third for being preserved in order to freshen, for the reception of the principal stock. Besides, he says, he is decidedly of opinion, that whether the ground may consist of one, two, or a greater number of divisions, not a weed should be suffered to seed, or a tuft of stale grass to stand on it; but once, at least, in the summer season be levelled down by the scythe, as by such means weeds may be converted into nourishment, and waste into after-grass."

It has, however, been seen above, that by proper stocking there need not be any necessity for the operation of the scythe.

The practice of close feeding, renders it unnecessary, and at the same time affords a superior advantage to the farmer.

It is further stated, that "the proportions of stock of different sorts that can be properly supported on any given space of pasture ground must vary considerably, according to the natural goodness of the soil, the properties of the grass, and the differences in the sizes of the animals. And that there is likewise another circumstance which should be attended to, which is the length of time the land has been in the state of sward, as new lays are seldom capable of carrying so much stock on the acre as those of the older kinds."

But, "it is also a point that ought to be attended to, that those lays should be stocked as much as possible with sheep."

It is advised by Mr. Young that, in the stocking grass-lands, "the farmer should attend well to the proportion between his stock and the quantity of his feed. Let him remember, says he, when he stocks his grounds, that he should be pretty nice in this proportion; for if he overstocks, his loss will be certain and great; and, if he does not throw in as many cattle as he ought, then he will suffer in his profit."

In respect to the exact number of animals, whether of the cattle or other kinds that may be grazed on the acre, it is not easily ascertained so as to avoid leading the farmer into error, as it will differ so greatly in different situations and circumstances; besides, it is unnecessary, as the proportion of different sorts of stock that may be admitted upon grazing lands, in different districts, will be shown in speaking of the manner of feeding or fattening animals at grass, in considering the practice of grazing. See *Grazing*.

It is stated by a late writer, that "lands employed for the purpose of pasture are frequently occupied by stock during the autumn and winter, as well as the spring and summer months: it is, however, only those of the very dry kinds that can be turned upon in the winter season, especially by heavy cattle: and it is probably, in all cases, a much better practice to confine that sort of stock wholly to the fold-yards at such seasons, as by suffering them to be turned upon the pastures there must be a great loss in the

waste of manure." And "it has been found an advantageous practice by some to shut up their pastures late in the autumn, according to the state of the grass and other circumstances, eating them down as close and evenly as possible previous to the stock being removed, and keeping them perfectly free till they are wanted for ewes and lambs in the early part of the year, or for cattle at a later period, as when the first shoots appear in the spring, which from being intermixed with those of the autumn, are supposed to afford more nourishment for the support of the stock than when either of them are eaten separately."

It has been remarked in the Agricultural Report of Perthshire, that, "in fields that are pastured by cattle, care should be taken that all such plants as are hurtful to stock be completely eradicated from them, as much injury is often done by them to the cattle as well as the products which they afford. The plants most prejudicial in this way are those of the hemlock, henbane, nightshade and yew kinds. It has been observed, that while the grass is plentiful there is not much danger of their feeding upon such plants; but when it becomes scarce, and they are confined, it is likely to take place, especially in the spring season," when they are fond of devouring young shoots of almost any kind.

And a writer in the Farmer's Magazine, strongly advises the following practice, which, he says, he has uniformly followed himself, and is thoroughly sensible of its beneficial effects. It is, regularly to cut down all weeds, that spring up in the fields in spite of the stock, before they get into seed. This is by no means expensive; as two or three children are sufficient to keep down the weeds of a large pasture farm. And it is an old, and true proverb in husbandry, that "once seeding causes seven years weeding."

In the feeding down of pasture lands it is "indispensably necessary to attend to the circumstance of their being well supplied with water, as without having this in some degree at command, it is impossible that the stock can thrive well, or answer in the most perfect manner in other views. Where they are not therefore supplied by brooks or streams running through them, it will be necessary to have recourse to the forming of ponds, or pools, for the purpose in the fields." And "in situations where the natural stratum of clay is of considerable thickness, there is little difficulty in the constructing of such watering ponds so as to be perfectly retentive or water tight: but in loose porous soils the business is not executed without considerable care and attention as well as much art. See *Watering Ponds*.

Mr. Marshall, in his Treatise on Landed Property, advises that in laying out perennial pasture lands, as those of grazing and cow grounds, attention should be particularly paid to the circumstance of water, and that wherever good water is naturally found or can be brought conveniently by art, to that point the pasture grounds ought to tend, in order that they may have a due supply of so necessary an article to the pasturing of them with cattle.

The first improvement of upland pasture, before eating it down with stock, when not inclosed, is, by fencing it in, and dividing it into small fields of four, five, six, eight, or ten acres each; planting timber trees in the hedge-rows, which will screen the grass from the dry pinching winds in March, which prevent it from growing in large open exposed lands; so that, if April proves a dry month, the land produces very little grass; whereas in the sheltered fields, the grass begins to grow early in March, covers the ground, and prevents the sun from parching the roots, whereby it keeps growing, so as to afford a tolerable bite if the spring should prove dry. But, in fencing in the land, it must be observed, not to make the inclosures too small, especially where the hedge-rows are planted with trees; because, when the trees are advanced to a considerable height, they spread over the land; and where they are close, render the grass sour, and in that way, instead of being of advantage, greatly injure the pasture.

A second improvement of upland pasture is, tha of making the turf or sward good, where, either from the badness of the soil, or for want of proper care, the grass has been destroyed by rushes, bushes, or mole-hills. Where the surface of the land is rough, clayey and cold, it may be best improved by paring it off and burning it in the manner directed under that head, breaking it up and then laying it down again to sward; but, if it is hot sandy land, then chalk, lime, marle, or clay are very proper manures to apply upon it; but this should be laid in pretty good quantities, otherwise it will be of little service to the land.

If the ground is over-run with coarse plants, as rushes, &c. it will be a great advantage to it to cut or grub them up towards the latter part of summer; and after they are dried to burn them, and spread the ashes over the ground just before the autumnal rains; at which time the surface of the land should be levelled, and sown with grass-seeds, which will come up in a short time, and make good grass the following spring. So also, when the land is full of ant hills, these should be pared off as above, and be either burnt for the ashes, or spread immediately on the ground, when they are pared off, observing to sow the bare patches with grass-seeds in the autumn. See *Ant-hill*.

Where the land has been thus managed, it will be of great service to roll the turf, in the months of February and March, with an heavy wooden roller, in moist weather, that the roll may make an impression; this will render the surface level, and cause the turf to thicken, so as to have what the people usually term a good bottom. The grass will likewise be sweeter, and bad weeds be destroyed.

Another improvement of these pastures is, by judicious feeding as above. Where this is not practised, the land must be manured at least every third year: but where a farmer has much arable land in his possession, he will not care to part with his manure to the pasture. Therefore every farmer should endeavour to proportion his pasture to his arable land, especially

where manure is scarce, otherwise he will soon find his error; as the pasture is the foundation of all the profit which may arise from the arable land.

Whenever such upland pastures are to be mended by manure, there should be a regard had to the nature of the soil, and a proper sort of manure applied: as for instance, all hot sandy lands should have a cold manure; neat's dung, swine's dung, and earthy composts are very proper for such lands; but for cold lands, horse-dung, ashes, and other warm manures are more proper. And when these are applied, it should be done in autumn, before the rains have soaked the ground, and rendered it too soft to cart on; and it should be carefully spread, breaking all the clods as small as possible, and then harrowed with bushes, to let it down to the roots of the grass. When the manure is laid on at this season, the rains in winter will wash down the valuable parts, so that the following spring the grass will receive the advantage of it.

There should also be great care had to the destroying of weeds and coarse plants in pastures every spring and autumn as above; for, where this is not practised, they ripen their seeds, which spread over the ground, and fill it so as soon to overpower the grass, and destroy it. Besides, it is very difficult to root them out, after they have gotten such possession.

In these pastures, the grass seldom degenerates if the land is tolerably good; whereas, in the low pastures, which are overflowed in winter, in a few years it often turns to an harsh rushy nature.

There is no part of husbandry, which, till of late, farmers were, in general, more ignorant of, than that of the management of pastures; most of them supposed, that when old pastures were ploughed up, they could never be brought to have a good sward again; of course their common method of managing their land, after ploughing, was to sow, with their crops of barley, some grass-seeds, as they call them; that is, either red clover, which they intended to stand two years after the corn was taken off the ground, or rye-grass, mixed with trefoil: but as most of these are but biennial plants, whose roots decay soon after their seeds were perfected; so the ground, having no crop upon it, was again ploughed for corn; and this was the constant round which the lands were employed in by most farmers: they had not any notion of laying down their lands to grass for any longer continuance.

Modern husbandry has, however, shown that it is possible to lay down land, which has been in tillage, with grass, in such a manner, as that the sward shall be as good, if not better than any natural grass, and of as long duration. See *Laying down to Grass.*

In respect to the improvement of wet pastures, it has been suggested that, the first thing to be done is, to make large deep ditches round every field, and if the fields are large, to divide them into smaller, of five, six, or seven acres each, by new ditches; nothing is attended with a more sudden improvement of all the ground near the borders of the fields than good ditches. They are generally made six feet deep perpendicularly, seven wide at top and three at bottom. They should be made in such a manner that no water can remain in them, but have a descent from one to another to carry it quickly off.

When the ditching is done, the next work is to land-drain the whole fields in such a manner that every part of them may be laid dry. If there is the least fall in any part, or any place more wet than another, the drains should be cut through them. If the surface be exactly level, the depth of the drains should vary, so that the water may every where have a descent. These drains are made, in general, thirty-two inches deep, twenty inches wide at the top, and four wide at the bottom. They are filled eight inches deep with either stones or wood; but the former are the most effectual and lasting, to those who are not desirous of saving the difference of the expense. However, wood answers extremely well. See *Draining of Land.*

The prodigious advantage of these drains appears the very first year, especially if the season proves wet: the grass being fresh, vigorous, and sweet.

The materials taken out of the ditches, should, after being well mixed with dung, or some other manure, be spread evenly over the surface of the ground. The expense of this sort of improvement will vary greatly, according to the nature of the land and situation.

PATE, a provincial name, applied to a brock or badger.

PATH, a track or road across a field: a path across arable land is as great a loss as a crooked hedge, and should always be avoided as much as possible, both in arable and pasture grounds, in the laying them out at first, where they are directed, on the inclosing of waste or other lands.

PATTEN-SHOE, in *Farriery*, a term applied to a horse shoe, under which is soldered a sort of half ball of iron, hollow within. It is designed for hip-shot horses, and put upon a sound foot, to the end that the horse, not being able to stand upon that foot without pain, may be constrained to support himself upon the lame foot, and so counteract the disposition in the sinews to contract the haunch. It is the practice with some, when a horse has been recently lamed in the shoulder, to peg the other foot, or set on a patten shoe, to bring the lame shoulder upon a stretch; and others turn them immediately out to grass: but according to Gibson this "is very preposterous, and the direct way to render him incurably lame; a patten-shoe being only necessary in old lamenesses, where the muscles have been a long while contracted."

PEAR, a fruit tree of the orchard kind. There are many sorts of this tree; but, for the purpose of cyder, the squash is in much the highest esteem. It is an early fruit, remarkable for the tenderness of its flesh. If it drops ripe from the tree, it bursts to pieces with the fall. The liquor made from this fruit is pale, sweet, yet remarkably fine, and of a strong body; a most excellent liquor, if duly manufactured

from a soil which suits it. The oldfield is a favourite old pear, remarkable for the elegant flavour of its liquor. The barland pear is in great repute, as producing a perry which is esteemed singularly beneficial in nephritic complaints; as is the red pear for producing a liquor of singular strength. The huffcap and the sack are other pears which have been usually grafted: and besides these, and a variety of others, great numbers of kernel fruits are found among the pear-trees in Herefordshire. See *Perry* and *Orchard*.

It is remarked by Mr. Knight, in his valuable Treatise on the Culture of the Apple and Pear, that "the experiments he has made on the pear have not been nearly so numerous as those on the apple, and have been confined to a single variety, the Teinton squash; but they have been fully sufficient to convince him, that the diseases of both chiefly arise from the debility of old age, and will be found equally incurable. Though the pear is more properly a naturalized than an indigenous fruit in this country, it is much more hardy than the apple, and may certainly be cultivated in almost every part of England with nearly as much success as in Herefordshire. Like the apple it grows, he says, with greatest luxuriance in strong deep soils, and in these the finest liquors are at present obtained from it; but it will flourish in every variety, where it is not incommoded with water. Its culture differs so little from that of the apple, that the same rules are in general equally applicable to both. It is, he thinks, most successfully propagated on stocks of its own species, but it will succeed in some degree on those of the quince, the medlar, the whitebeam, the common service, and the hawthorn; and probably on many others. When grafted on its own seedling stocks, which alone he would recommend, the operation should always be performed near the ground, on account of the reclining top-heavy growth of the young stocks. In raising stocks from the seeds of this fruit, a light, and soft, loamy soil should be chosen, which is naturally of good quality, but which has not been recently manured. In this the seeds, like those of the crab-tree, should be covered about an inch deep, as soon as they are taken from the fruit." And much attention must, he says, be paid to them during the early part of the first summer, or great numbers will perish. They must be kept clear from weeds, and be regularly watered in dry weather; and if the mould be frequently stirred between the plants, it will be of great advantage to them: after the middle of August, they become more hardy, and little care or attention will be required from the planter."

It is added, that "a sufficient number of varieties of this fruit, in a good state of growth, are in cultivation; but few of them possess any high degree of merit. The greater part are extremely productive of juice, and require to be ground soon after they fall, or are blown from the trees. The produce of some of them, when it has been nicely manufactured from well ripened fruit, often possesses great excellence; but it is, he thinks, often at the same time sweet and acetous; and if, owing to an unfavourable season, the fruit has not been properly ripened, and an excess of fermentation cannot be prevented, the liquor becomes sour and unpalatable, and scarcely good enough to answer the meanest purposes of the farm-house." He is "much disposed to doubt whether a single perry-pear, possessing nearly the greatest degree of excellence of which this species of fruit is capable, has yet been in cultivation. It appears highly probable that firmer fruits, which might be kept some time, or left under the trees to attain a more perfect and regular maturity, are likely to afford a more permanent and generous liquor. One pear, which in some degree answers this description, has, he says, been much cultivated, the longland; and though its produce, being without the fine flavour which is found in some others, is little attended to by the merchant, it has qualities which render it extremely valuable to the farmer: the fruit may be kept some time without sustaining any great degree of injury, when business of more importance occupies his attention: the liquor obtained from it is never very fine, but it is rarely below mediocrity: it possesses more body than is generally found in perry, and retains many of its good qualities in every different soil and situation. It is a fruit he should strongly recommend for culture in cold and exposed situations, for which the hardiness of it's blossom renders it peculiarly well calculated; but he is afraid it is advancing nearly to that period when young trees can no longer be raised with advantage to the planter."

He further observes, that "the pear is an extremely long-lived tree, and the same variety may in consequence be very long kept in cultivation. At what period the Teinton squash first sprang from the seed, probably cannot now be at all ascertained; but he suspects from its present diseased and worn-out state, that it existed at least as early as the beginning of the sixteenth century. For another kind, the barland, which was much cultivated in the early part of the seventeenth century, still retains a large share of health and vigour, and the identical trees which supplied the inhabitants of Herefordshire in the seventeenth century with liquor, are likely to do the same good office to those of the nineteenth. He suspects, however, that this variety naturally possessed a greater degree of durability than is common to the species; and that its lofty spiral growth, by rendering it difficult to get grafts from the extremities of the bearing branches, has, in cultivation, made it still more durable. It is yet capable of being propagated; but trees nearly of the same stature with those which now abound, must not again be expected. The tree, which is said to have been the original, grew, he says, in a field called the Barelands, in the parish of Bosbury, and was blown down a few years ago."

"But though he does not think very highly of any of the perry-pears which are now cultivated, he does not know that he can point out the means of

acquiring better. Those which he has employed to obtain improved kinds of the apple, appear to him to be wholly improper. Every variety of that fruit, which possesses colour and richness, is capable of making fine cider, but a good perry-pear requires an assemblage of qualities, which will be rarely found in the same fruit. It must contain a large portion of sugar, or its juice can never possess sufficient strength; and unless it be at the same time extremely astringent, the liquor produced from it will be acetous whenever it ceases to be saccharine. In the latter state it will, he supposes, agree with few constitutions, in the former with none. The juice of the best perry-pears is so harsh and rough, as to occasion a long continued heat and irritation in the throat, when the fruit is attempted to be eaten; yet by being simply pressed from the pulp, it becomes rich and sweet, without more roughness than is agreeable to almost every palate. This circumstance appears extraordinary, but it does not stand alone in the vegetable world." There are many cases in which similar changes take place with acrid vegetable substances. It is stated that "the defects of the apple and pear, when raised from seed, are generally of opposite kinds: in the former the fruit is usually harsh and sour, in the latter it is apt to be, when thoroughly ripe, sweet and insipid. The mode of cultivation therefore, which would improve the one by bringing it nearer to the highly cultivated state, and lessening its harshness, would not improbably be injurious to the other by producing the same effects."

It is suggested that "an estimate may be formed in the apple of the merit of the fruit by the leaf and growth of the seedling tree, but in the pear these scarcely afford the slightest indication of the future produce. The leaves of those plants which will afterwards afford large rich fruits for the desert are often small and thin, and the stems will be covered with thorns; whilst others, whose leaves and growth shew every mark of a high state of cultivation, will sometimes produce fruits which are small and worthless."

He does not know that "better means can be used in obtaining new varieties of this fruit, than sowing a large quantity of seeds from healthy trees of an orchard in which the best kinds only have been planted, and afterwards selecting the plants of the most luxuriant and vigorous growth. But as no estimate can be formed of the value of their future produce, it will be prudent to retain a considerable number till their fruits be known: few of which, he is afraid, must be expected to answer the wishes of the planter."

He adds that "he has, during the last twelve years, examined a very large number of seedling-pears, and has a considerable variety growing on a farm he occupies, but he has never discovered more than one kind, which he thought capable of making fine perry. The greater part of these, however, appeared to him to have sprung from the seeds of rich eatable pears, and some of them bore a very close resemblance to the fruits of old grafted trees in the neighbouring orchards. There is little reason to believe that the resemblance would have been less between the parent and the seedling fruit, had the former been eminent for the production of fine perry; and it therefore appears probable, that good new kinds may readily be obtained from the seeds of the best now cultivated. But even if few should be found capable of affording fine perry, the produce of all will be valuable to the farmer to mix with crabs, or apples which have been blown prematurely from the tree. The vapid sweetness of the juice of the pear is corrected by the acidity of these, and the liquor produced by the mixture often possesses much more merit, than could have been expected from the ingredients. It will perfectly supply the place of small beer, and may be brought into the market at less than half the price, with sufficient profit to the grower."

The same author says, that "the time which seedling trees will require to attain sufficient maturity to produce fruit, appears to vary much in different varieties. He has one plant which produced fruit at sixteen years old, and another which, from the concurrent testimony of many old people, who remember its first blossoms, appears to have remained unproductive through the first seventy years of its existence. It has since borne tolerably well; but its fruit is always without seeds, or internal cavity; and it appears to set with difficulty, much the greater part of the blossoms being constantly unproductive. Possibly its long continued barrenness, and the defects in its fructification, may both have arisen from some incidental imperfection in the organization of the plant. The fruit is in other respects perfect, and possesses great merit as a pear for the table."

In respect to planting, it is stated that the directions he has given for planting the apple, are in every respect applicable to the pear; except that this tree being of more luxuriant and lofty growth, will require wider intervals. See *Apple Tree* and *Orchard*.

In the most closely planted orchards the rows should not, he says, "be put at less than eighteen yards distance, nor the trees nearer than eight or nine to each other; and when the ground is to remain in tillage, intervals of twenty-five, or thirty yards, should be allowed between the rows. Attention must also, he says, be paid to the forms and stature of the different varieties, and as the fruit of these is rarely mixed with a view to make fine perry, trees of one kind should occupy each row." And it is added, that as "in some kinds the fruit grows only on the outside of those branches which are exposed to the sun and air; while in others it occupies every part of the tree; the former will of course require to be planted at greater distances than the latter."

And "as the produce of the pear tree, though of the same variety, and growing on the same stock, ripens extremely irregularly; the planter must therefore have a considerable number of trees of each kind he plants, or he will rarely have a sufficient quantity ready to be ground at the same time. Even when the fruit has fallen spontaneously from the trees, a fourth at least of some kinds will be found immature, or decaying, and totally unfit to make

fine perry; and should be (though it rarely or never is) separated from the rest." It is to this want of perfect and regular maturity in the fruit that Mr. Knight ascribes a defect, which perry is seldom found wholly free from, which is that of a crude and harsh acid which dwells on the palate, and which disgusts the best judges of vinous liquors; and he supposes that to the same cause it may be owing, that perry when genuine, does not agree with so many constitutions as cyder. It is noticed that "the pear requires a certain state of maturity to afford perry in the greatest state of perfection: it should be ripe without being mellow, or decaying; when it has not obtained the proper state of ripeness, an excess of fermentation cannot be prevented, and when it has exceeded it, the liquor rarely ferments kindly, and is extremely apt to become sour; probably by having lost too great a portion of its astringency: hence few kinds are found to improve by being kept after they have fallen from the trees" on which they grow.

In regard to pruning, it "is not often wanted in the culture of the pear tree, which is rarely much incumbered with superfluous branches; but in some kinds, whose form of growth resembles the apple tree, it will sometimes be found beneficial. The directions in this case are the same as those for the apple. See *Apple* and *Orchard*.

These trees are subject to similar diseases with those of the apple; "the blights of the trees, like those of the apple, arise either from insects, or unfavourable weather, or a combination of both. The blossoms are often rendered abortive, by a small brown beetle, precisely similar to that found on the apple tree, and probably of the same species; and a considerable quantity of its fruit is frequently destroyed by the *larvæ* of a small green four-winged fly. Each fruit, he says, which contains the latter insects becomes in a few days rounder than those in the natural state, and grows with much greater rapidity; but it falls off early in the summer, and if it be examined whilst growing, it will be found full of small grubs." He adds that "the pear tree suffers more frequently from cold than from insects, and therefore those varieties whose blossoms are produced rather late in the spring, and are preceded by the leaves, are generally most productive of fruit; and some kinds of the pear, as of the apple, are much more subject to injury both from insects and unfavourable weather, than others. He has one seedling tree whose blossoms appear capable of bearing the most unfavourable weather without injury, and which has not once failed to produce a good crop in the memory of the oldest inhabitant of the village in which it stands. The fruit is rather too sweet to make good perry, unless in mixture with other kinds; but it nevertheless forms a very valuable variety for cold and exposed situations, as it ripens somewhat early in the autumnal season of the year.

It is remarked in the Report of the State of Agriculture in Herefordshire, that the pear, though in common producing an inferior liquor, has many advantages over the apple for general use. It is capable of succeeding in a greater variety of soil, is more productive in fruit, and less liable, especially in the perry kinds, to depredations. Besides, it has a more ornamental effect, and is of course better calculated for particular situations. The produce of each full grown tree, will mostly be in the proportion of about twenty gallons of liquor. See *Apple Tree*.

The methods of preparing the pears in the manufacture of perry, will be considered under the proper head. See *Perry*.

PEARL, in *Farriery*, a spot or film over the eye, proceeding from a stroke, blow, or any other similar cause. It is often met with in horses.

PEASE, a sort of plants generally cultivated as a field crop.

This sort of crop is often supposed to be less advantageous to the farmer than several others; but in many situations and circumstances of land, it will be found highly beneficial to the cultivator, from its ameliorating and cleaning properties.

There are numerous varieties of pease, but those employed in field culture are distinguished into two kinds, the early and late; the chief of the former of which are the *early* charlton, the *golden hotspur*, and the *common white* sorts; and of the latter the various kinds of gray pease, as the *marleborough gray*, the *horn gray*, and the *purple gray*; but the marleborough is the most commonly made use of.

Pease are a crop that are grown upon almost any sort of soil, but which answer best, on those that are dry, and free from stagnant moisture, and which are in a good state of mellowness and impregnated with calcareous materials.

"All the sorts of early pease should, according to Mr. Young, be cultivated on dry soils only. They will grow on moist, and even wet ones, but the crop is seldom beneficial. Upon sands, dry sandy loams, gravels, and chalks they succeed well. They are not, however, to be much recommended on land in tilth. Great success is rarely commanded, especially in a wet season, if they be not on a layer."

This sort of crop is cultivated after many different kinds, as almost all those of the grain description, as well as clover sain-foin, and on old lays newly broken up from sward. But Mr. A. Young has well remarked, that "a farmer desirous of keeping his land always in good and clean order, should, in the arrangement of his crops, take great care not to be too free with wheat, barley, and oats, which are all exhausting plants. He should sow beans and pease enough, because they are ameliorating ones, and admit hand-hoeing, to kill the weeds. In those fields, in which the common husbandmen sow oats or barley, after wheat, or after each other, let the good cultivator substitute pease or beans, or some other ameliorating crop, which will pay him better than white corn, under such circumstances, and at the same time keep his land clean. Pease may be sown, like black oats, on turf ploughed up before winter, and harrowed in." He further remarks, "on the culture of pease, that bad farmers are too

apt to sow this pulse, when the land will yield nothing else. They have a proverb among them, he says, which signifies, that the season does as much for pease as good husbandry; and they from thence take care, that good crops shall be owing to season alone. Hence arises the general idea of pease being the most uncertain crop of all others. This is owing to their being scarcely ever sown on land that is in good order. Let, continues he, the good husbandman lay it down as a maxim, that he should sow no crop on land that is not in good order; not merely in respect of fine tilth at the time of sowing, but also of the soil's being in good heart, and clear of weeds. He would not, however, here be understood to rank all these crops together; because beans and pease will admit of cleaning while they grow. On that account, if a farmer comes to a field which his predecessor has filled with weeds, a horse-hoed crop of beans will be expedient, when a barley crop would be utterly improper, and, after land has yielded one crop of barley, certainly another should not be sown, but one of pulse substituted. If these ideas are well executed, the pease and beans, in every course, will find the land in heart enough for barley, the soil will always be clean, and the crop good. Pease, when managed in a spirited manner, will not have the reputation of being so very uncer, tain a crop, which character has, he thinks, in some measure been owing to ill conduct."

The same writer thinks, that the following courses do well for them:

" 1. Turnips,
2. Barley,
3. Clover,
4. Pease and turnips,
5 Barley,
6. Carrots,
7. Barley,
8. Clover,
9. Wheat.

Also,

1. Turnips,
2. Barley,
3. Seeds for 2, 3, 4, or more years;
4. Pease and turnips,
5. Barley,
6. Beans,
7. Wheat."

He adds that " there is a remarkable circumstance observed by that excellent husbandman, Mr. Overman, of Norfolk, relative to pease, which should be in the mind of every farmer fond of a pea crop. It is, that they do not succeed well, if sown oftener than once in 10 or 11 years; and he has heard it more generally observed by others, that pease should not be sown *too* often."

On the subject of manuring for this crop, he observes, that " it is the practice with some farmers to manure for them. But he must confess that he has been always so much against it, that he never did it himself, and therefore can only state his reasons for avoiding it. If land is in heart, and they are put in on a layer, they do not want manure. A very good crop may be gained without it. He has had 5, and even $5\frac{1}{2}$ quarters an acre, without any manure applied for this crop. Dung makes them run to long straw, and that is not favourable for podding productively. Dung encourages weeds; and pease, except in the early stage of their growth, do not admit of such hoeing as a farmer would wish to give. Beans cannot have too much dung, but with pease the case is different. There are very few situations in which the farmer can have such a command of manure as to give him a sufficiency. It is therefore of much consequence to him, never to spread a load but where it will be sure to answer best. Every man complains of a want of dung; how very careful therefore ought all to be, to give it to the crops that will pay best for the expense." But notwithstanding these useful remarks, manure may in many cases be employed with advantage for crops of this kind, and in some they cannot probably be grown without it.

In regard to the time of putting this sort of crops into the ground, it must differ considerably according to the intentions of the cultivator. When they are grown for podding early for sale green, they should be sown at different times from January to the end of March, beginning with the dryest and most reduced sorts of land. And in this intention in some southern counties they are put in in the autumn.

For the general crops from February to April, as soon as the lands can be brought into proper order is the proper season; the grey sorts being employed in the early sowings, and the white sorts in the later. Mr. Young says, that where these crops cannot be put in in February, they should always be completed in the following month.

It is observed by the same writer, in sowing on layers, that " the white boiling pea, of many sorts and under various names, is more tender than the greys, and various kinds of hog pease; but he has many times put them into the ground in February, and though very smart frosts followed, they received no injury. He has uniformly found, that the earlier they were sown the better. There is also a particular motive for being as early as possible: that is, to get them off in time for turnips. This is most profitable husbandry, and should never be neglected. If they are sown in this month and a right sort chosen, they will be off the land in June, so that turnips may follow at the common time of sowing that crop."

The quantity of seed must be different in different cases and circumstances, and according to the time and manner in which the crop is put into the ground; but in general, it may be from two and an half to three bushels, the early sowings having the largest proportion of seed. In planting every flag, Mr. Young says, two bushels and an half is the usual proportion; but when drilled at greater distances, six or seven pecks will answer.

There are different practices pursued in putting this sort of crop into the soil: Mr. Young remarks, that in common management, they are sometimes ploughed

and at others harrowed in, circumstances which often make a difference in the crops, as where the land is apt to bind with rain, and the pease are ploughed in, they sometimes do not come up at all, not having strength to pierce the plastered surface. But this is an evil that attends only the very binding soils with late sowing. On the other hand, when the seed is only harrowed in, where the land is not very well guarded, much devastation will be committed by the pigeons and other birds, for which allowances should be made. It is supposed that where the lands harrow well, all should be harrowed in except on the lightest lands. But on these, such as loose sands and other very porous and dry soils, it is a preferable practice to plough them in, as they have a greater depth, and are of course less liable to burn in hot summers.

A late writer remarks, that "it is usual in these cases, in many districts to put the seed into the ground in the broadcast method; but the drill or row system is mostly to be preferred, as being more regular, saving considerably in the proportion of seed, and admitting of cultivation afterwards with more ease and advantage." And that "different implements have been contrived for this use, but the most convenient is probably a small light sort of wheel-plough, to the body of which a sort of seed-box is attached, through the bottom of which the axis of a light wheel passes, by which the sowing is regulated, and which is pulled up and prevented from letting the pease be deposited at the ends of the ridges, or other places, as in turning, by a string attached to the handle. It may be conveniently employed with one or two horses. In regard to the rows it is observed, that the proper distance of drilling this kind of crop is mostly about twelve or sixteen inches for hand-hoeing; but where the horse-hoe is employed, from two to three feet; and the depth to which the seed is deposited, from two to three inches. And that, in some districts the seed is put by the hand into drills mostly made cross-ways of the ridges, but occasionally in the direction of them at the distance of about fifteen inches from each other, and afterwards covered in by means of hoes. In some instances also a bush harrow is drawn over the surface, by which the land is rendered smooth and even. But where this sort of crop is cultivated on a ley preparation, the best method is probably to dibble the seed in. This is the practice constantly followed by the best cultivators in some districts, as Middlesex. Mr. Young however advises that "broadcast pease should be utterly rejected in every case. The only question that can arise, he says, in their culture, is between drilling and dibbling. If the former is determined on, the land should have been ploughed late in autumn, with Ducket's skim coulter, into lands adapted to the drill machine, and scarifiers. The surface being then worked shallow, in this month drilling should directly follow. If dibbling is determined on, the land should not be ploughed till the time of planting, and a heavy roller follow the plough. On lighter soils, if the frost has worked the surface, after ploughing, the ground will be in too friable a state, the holes will moulder in, and the seed will be laid too shallow. Dibbling pease on a layer cannot be too much commended. It is an excellent practice."

And that in respect to the rows, the practice of various farmers differs exceedingly. "Equi-distant rows from 9 to 18 inches are common. He has seen them at 2 feet, and even at 3. In dibbling it is common in Norfolk and Suffolk to put in two rows, on every flag of 9 or 10 inches breadth; some farmers one row on such a furrow: and he has known very good crops in most of these distances. If horse-hoeing, or much hand-hoeing, is intended, double rows at 9 inches, with intervals of 18, do well; but the greatest crops have been from planting every flag."

It has been observed, that, though the practice of steeping this sort of seed is seldom had recourse to by the cultivators of pease, it is probable that the later sown crops may be greatly benefited by it, as the vegetation of the plants may be rendered more quick, regular, and uniform. And in the Maisons Rustiques the same practice is approved of, not only to separate the bad and faulty, but to enable the crop to rise sooner.

It is observed, that it is the custom in Hertfordshire, and some other districts, to sow beans, or even oats, sometimes with the pease, with a view of keeping them up. These mixtures should, however, never be adopted, as the different crops, from their being of an unequal growth, must constantly be liable to injure each other while they are growing on the land.

In the after-culture of these crops there can be no doubt, but, that the use of the hoe in stirring the intervals, and earthing up the young plants where the crop has been put in in rows by the drill or dibble, is of essential advantage in promoting their growth, and protecting them from the injuries of the season. "Where the method of handculture prevails, it is the general custom to have recourse to two hoeings; the first when the plants are about two or three inches in height, and again just before the period in which they come into blossom. In this way the vigorous vegetation of the young crop is secured, and a fresh supply of nourishment afforded for the setting of the pods and the filling of the pease. At the last of these operations, the rows should be laid down, and the earth well placed up to them, the weeds being previously extirpated by hand labour." It has been stated, that "in some parts of Kent, where this sort of crop is much grown, it is the practice when the distance of the rows is sufficiently great, to prevent the vegetation of weeds, and forward the growth of the pea crops, by occasionally edge-hoeing, and the use of the brake-harrow, the mould being laid up to the roots of the plants at the last operation by fixing a piece of wood to the harrow. This should however only be laid up on one side, the peas being always placed up to that which is the most fully exposed to the effects of the sun. The edge-hoeing is performed at the rate of from two to three shillings the acre, according to the nature of the land." These sorts of crops can never

be kept too clean, therefore the greatest attention should be paid to them.

It is observed by the author of Practical Agriculture, that "there are many inducements to the cultivation of this crop, on suitable soils in the vicinity of large towns, where the demand for green pease is considerable; such as the ready supply of money that is thus provided for the other expensive operation during the summer months, the facility of thus rendering the land proper for the growth of turnips, and the large supply of fodder that is afforded by the stems of the plants when properly secured; notwithstanding the danger of such crops during the winter, and even in the spring months, when the season proves unfavourable, and the heavy expenses incurred in the gathering and disposal of them." And it is added, that "it is frequently a practice with the large cultivators of early green pea crops, in the neighbourhood of London, to dispose of them, by the acre, to inferior persons, who procure the podders; but the smaller farmers for the most part provide this description of people themselves, who generally apply at the proper season for the purpose. The business of picking or podding the pease is usually performed by the labourers at a fixed price for the sack, of four heaped bushels. The number of this sort of persons is generally in the proportion of about four to the acre, the labour proceeding on the Sundays as well as other days. It is sometimes the custom to pick the crops over twice, after which the rest are suffered to stand till they become ripe for the purpose of seed. This, however, mostly arises from the want of pickers, as it is considered as a loss, from the pease being less profitable in their ripe state than when green. Besides, they are often improper for the purpose of seed, as being the worst part of the crop. It is therefore better to have them clear picked when hands can be procured. After this they are loaded into carts, and sent off at suitable times, according to the distance of the situation, so as to be delivered to the salesmen in the different markets from about three to five o'clock in the morning. In many cases in other parts the early gatherings are, however, sent to the markets in half-bushel sieves, and are frequently disposed of at the high price of five shillings the sieve; but at the after periods they are usually conveyed in sacks of a narrow form, made for the purpose, which contain about three bushels each, which, in the more early parts of the season, often fetch twelve or fourteen shillings the sack, but afterwards mostly decline considerably, in some seasons so much as scarcely to repay the expences. This sort of crop affords the most profit in such pea seasons as are inclined to be cool, as under such circumstances the pease are most retarded in their maturation or ripening, and of course the markets kept from being over abundantly supplied." With respect to the expense attending the gathering of green peas, "it is different, according to the difficulty of procuring podders, the bulk or abundance of the crops, and the kind of pea or size of the pods. Those of the larger sorts, such as the marrowfats, being in the county of Middlesex about one shilling, and those of the smaller kinds, as the Charlton, from fifteen to eighteen pence the sack. In Kent the usual price is about fourteen pence the sack for podding, one shilling for conveying them to the market, and three pence the sack for the salesman." It is obviously, only in the vicinities of large towns, that the system of green pea management can be carried on with the prospect of much profit; in other cases it will be better to take regular field crops in the usual way.

It is further stated by the same writer that the quantity of "produce of both the early and late pea crops vary much according to the nature of the season, and many other circumstances. The average of the early crops in Middlesex is supposed to be from about twenty-five to thirty sacks the acre, which, selling at from eight to eighteen shillings the sack, afford about eighteen pounds the acre." The author of the Synopsis of Husbandry, however, states the produce about Dartford, in the county of Kent, at about forty sacks the acre, though, he says, fifty have sometimes been gathered from that space of land.

Mr. Middleton, in his Report of the state of Agriculture in Middlesex, states the produce and expense of cultivation of a field of six acres, in June, 1796, which was not remarkable for more than a common crop, to stand thus:

Number, 40 sacks, of four bushels each, of pods sent to market, and sold from 6s. to 13s. average 7s. 6d. each - -	£.	15	0 0
Haulm, stacked, and given to draught horses, one ton per acre, worth two-thirds as much as hay, but say only: - - -		3	0 0
Produce - - -	£.	18	0 0

Expenses.

Ploughing once from clover ley	£. 0	10	0
Seed, four bushels, at 12s.	2	8	0
Drilling, covering, &c.	0	7	0
Hoeing twice - -	0	10	0
Podding at 18d. per sack, on 40	3	0	0
Marketing, distance ten miles, land carriage - -	1	5	0
		8	0 0
Remains -	£.	10	0 0

In "the latter crops that stand to ripen, it is supposed by some to be from three and a half to four quarters the acre; others, however, as Mr. Donaldson, imagine the average of any two crops together not more than about twelve bushels. And that on the whole, if the value of the produce be merely attended to, it may be considered as a less profitable crop than most others. But as a means of ameliorating and improving the soil, at the

same time, it is, however, to be esteemed as of great value."

In addition it is remarked, that "the greatest danger to the early pea crops is to be apprehended when the weather during the more early spring months is hot and sunny in the day-time, attended with sharp frosts in the night, as in this way great mischief is often done, the crops becoming attacked with the mildew, and not ripening in a proper manner. And, while the pease are proceeding in their growth, and still more particularly at the periods when they come into blossom and begin to set their pods, it is of great importance to have rather moist weather, as by that means the vegetation of the crop is promoted in a more perfect manner, and there is a greater chance of the peas being well podded." The chief signs of the healthy and vigorous vegetation of pea crops are those of their leaves possessing a fine bloom of a bluish cast, and having the outermost large leaves of the blossom extending backwards in some degree.

When pea crops become ripe they wither and turn brown in the haulm or straw, and the pods begin to open. In this state they should be cut as soon as possible, in order that there may be the least loss sustained by their shedding. It is observed that "in the late or general crops, after they are reaped or rather cut up by means of a hook, it is the usual practice to put them up into small heaps, termed wads, which are formed by setting small parcels against each other, in order that they may be more perfectly dried both in the seed and stem, and be kept from being injured by the moisture of the ground. But in the early crops the haulm is hooked up into loose open heaps, which, as soon as they are perfectly dry, are removed from the ground and put into stacks for the purpose of being converted to the food of animals, on which they are said to thrive nearly as well as on hay. When intended for horses, the best method would seem to be that of having them cut into chaff and mixed with their other food."

Mr. Young says, that forward white pease will be fit to cut early in July; "if the crop is very great, they must be hooked; but if small, or only middling, mowing will be sufficient. The stalks and leaves of pease being very succulent, they should be taken good care of in wet weather: the tufts called wads or heaps, should be turned, or they will receive damage. White pease should always be perfectly dry before they are housed, or they will sell but indifferently, as the brightness and plumpness of the grain are considered at market more than with hog-pease. The straw also, if well harvested, is very good fodder for all sorts of cattle and for sheep; but if it receives much wet, or if the heaps are not turned, it can be used only to litter the farm-yard with."

It is stated as "the practice in some districts to remove the haulm as soon as it has been cut up by hooks constructed with sharp edges for the purpose, to every fifth ridge, or even into an adjoining grass field, in order that it may be the better cured for use as cattle food, and at the same time allow of the land being immediately prepared for the succeeding crop. What are usually termed winter pease, or such crops as have been sown in the autumn, generally afford the largest proportion of cattle fodder" when properly managed.

It is well remarked by Mr. Bannister, that, "if wet weather happens whilst the pease lie in wads, it occasions a considerable loss, many of them being shed in the field, and of those that remain a great part will be so considerably injured, as to render the sample of little value. This inability in pease to resist a wet harvest, together with the great uncertainty throughout their growth, and the frequent inadequate return in proportion to the length of haulm, has discouraged many farmers from sowing so large a season of this pulse as of other grain; though on light lands which are in tolerable heart, the profit, in a good year, is far from inconsiderable."

It is supposed by some to be "of considerable importance in the economy of a farm, when the nature of the soil is suitable, to have recourse to the early sorts; as by such means the crops may in many cases be cut and secured while there is leisure, before the commencement of the wheat harvest." And that "where the nature of the soil is dry and warm, and the pea crop of a sufficiently forward kind, it may be easy to obtain a crop of turnips from the same land in the same year," as has been suggested above. "But in this view it is the best practice to put the crops in in the row method, and keep them perfectly clean by means of attentive hand and horse hoeing; as in that way the land will be in such a state of preparation for the turnips, as only to require a slight ploughing, which may be done as fast as the pea crop is removed, and the turnip seed harrowed in as quickly as possible upon the newly turned up earth. In some particular districts a third crop is even put into the same land, the turnips being sold off in the autumn and replaced by collards, for the purpose of greens in the following spring. This, according to Mr. Middleton, is the practice in some places in Middlesex." But it is obviously "a method of cultivation that can only be attempted on the warm and fertile kinds of turnip soil, and where the pea crops are early; on the cold heavy and wet descriptions of land, it is obviously impracticable, and wholly improper."

The author of Practical Agriculture states that, "with the marrowfat and other late sorts of pease, the usual practice is to either prepare the land for wheat, or to put in crops of savoys or other late sorts of cabbages, which are methods of husbandry that may often be had recourse to even on the more heavy sorts of land, with success. And that from pea crops rendering the lands on which they are cultivated more light, open, and porous, they are supposed to be less proper, for preceding wheat, than those of beans; on the more stiff sorts of ground this cannot, however, be an objection of any great consequence, and even on the lighter kinds it may often be obviated, by giving the seed earth early, so that the crop may be put in upon a stale furrow, by the use of the sheep-fold, either immediately before or after the grain is deposited in

the soil, and by repeating the same practice occasionally afterwards, as well as by rolling," in particular cases.

In regard to the application of the produce of this sort of crop, it is stated that "the portion of peas that is not consumed as human food is mostly appropriated to the purposes of fattening hogs and other sorts of domestic animals; and, in particular instances, supplies the place of beans as the provender of labouring horses; but, that care should be taken, when used in this way, that they be sufficiently dry, as, when given in their green state, they are said to be apt to produce the gripes," and other bowel complaints in these animals.

And Mr. Bannister, after observing that the straw is a very wholesome food for cattle of every kind, says, there is generally a considerable demand for pease of every denomination in the market, the uses to which they may be applied being so many and so various. The boilers, or yellow pease, always go off briskly; and the hog-pease usually sell for 6d. or 1s. per quarter more than beans. For feeding swine the pea is much better adapted than the bean, it having been demonstrated by experience, that hogs fat more kindly when fed with this grain than on beans; and, what is not easy to be accounted for, the flesh of swine which have been fed on pease, it is said, will swell in boiling, and be well tasted; whilst the flesh of the bean-fed hog will shrink in the pot, the fat will boil out, and the meat be less delicate in flavour. It has, therefore, now become a practice with those farmers who are curious in their pork, to feed their hogs on pease and barley-meal, and if they have no pease of their own growth, they rather chuse to be at the expense of buying them, than suffer their hogs to eat beans. Nay, so far, says he, do some of them carry their prejudice in this particular, as to reject the grey pease for this use, as bearing too near an affinity to the bean, and therefore reserve their growths of white pease solely for hog fatting.

"Pease, if the ground is kindly for their growth, and the summer moist, generally, he says, produce a great abundance of haulm, which takes up a large space in the barn, and for this reason the mow ought always to be trodden with hogs or horses, which will close down the haulm into one sixth part of the compass it would otherwise have occupied."

In Leicestershire they set all their pease abroad in stacks, being persuaded that they thence acquire a much better colour than when housed in the barn.

Malted pease have been found to answer well in the fattening of hogs and turkeys, as well as in the feeding of horses.

In the saving of any particular sorts of pease for seed, they should be carefully looked over while in flower, in order to draw out all such plants as are not of the right sort; as there will always be, in every sort, some roguish plants, which, if left to mix, will degenerate the kind. As many rows as may be thought sufficient to furnish the desired quantity of seed should then be marked out, and left till their pods turn brown, and begin to split, when they should immediately be gathered up, with the haulm; and if the farmer has not room to stack them till winter, they may be threshed out as soon as they are dry, and put up in sacks for use: but particular care should be taken not to let them remain too long abroad after they are ripe; as wet would rot them; and heat, after a shower of rain, make their pods burst in such a manner that the greater part of their seeds would be lost.

There are probably other plants of the pea kind that may be cultivated with great advantage, as green food for animals.

Everlasting PEA, a plant of the vetch kind, that may probably be grown to advantage for the food of animals.

In the eighth volume of the Agricultural Magazine, Mr. Weston observes, that "tares and vetches are plants of which horses are very fond, and are cultivated with great advantage for that purpose. The everlasting pease belong to the same class of plants; are much more luxuriant in their growth, and yet are not cultivated, except for ornament. These plants are well known, and may, he says, be found in the gardens of almost every village in the kingdom. The luxuriance of their growth is so great, that the narrow-leaved, *lathyrus sylvestris*, grows to the height of five or six feet, the other, *lathyrus latifolius*, to eight, ten, or more. They begin to vegetate early in the spring, and continue growing until severe frosts stop them. Another peculiar advantage belonging to them, is, he adds, that they are perennial-rooted plants, and when once sown, improve in their vigor and growth, after the first year, and continue increasing for several successive ones, as may readily be proved by examining the gardens in which they are to be found, where seed may be had, and tried at first upon a small scale, with very little trouble and expense, and afterwards increased. A rood of land, light, and but poor in quality, was sowed, he says, with it, early in the spring; the land prepared as for barley. A slight furrow was drawn with a light plough, and the seed thinly dropped into it. Another was drawn at a foot distance, and the seed dropped in like manner. An interval was then left at least two feet wide; then two more rows, till the whole was sown. The seed was afterwards covered by drawing a light harrow with wooden tines, backwards and forwards across the land. When the plants came up and grew a little strong, they were thinned with a hoe, to a foot distance, that they might have room to spread and branch. The first year they made no great quantity of fodder, but since made ample amends.

"The second spring they came up very strong and vigorous, branching out very much. A couple of horses were turned in to feed, who were very fond of them, eating them very greedily, though they were taken out of a good natural upland pasture. The third year the land was almost entirely covered, and it yielded a great deal of food. For experiment a few rods were mowed just before it flowered, which made good hay, sweet without being sticky."

It is remarked, that "this experiment is not described longer than the three first years. Instead of destroying the plants by hoeing them where too thick, he would recommend them to be drawn out, and a fresh plantation made with them. In gardens,

they are generally transplanted from the seed beds the second spring." And "instead of turning horses in to feed, he would prefer cutting them either with a scythe or sickle, and have them given to the horses. It would certainly by that method produce more fodder, and you could find how many times in the summer they would bear cutting, and at what height it is the most advantageous to cut them. If the intervals be left three feet wide, instead of two, there would be room to plant in September and October a winter crop, when the pease cease growing, as borecole, cabbage plants, &c. which would occupy the ground till March, at which time they begin to vegetate."

Others have found much advantage from this plant in the fattening of cattle.

PEASE-BOLT, a provincial term applied to pease-haulm.

PEAT, a sort of earth dug out and used in many countries for fuel.

It is found in most low grounds that lie betwixt hills, especially if timber has formerly stood upon the spot. It lies in various depths, being often near the surface, and sometimes six, eight, or ten feet deep, having a stratum of black moory earth over it, such as the soil of many of our low meadows near the banks of rivers: it sometimes even lies under a bed of gravel.

This sort of material is found to exist in large tracts in different parts of the kingdom, and was formerly supposed to be useless in improving the lands in its neighbourhood; but later experiments have sufficiently shown, that it is a vegetable substance that when properly mixed with other materials and applied, is capable of affording vast advantages in different cases. It should therefore not be neglected or overlooked where the farmer has an opportunity of making use of it. Lord Dundonald has well remarked, that "peat or vegetable matter, should be carried from the peat moss to the poor soil, and the surface mould from the poor soil to the peat moss. By these means two beneficial purposes may at the same time be effected. The quantity of such like, or other earthy matter necessary to be added to a peat soil, to alter the mechanical arrangement of its parts, is to be ascertained by proper trials; and on the other hand, the quantity of peat requisite to be applied to poor soils will be regulated by the quantity of vegetable matter which such soils may already contain." And, he thinks, "the most efficacious method of applying peat to poor barren soils, is to mix it with the urine and dung of cattle; on failure of these articles, with alkaline and other salts; and, lastly, with lime." He observes, that "experience can only determine the number of loads or weight of these different preparations, which should be given to an acre of ground. From such experiments as have already been made with the preparations of alkaline and some other salts, there is reason to believe that the quantity necessary to be given at one time would not exceed that of a proper dunging, and that equally beneficial effects would be produced. If this, says he, on general experience should be proved, the peat mosses in Great Britain and Ireland will not only afford an inexhaustible supply of manure for the poor lands in their vicinity, but may themselves, by the application of alkaline and other salts, be brought to the highest state of fertility."

It is added, that "peat mosses and fens have, hitherto, generally been considered either as nuisances, when in an unimproved state, or as soils of the greatest fertility, when cultivated. These different states regard only the peat moss or fen itself, and have no reference to any consequences that might arise by the application of peat or of any preparation of it to the neighbouring lands. But as peat has been discovered to be capable of being converted into the most valuable of all manures, the importance of the peat mosses in Great Britain and Ireland cannot, therefore, be too much impressed on the minds of the land-owners and occupiers of these countries." He further states that "from experiments made with alkaline salts and peat, it can be asserted, that the effects of such mixture, weight for weight, are equal, if not superior to those of dung. The usual quantity of dung given to an acre of ground, when it is intended to manure it effectually, is about eighteen tons. This it may, perhaps, receive once in five years. It will require a farm to be well managed and in high cultivation, to admit of one-fifth of it to be annually so manured." He supposes, that "the best cultivated land, by the return of its own manure, unless when a quantity of vegetable matter has been accumulated, cannot do more than keep itself in heart: of course, nothing can be spared for the amelioration or improvement of poor or waste lands. The rendering the inert vegetable matter of peat mosses and fens serviceable to this purpose, though effected at a greater expense than is at present incurred by any application or dressing to ground, could not, he thinks, fail to answer the expectation of the farmer, and must be considered as one of the most valuable improvements that has hitherto occurred in the annals of husbandry."

Some have supposed that it may be laid on land in the most effectual manner, by having it mixed up or blended with lime newly slaked in the proportion of one part of the lime to five or six of the peat; but later trials lead to the conclusion that it may be used more successfully by having it incorporated with some sort of manure, such as that of dung. In this state of combination very great effects have been produced by it, as suggested above, in numerous instances.

The different preparations of peat, or states of mixture, in which it may be applied to lands, with good effects in counteracting particular defects, or in rendering them generally more futile, are these, according to the Earl of Dundonald:

"Peat - unmixed
Peat - ditto - oxygenated
Peat - oxygenated, mixed with dung and urine
Peat - ditto - with alkaline salts
Peat - ditto - with alkaline hepar
Peat - ditto - with Glauber salt and lime
Peat - mixed - with newly slaked lime
Peat - and lime, mixed with peat ashes."

He supposes, that "all these preparations may, according to circumstances, be used to advantage. The consuming peat to ashes by fire, is always to be considered, he thinks, as the least productive, and most unœconomical. The most beneficial and productive of these preparations will, he says, be found to be,

Peat with dung and urine ;
Peat with alkaline salts ;
Peat with alkaline hepar ;
Peat with Glauber salt and lime ;
And peat with lime.

"Where the soil does not contain a due proportion of calcareous matter, a preference should always be given to the last or the two last of the above preparations, until it shall have received a sufficient supply of an article so indispensably necessary as calcareous matter to the production of sweet herbage, liguminous plants, and grain." It is farther supposed that by the above method of mixing peat with lime in the proportion of five or six times the weight of the former to that of the latter, no injury can possibly arise from the over proportion of the lime. As the lime, when thus mixed with the peat, will meet with proper matter for it to combine with or act upon ; and the small proportion necessary to be used, when put in comparison to the weight of the peat, will be much less than the quantity of lime only, frequently applied at once to land. It is conceived that the bulk, weight, and the expense of the preparation may direct the farmer in respect to the proportion that may be requisite to effect his purpose.

In an ingenious pamphlet lately published by Lord Meadowbank, the following directions are given for forming peat into a manure to be applied to ground :

"Let, says he, the peat-moss, of which compost is to be formed, be thrown out of the pit for some weeks or months, in order to lose its redundant moisture. By this means, it is rendered the lighter to carry, and less compact and weighty, when made up with fresh dung for fermentation ; and, accordingly, less dung is required for the purpose, than if the preparation is made with peat taken recently from the pit. The peat taken from near the surface, or at a considerable depth, answers equally well." Then "take the peat-moss to a dry spot, convenient for constructing a dunghill to serve the field to be manured. Lay the cart-loads of it in two rows, and the dung in a row betwixt them. The dung thus lies nearly on the area of the future compost dunghill, and the rows of peat should be near enough each other, that workmen, in making up the compost, may be able to throw them together by the spade. In making up, let the workmen begin at one end ; and at the extremity of the row of dung, (which should not extend quite so far at that end as the rows of peat on each side of it do), let them lay a bottom of peat, six inches deep and fifteen wide, if the grounds admit of it ; then throw forward, and lay on, about ten inches of dung above the bottom of peat ; then add from the side-rows about six inches of peat ; then four or five of dung, and then six more of peat ; then another thin layer of dung ; and then cover it over with peat at the end where it was begun, at the two sides, and above. The compost should not be raised above four feet, or four feet and a half high ; otherwise, it is apt to press too heavily on the hinder parts, and check the fermentation. When a beginning is thus made, the workmen will proceed working backwards, and adding to the column of compost, as they are furnished with the three rows of materials directed to be laid down for them. They must take care not to tread on the compost, or render it too compact ; and, of consequence, in proportion as the peat is wet, it should be made up in lumps, and not much broken." It is added, that "in mild weather, seven cart-loads of common farm-dung, tolerably fresh made, is sufficient for twenty-one cart-loads of peat moss ; but in cold weather, a large proportion of dung is desirable. To every twenty-eight carts of the compost, when made up, it is of use to throw on, above it, a cart load of ashes, either made from coal, peat, or wood ; or if these cannot be had, half the quantity of slaked lime may be used ; the more finely powdered the better. But these additions are no wise essential to the general success of the compost." It is farther stated that "the dung to be used should either have been recently made or kept fresh by compression ; as, by the treading of cattle or swine, or by carts passing over it. And if there is little or no litter in it, a smaller quantity will serve, provided any spongy vegetable matter is added at making up the compost, as fresh weeds, the rubbish of a stack-yard, potato-shaws, sawings of timber, &c. And as some sorts of dung, even when fresh, are much more advanced in decomposition than others, it is material to attend to this ; for a much less proportion of such dung as is less advanced, will serve for the compost, provided care is taken to keep the mass sufficiently open either by a mixture of the above mentioned substances, or, if these are wanting, by adding the peat piece-meal ; that is, first making it up in the usual proportion of three to one of dung ; and then after a time, adding an equal quantity, more or less, of moss, or peat. The dung of this character, of greatest quantity, is shamble dung, with which, under the above precautions, six times the quantity of peat, or more, may be prepared. The same holds as to pigeon dung, and other fowl dung ; and, to a certain extent also, as to that which is collected from towns, and made by animals, that feed on grains, refuse of distilleries, &c." It is still further observed, that "the compost, after it is made up, gets into a general heat sooner or later, according to the weather, and the condition of the dung: in summer in ten days or sooner ; in winter, not perhaps for many weeks, if the cold is severe. It always, however, has been found to come on at last. In order to bring on the heat more expeditiously in a compost made up in frost, a narrow addition of dung and peat has, sometimes after the frost has gone off, been laid along the sides of the compost, scraping down a little the coating of peat upon it, and, in summer, it sometimes rises so high, as to be mischievous, by consuming the materials (fire fanging). In that season a stick should be kept in it in different parts, to pull out and feel now and then ; for if it approaches to blood heat, it should either be watered, or turned

over; and on such an occasion, advantage may be taken to mix it with a little fresh moss. In June 1796, a compost was formed, only $2\frac{1}{4}$ peat to one dung: it heated in July beyond the measure of a thermometer graduated to 110°. Part was allowed to stand, part turned with a half more moss. Three weeks after, (18th August), the heat of the former had descended to 84°, while that of the latter had got up again to above 110°. The heat subsides, after a time, and with great variety, according to the weather, the dung, and the perfection of the making up of the compost; which then should be allowed to remain untouched, till within three weeks of using, when it should be turned over, upside down, and outside in, and all lumps broken: then it comes into a second heat; but soon cools, and should be taken out for use. In this state, the whole, except bits of the old decayed wood, appears a black free mass, and spreads like garden mould. Use it weight for weight, as farm-yard dung; and it will be found, in a course of cropping, fully to stand the comparison. Let it be observed that the object in making up the compost, is to form as large a hot-bed as the quantity of dung employed admits of, and then to surround it on all sides, so as to have the whole benefit of the heat and effluvia. Peat, nearly as dry as garden-mould in seed-time, may be mixed with the dung, so as to double the volume and more of it. Workmen must begin with using layers; but, when accustomed to the just proportions, if they are furnished with peat moderately dry, and dung not lost in litter, they throw it up together as a mixed mass; and they improve in the art, so as to make a less proportion of dung serve for the preparation. The addition, recommended, of ashes or lime to the compost, is thought to favour the general perfection of the preparation, and to hasten the second heat. The lime laid on above the dung-hill, as directed, is rendered mild by the vapours that escape during the first heat." It is added that "such compost as is made up before January, has hitherto been in good order for the spring crops; but this may not happen in a long frost. In summer, it is ready in eight or ten weeks; and if there is an anxiety to have it soon prepared, the addition of ashes, or of a little lime rubbish of old buildings, or of lime slaked with foul water, applied to the dung used in making up, will quicken the process considerably. Lime has been mixed previously with the peat; but the compost prepared with that mixture, or with the simple peat, seemed to produce equally good crops. All the land, however, that it has been tried on, has been limed more or less within these twenty-five years."

It is observed farther, that "the rich coarse earth, which is frequently found on the surface of peat, is too heavy to be admitted into this compost; but it makes an excellent top-dressing, if previously mixed and turned over with lime. And peat, prepared with lime alone, has not been found to answer as a good manure. In one instance, viz. on a bit of fallow, sown with wheat, it was manifestly pernicious to the land."

By these modes this substance may be rendered capable of extensive application as a manure. See *Moss*.

Peat-*ashes*, the ashes that remain after the combustion of this sort of vegetable material. This is, however, a very wasteful and dissipating process, as there is seldom one twentieth part of its weight afforded in ashes. The rest is thus forced off into the air and lost, which by other means might be saved, and contribute to the vegetation and growth of plants. See *Ashes*.

Where, however, the practice of converting it into ashes is had recourse to, it is observed that the peat may be burnt all the summer season: as soon as it is dug, some of it is mixed in a heap regularly disposed with fagot wood, or other ready burning fuel: after a layer or two of it is mixed in this manner, peat alone is piled up to complete the heap. A heap will consist of from four hundred to a thousand loads. After setting fire to it at a proper place, before on purpose prepared, it is watched in the burning, and the great art is to keep in as much of the smoke as possible, provided that as much vent is left as will feed the fire. Whenever a crack appears, out of which the smoke escapes, the labourer in that place lays on more peat; and if the fire slackens too much within, which may be easily known by the heat on the outside, the workman must run a strong pole into the heap in as many places as is necessary to supply it with a quantity of fresh air. When managed in this manner, the work goes on as it should do. It is to be noticed that when once the fire is well kindled the heaviest rains do it no harm whilst it is burning.

"Having procured a sufficient quantity of ashes, the farmer's next care should be to apply them properly to use; and to do this, he must be well acquainted with the nature of the manure he is to lay on his land. With respect to peat-ashes, almost the only danger proceeds from laying them on in too great quantities at improper seasons. Nothing can be better, it is asserted, than peat ashes for dressing low damp meadows, laying on to the quantity of from fifteen to twenty Winchester bushels on an acre: it is best to sow them by hand, as they will then be more regularly spread. And this work should be done in January or February at latest, that the ashes may be washed in towards the roots of the grass by the first rains that fall in the spring. If they were spread more forward in the year, and a speedy rain should not succeed, being hot in their nature, they would be apt to burn up the grass, instead of doing it any service." In regard to the quantity, it must "be remembered, that the damper and stiffer the soil, the more peat ashes should be laid on it; but on grass lands the quantity should never exceed thirty Winchester bushels, and on light warm lands less than half that quantity is fully sufficient."

It is added, "that on wheat crops these ashes are of the greatest service, but they must be laid on with the utmost discretion. Were they to be spread in any quantity before the winter, after sowing the corn, they would make the wheat too rank, and do more harm than good: was the spreading of this

manure, on the contrary, deferred till the spring, the corn could not possibly during the winter season be benefited by it. After due reflection and repeated experience, the writer's method of management was as follows:

"About the beginning of November, before the hard frosts set in, he sows on every acre of his heavy clayey wheat land about eight Winchester bushels of these ashes; on his lighter warmer lands in wheat, he sows only four bushels at this season. The winter dressing is, he imagines, of great service: trifling as the quantity may seem, it warms the roots of the plants, brings the crop moderately forward, preserves its verdure, and disposes it to get into a growing state the first fine weather after Christmas. About the latter end of February, or the beginning of March, on the above mentioned heavy lands in wheat, he bestows another dressing of ashes, by sowing of them on every acre eight bushels more; on light lands, in this second dressing, he allows only six bushels. These ashes laid on in the spring are of the greatest service, without any probability of danger; if rain falls within a few days after the dressing is laid on, it is washed in, and has a happy effect on the succeeding crop, co-operating with the manure that was laid on in November: if, on the contrary, dry weather for a long continuance succeeds, the first winter-dressing has its full effect, and the quantity laid on in the spring is in fact so small, that there is very little probability of its burning or hurting the crop. This method has succeeded very well with him, and he has no reason to think it can fail with others. It is likewise stated as an useful fact that this excellent manure is of great use in the turnip husbandry, on many accounts, particularly as it much contributes to preserve the young crop from being devoured by the fly. When the writer sows his turnips before he harrows in the seed, he has eight bushels of these ashes strewed by hand on every acre; and when the plants shew their first leaves above ground, he sows on every acre four bushels more: by this management his crops, he says, seldom fail, when at the same time some of his neighbours sow their turnip land three or four times over." This hint deserves attention, as pared and burnt land is said to have the same effect in preserving turnip crops from the dreadful ravages of the fly.

The author proceeds to state that "one of the principal advantages derived from these ashes is, however, the very great service they are of to every kind of artificial pasture. Sainfoin, he says, receives great benefit from this manure, and so does clover, ray-grass, and trefoil, provided it is laid on with discretion: the proper season, he thinks, is about the month of February: the quantity must be regulated by the nature of the crop and soil; but, in his opinion, it ought scarcely in any instance to exceed thirty Winchester bushels. Clover, with the help of this manure, grows with great luxuriance, insomuch that he has often had two large crops of hay from the same field in a year, and good autumn feed afterwards."

It is however added, that "the effect of it is most seen in tares and vetches, and on them it is, he bestows most of this manure, as they will bear it, being a very succulent plant. He had last summer a crop of tare-hay that was astonishing by the help of these ashes, being above three large loads on an acre. The field contained six acres; it was a dryish loam, and not very rich. In the beginning of February, he caused ten bushels, Winchester measure, to be strewed on each acre: immediately after the first rains had washed them in, the same quantity was in like manner spread, and about the middle of March he bestowed on each acre six bushels more for the last dressing. He is fond of dividing his entire quantities, thinking his crops are thereby less exposed to the danger of being burned, and the manure is besides more gradual and lasting in its effects. His tares, he says, came on amazingly; but they ran chiefly to haulm, which was what he wished, not having any desire of saving the seed, but intending to make the crop in hay: his only fear was, that it would rot on the ground before it was in a proper condition to cut; but this he luckily escaped, by the soil being tolerably dry, and by the fineness of the weather. It was so heavy in the swarth, that he was obliged to pay an extraordinary price for mowing it. He thinks the luxuriance of his crop was owing entirely to the invigorating quality of the ashes, which by their salts, &c. promoted the growth of the plants even to luxuriance."

He adds, that "before he well knew the great fertilizing quality of these ashes, he lost by improper management, a fine three acre piece of hog-pease. He laid on this field, soon after the pease came up, threescore Winchester bushels of these ashes at one dressing: this brought them forward a great pace, but at harvest, he found to his grief, he had scarcely any corn, for he had overdone it in laying on so much, and the pease were run all to haulm. Ever since this accident he has declined using them as a common dressing for his pease, and this he has been the more induced to do, as, in several little experiments he has since made, he has found it extremely difficult to apportion the several quantities which ought to be laid on various soils when sown with pease; for the quantity that has one year succeeded very well with him, has, the next, owing to the difference of seasons, on the same soil, in another part of the same field, totally disappointed him; so that, for pease, he esteems it a very critical manure, therefore to be used very cautiously." He further states, that "the effects of this manure will be visible at least three years, and it does not, like some others, leave the land in such an impoverished state, when its virtues are exhausted" and spent.

He thinks that "peat-ashes are not so certain a manure for barley and oats as for winter corn; for as these are quick growers, and occupy the land but a few months, this warm manure is often apt to push them forward too fast, and make them run too much to coarse straw, yielding only a lean immature grain. Oats, however, are not so apt to be damaged by it as barley."

It is further remarked, that "peat-ashes approach,

in their effects on the several crops on which they are laid, to coal-soot; but two-thirds of the quantity that is used of soot, will be sufficient of the ashes, as they are, in a much stronger degree, impregnated with a vegetative power; and they are, besides, in most places easier procured in quantities, and at a cheaper rate."

Though this sort of dressing has been found useful on different sorts of land, it has by much the best effects on those of the light chalky kind, being often uselessly applied on such as are of a wet nature.

The full quantity is usually about forty bushels to the acre, and the time of applying them in improved husbandry in the spring months, as about March. See *Ashes*.

PEAT-*moss*, a term applied to the earthy material, which is dug up for fuel in some districts. See *Moss*.

PEATY-*earth*, that sort of land which is of a peaty quality, or which contains much vegetable peaty matter.

PEATY-*land*, that sort of ground which is of a peaty nature, or which abounds in the peaty material. There are many varieties of this sort of land, some being constituted of this substance to several yards depth, while others have it only in a very superficial manner. The former are frequently denominated peat mosses or bogs, and the latter fens. Some of the different modes of bringing peaty lands into cultivation, have been already noticed in speaking of moss, but others may be introduced here with propriety. According to the earl of Dundonald, "the primary step towards improving a peat moss, is to take off by proper channels the great feeder of water. This is to be effected by conducting one or more principal drains through the moss, and by water courses on the solid or dry land, immediately above the level of the moss, so that it shall not be inundated by the surface water or springs of the surrounding higher lands, and shall afterwards only require to be freed from the water that shall fall on its superficies. This being accomplished, the intermediate parts of the bog should be drained, partly by open and partly by covered drains; care being taken that they are not made so deep as to lay the moss or bog too dry: by which the peat, becoming oxygenated, and thence insoluble, would be incapable of yielding food to vegetables. By the opposite extreme, unprofitable grasses and aquatic vegetables are produced. It is therefore an object of great importance, in effecting the drainage, to preserve a full command of the water, that it may be regulated at pleasure by the operation." The practical modes of management that are necessary in those cases, are explained more fully in speaking of the nature of moss. See *Moss*.

The able writer farther observes, that "should a moss or bog be so circumstanced, as to admit of its being drained through a country which might be improved by a supply of vegetable matter, it would be prudent, previously to making the great or leading drains through the adjacent country or moss, to concert measures for making a proper communication by a canal, so that the remote lands might be supplied with peat from the moss, and the moss supplied with lime, marl, clay, earth, sand, shells, and other materials, from the distant country. And that "as shell-marl is frequently found under peat mosses, they should be bored in different places, to ascertain if they possess this valuable substance; or if they contain under the moss a rich clay or limestone gravel: for, in the event of these being found at a moderate depth, the moss or bog may be improved at a much less expense, as the distant carriage of these necessary articles, and the difficulty of carting and laying them on so loose and spongy a surface, would thereby be diminished. It is suggested that "the burning a part of the upper surface may, in some cases, be requisite, to afford, when it is otherwise too difficult to be procured, a due proportion of earthy matter. Peat ashes will, in such cases, act in making a different mechanical arrangement in the soil; but, near the sides of the bogs where surface mould is to be had, a preference should be given to it in most cases."

And "the alteration in the mechanical arrangement of the soil being thus effected, the next object is, he says, the application of such substances as will bring the peat, or inert vegetable matter, into action. These substances are lime and alkaline salts, which contribute in different ways to the proposed improvement. Improved peat mosses, bogs, or reclaimed fen lands, are the soils, he says, the most productive of luxuriant vegetation, although from this cause they do not in general yield, in this northern and humid climate, heavy and well filled grain. Such soils should be principally dedicated to pasture, and should only be ploughed when, notwithstanding the utmost endeavours, the ground produces coarse or rank grass; but this is in a great measure, or perhaps entirely, to be prevented by the due attention to the following directions: to keeping the water in the ditches at a proper level: to stocking the ground with a due proportion of neat cattle, sheep, and horses; as the one animal will eat the grass which springs up on the dung of the other, and which otherwise would produce tufts of coarse grass: to folding of cattle on different parts of each field: to using of heavy rollers: and to top-dressings of alkaline salts, and other saline substances: and also to top-dressings of lime, either by itself or well mixed with peat or fen mould, in the manner that has been directed above."

It is likewise advised, that "the pasture should always be eaten quite close before winter, excepting such portions of it as are intended for winter food, which likewise should be eaten close off, before the spring vegetation commences; after which time, it should not be depastured until the grass be sufficiently advanced to allow of a good bite. As all plants receive nourishment two ways, by their stems and leaves as well as by their roots, the growth of young vegetables must necessarily be much retarded, when deprived, by being constantly eaten down, of one of their sources of subsistence." And as the consolidating the soil of peat lands is an object of the first consideration, it is obvious, both on chemical and mecha-

nical principles, that much cropping, and the consequent exposure of fresh surfaces to the action of air, are improper; and that after a few crops are obtained, the ground should be laid down with meadow grasses and white clover, and depastured with as much stock as it will carry. By these means, not only the soil will be consolidated and compressed, and particular grasses or herbage promoted according to the cattle so depastured, but the urine and dung of the cattle, by carefully folding them, will be laid on in such quantities, as will perform rapidly, and at once, the effect required; whereas, if the same quantity were divided over fifty or a hundred times the surface so folded upon, its operation would scarcely be perceptible, and the application of each year's manure so subdivided, would either be washed away, or its beneficial effects lost, before the further quantity necessary could, in a series of fifty or a hundred years, be added to it. Hence a system of under-dunging, or manuring land, may be said to be nearly equal to no dunging at all: on which account the preference, with great reason, has been given, under all circumstances, to the ancient mode of cultivating the infield lands of Scotland. Folding in a proper manner, is particularly recommended for fen lands and peat mosses, as the immediate effect produced by urine, is that of dissolving into mucilaginous saponaceous matter the oxygenated peat. Indeed, in all businesses, it is well known, that what is once well done is not to do again. By this judicious mode of proceeding, the chemical qualities and mechanical arrangement of the soil are so altered, that, without the grossest mismanagement, it is impossible it should return again to its former unproductive state. If this be properly attended to, the pasture will never grow coarse, or require breaking up, but will continue to improve the longer it is suffered to remain in that state. There are other reasons for continuing such lands in pasture, viz. the difficulty, from the softness of the soil, of conveying dung from the farm-yard to the fields; and likewise the tendency which such soils have, by exposure to air to become oxygenated, and consequently incapable of yielding the food requisite for the support of vegetables." And "in the mode of stocking such pastures, it is further recommended to keep the fat, the half fed cattle, and the lean or young stock, in different inclosures, as is the practice in Ireland, and where grazing is well understood in England. The fat cattle should only top the grass, the half fed should succeed those, and lastly, the lean or store cattle should follow on the same pasture, and eat the herbage close down; repeating this practice as often as the fresh growth of grass will permit its being done with propriety."

It is probable that under the above circumstances, the best sort of stock are those of sheep, as eating the herbage down in a more regular and equal manner; and at the same time contributing more to the improvement of the land without doing any injury by their treading. See *Moss*.

Peaty-*soil*, that sort of soil which is constituted chiefly of the peaty material. See *Soil*.

PECK, a measure of capacity used in measuring grain pulse, and other similar dry substances; the standard or Winchester peck consisting of two gallons, each of which in grain weighing about eight pounds troy weight. Four of these pecks constitute the bushel. But besides the standard peck, there are local pecks, which are extremely various. Thus the peck in Lancashire contains six gallons. In other counties it is, however, much less. See *Weights and Measures*.

PELT-*rot*, a disease in sheep, which is often very destructive. See *Rot*.

PENNY-*earth*, a term used by some farmers to signify a hard, loamy, or sandy earth, with a large quantity of sea shells intermixed in it; some of which being round and flat and in some measure resembling pieces of money, have occasioned its being called by this name. It is an earth not easily dug, but is usually undermined with pickaxes, and then falls in large lumps; which, with the frosts, break to pieces, and leave the shells loose. According to Moreton in his Northamptonshire "it is prepared by breaking and mixing well with water, and then makes a very desirable floor. The Jersey combers comb-pots are also made of it, and the sides and roofs of ovens are plastered with it; and being rightly managed, it combines into a floor almost as strong as plaister of Paris."

PENNY-WEED, a troublesome weed known sometimes by the name of nettle.

PERIPNEUMONY, in *Farriery*, a disease of the inflammatory kind. It is produced by cold applied to the skin, mouth, or stomach, when there exists an inflammatory diathesis, an over-distention of the lungs, or any of the general causes of inflammation. Such causes as particularly affect the lungs are impure air, irritating matter in the atmosphere, or other hurtful exhalations, violent exercise of the lungs by inordinate muscular exertion, &c. When the disorder is once excited, it is attended with different effects, according to the difference of the part affected.

The symptoms, according to Mr. Denny in his Treatise on the Diseases of Horses, are, that "the horse generally appears restless, and refuses his food for two or three days previous to the following symptoms: namely, fever, cough, with quick and painful respiration. The legs and ears are cold: the horse hangs back in the stall, with his head near the ground, but never lies down. As the disease advances, the breathing becomes more quick, and the cough worse, with partial sweats over the body. The legs and ears remain cold. On the fourth or fifth day, a matter of various colour, often tinged with blood, is discharged from the nose."

He suspects the causes of the disease to be a sudden change of temperature in the atmosphere; the drinking of cold water, after being heated by exercise; exposure to damp air; high feeding, and want of regular exercise; with wounds of the chest and lungs.

He considers the danger to be in proportion to the degree of fever. When the symptoms resist the effect of proper treatment beyond the fourth day, death may be expected, as the disease generally terminates in gangrene, abscess, or effusion of blood in the lungs.

If the symptoms be relieved by the third or fourth day, the cough becoming milder, with a discharge of mucus from the nose; the animal lying down, and having an inclination for food, a favourable termination may be expected.

It is judiciously advised, that "an immediate attempt be here made to lessen the force of the circulation, by taking away three or four quarts of blood from the neck vein, and repeating it if needful." And, that "the horse should have an additional covering, especially about the head and neck.

The following ball may be useful:

Take of Aloes, in powder, four drachms;
Calomel, one drachm;
Honey, enough to form the ball."

And, in "about six hours after, the following febrifuge powder ought to be given in three pints of warm gruel, and repeated every six hours:

Take of Antimonial powder, half a drachm;
Nitre, in powder, six drachms;
Aniseed powder, half an ounce.
Mix them.

"The larger intestines should likewise be cleared by clysters. And the horse be allowed a small stable, or the space of two or three stalls, of moderate temperature.

"The sides of the chest may also be blistered, by rubbing on the part the following liniment:

Take of Cantharides, in fine powder, one ounce;
Corrosive sublimate, in powder, two drachms;
Olive oil, six ounces.
Mix them.

"As soon as the inflammatory symptoms are abated, the powders may be omitted, and the following pectoral mixture given two or three times in the day:

Take of Linseed,
Aniseeds, bruised, each one ounce;
Liquorice roots, sliced, two ounces;
Water, three pints.
Boil for ten minutes; then strain, and add, of
Nitre, in powder, half an ounce;
Honey, two ounces;
Tincture of opium, two drachms.
Mix."

It is advised, "instead of putting the mashes into the manger, to let them be given in a common nose-bag, suspended by a strap over the head. The horse will be obliged to breathe through the bag, and by so doing inhale the warm vapour from the mash, which will considerably increase the secretion of mucus in the windpipe, and relieve the cough. His strength must be supported by gruel, until his appetite returns; and caution taken that the care bestowed in the day be not rendered ineffectual by neglect in the night. As his appetite returns, small mashes, of two parts bran and one of malt, may be occasionally offered him. His drink should be either warm water or thin gruel. And a small quantity of sweet hay may be allowed him once or twice in the day."

It is likewise advised that the horse's allowance of food should be gradually increased, cautiously avoiding to overload the stomach; and also that the stable and manger be kept clean, and the supply of bedding plentiful. The horse's nostrils should be washed with vinegar and water several times in the day; and his legs bathed with the following embrocation during his confinement:

Take of Opodeldoc, three ounces;
Spirits of turpentine, one ounce.
Mix them.

And, "after the seventh day, walking exercise should be allowed for a few minutes; both the time and distance being gradually increased as the animal recovers. If the cough continue troublesome, place a rowel in the chest, and give the following pectoral ball, instead of the mixture, morning and night:

Take of Myrrh,
Squills, of each, in powder, two drachms;
Nitre,
Sulphur, of each, in powder, half an ounce;
Opium, one scruple;
Honey, enough to form the ball.

It is further recommended, that "lime or tar water should be given for common drink: and that if there be any reason to suspect that the disease will terminate in broken wind, the food should be given in small quantities, at short intervals. In this case ten grains of calomel should be added to the ball It is still further stated, that the horse's recovery will be expedited by moderate exercise, and a strict attention to the quantity and quality of his food, with good grooming, &c."

Another intelligent writer, Mr. Ryding, strongly cautions the veterinary practitioner against delay in the application of the remedy of bleeding, on the mode of which he has some singularity. If, says he, the action of the heart and arteries be very great, there may be danger of suppuration or gangrene. In this case, bleeding from the vein on each side of the neck, at the *same time*, and from large orifices, should immediately take place. Three or four quarts taken away *in this manner*, will be found more beneficial than six or eight quarts taken only from one vein. If the pulse rise after this bleeding, which is often the case, we may venture to repeat it in sixteen or twenty hours after, or according as the symptoms may direct, and let the following medicines be given:

Take of Antimonial powder, one drachm and a half;
Nitre,
Cream of tartar, of each, one ounce and a half.
Mix them well together, and divide into four parts.
One of these powders is ordered to be given, in a quart of linseed decoction, every two hours; the body being at the same time kept open with gentle stimulating clysters.

The horse is advised to be kept in a moderate degree of temperature, avoiding, as much as possible, his being exposed to a current of air. His clothing should be rather warm, and he would be best in a

place where he could have the liberty to walk. His legs should be well rubbed, for half an hour, four or five times a-day, with a cloth; and his diet be warm mashes of bran, or warm water-gruel. And, if by this method of treatment the symptoms do not abate in two days, it will be necessary to take away a little more blood, and endeavour to prevent the formation of matter taking place in the lungs, by administering such medicines as powerfully determine the blood to the kidnies and intestines, and which also, by bringing on purging, open the body, and finally remove the disease.

Take of Calomel, one scruple;
Antimonial powder half a drachm;
Cream of tartar,
Nitre, of each, three drachms.
Mix them well together, and dissolve them in a quart of linseed decoction.

"This mixture may be given every two hours, until purging takes place; and its action may be promoted by the following clyster:

Take of Linseed, three ounces.
Boil it in four quarts of water, half an hour; pass the decoction through a coarse cloth, and dissolve in it
Aloes, in fine powder, half an ounce."

It is ordered to be thrown up the rectum two or three times a day, a little warm.

It is observed by Mr. Feron, who ascribes inflammation of the internal viscera, principally, to a sudden transition from a cold to a hot temperature; but never, or very seldom to the reverse, viz. a hot to a cold one: "The lungs, much more than any other organs, are subject to be diseased by this cause in the horse. It is also much more violent, and likewise different in some respects, from the same disease in man. Adhesions are general in the latter, but it is seldom that they are found in the horse:" and "the reason why an inflammation of the lungs, and of other parts, goes on so rapidly in the horse, is, he says, the great muscular power of the heart and arteries, which occasions the termination of the inflammation in gangrene and mortification."

In removing the disease it is advised that "all the most powerful means of resolution should be employed, on the discovery of the disease; copious bleeding, and that quickly from a large orifice, is what we chiefly depend upon, to the quantity of five or six quarts at once, which answers better than the common practice of drawing three pints or two quarts, as practised by farriers, grooms, &c. Previous to bleeding, the pulse is oppressed; but it soon becomes strong and full, by the removal of the distention of the vessels on bleeding, and, if the evacuation is continued, it becomes weak. We must endeavour also, he thinks, to bring on an external irritation on each side of the chest and legs, by blistering or firing (or perhaps both) on the region of the lungs; at the same time introducing one rowel under the chest, and another under the belly: the four extremities are to be well stimulated with oil of turpentine, twice a-day."

Mr. Coleman has likewise advised, the stopping the circulation in the veins by external compression. The same ingenious author recommends also inflating the cellular membrane under the skin of the chest with air, so as to bring on inflammation; and, if this does not succeed, to inject some stimulating fluid, as oil of turpentine, as the best stimulus. From the trials he has made, he conceives it may turn out a most valuable discovery, in the cure of this disease.

Internally, diuretics may be used with advantage; according to the former of the above authors.

Take of Tartarised antimony, an ounce and an half;
Opium, a drachm;
Calomel, fifteen grains to a scruple.
Make them into a mass, with linseed or liquorice powder, and treacle. The dose to be repeated twice a-day.

During this treatment, two or three large clysters of warm water are advised to be injected every day; and, at the same time, the animal kept in a warm stable well clothed; with good warm gruel, for his drink; no exercise whatsoever should be taken, during the inflammatory state of the disease.

After the termination of the disease, a collection of coagulated lymph is frequently left in the cavity of the chest unabsorbed; or a common anasarca of the lungs occurs; the difficulty of breathing produced by which, may be cured by the following: which must be repeated every morning, as long as necessity requires.

Take of Vitriolated copper,
Common turpentine, of each, two drachms;
Linseed powder, a sufficient quantity to give the ball a proper consistence.

And, blisters should be continued in the course of the windpipe and on the chest.

PERRY, the name of a pleasant and wholesome liquor made from the juice of pears, by means of fermentation somewhat in the same manner as cider from apples. See *Apple*, *Cider*, *Orchard*, and *Pear*.

The best pears for perry, or at least the sorts which have been hitherto deemed the fittest for making this liquor, are so excessively tart and harsh, that no one can think of eating them as fruit; for even hungry swine will not eat them; nay, hardly so much as smell to them. Of these the Bosbury pear, the Bareland pear, and the horse pear, are the most esteemed for perry in Worcestershire, and the squash pear, as it is called, in Gloucestershire; in both which counties, as well as in some of the adjacent parts, they are planted in the hedge-rows and most common fields.

It is observed by Mr. Knight, that in the making of this sort of liquor, the pears are ground and pressed in exactly the same manner, as those of apples in the manufacturing of cider; but that it is not usual for the reduced pulp to be suffered to remain any length of time without being pressed. It has never, he says, been the practice in Herefordshire or the counties in the vicinity of it, to blend the juices of the different varieties of the pear in order to correct the defects of one kind, by the opposite properties of the other.

It is however, he allows, more easy to find the required portion of sugar and of astringency as well as flavour, in three or four varieties than in one; hence, he supposes, a judicious mixture of fruits affords a prospect of great benefit.

In grinding, he remarks, that the pulp and rind of the pear, as in the apple, should be perfectly reduced, and that though no benefit is said to have been derived from the reduced pulp remaining some hours unpressed, he has no doubt but that where all other circumstances are the same, that portion of liquor will for the most part be found the best, which has remained the longest under the power of the mill-stone.

The juice of the pear and the apple, he says, are constituted of the same component parts, but that the proportions are different. In the juice of the pear the tanning principle is predominant, with a less portion of sugar, mucilage, and tinging matter.

The method of managing this sort of liquor during the process of fermentation, is likewise, he observes, nearly the same as that in cider; but that it does not afford the same indications by which the proper period of racking it off may be known. The thick scum that collects on the surface of cider, he remarks, rarely appears on the juice of the pear, and during the time of the suspension of its fermentation, the excessive brightness of the former liquor is seldom seen in the latter; but that where the fruit has been regularly ripe, its produce will generally become moderately clear and quiet in a few days after it is made, and it should then be drawn off from it's grosser lees. An excess of fermentation is prevented by the means used in the making of cider, and the liquor is rendered bright by isinglass. The power this substance possesses of fining liquors appears, he says, to be purely mechanical: it is composed of innumerable fibres, which being dispersed over the liquor, attach themselves to, and carry down, its impurities. For this purpose it should be reduced to small fragments by being pounded in a mortar, and afterwards steeped twelve or fourteen hours in a quantity of liquor sufficient to produce its greatest degree of expansion. In this state it must be mixed with a few gallons of the liquor, and stirred till it is diffused and suspended in it; and it is then to be poured into the cask, and incorporated with the whole by continued agitation for the space of two hours. This process must be repeated till the required degree of brightness is obtained, the liquor being each time drawn off, on the second or third day, from its precipitated lees. Not more than an ounce and a half, or two ounces of isinglass, are, he believes, generally put into a cask of a hundred and ten gallons, at once; but were its mode of action purely mechanical, there could be no objection to a larger quantity; but it has also, he says, a chemical action on the liquor. It combines with and carries down the tanning principle, and hence, during the process of fining, the liquor is deprived of a large portion of its astringency.

This substance is most readily diffused in liquors by boiling; but by this it is dissolved, and converted into glue; and its organization, on which alone its powers of fining depend, is totally destroyed. The application of it is sometimes also necessary in the manufacture of cider; though colour is seldom wanting in that liquor.

Where perry or cider can be made sufficiently bright without it, he would not by any means recommend its use. The liquor is rendered extremely agreeable to the eye by it; but has always appeared to him to become more thin and acid by its action.

In respect to the "after-management of perry it is the same as that of cider; but it does not bear situations where it is exposed to much change of temperature, so well, and its future merit cannot so well be judged of by its present state. In the bottle it almost always retains its good qualities, and in that situation he would always recommend it to be put, if it remains sound and perfect at the conclusion of the first succeeding summer."

On the whole the pear furnishes a less popular liquor than the apple, but the tree is capable of being grown on a greater variety of soil, and is more productive, furnishing in the proportion of 600 gallons of liquor to the acre, where the trees are full grown. See *Cider* and *Pear*.

PHALARIS, the title of a genus of grasses, of which there are several species, but none that can be introduced into field culture with advantage. It is the canary grass.

PHEASANT, a game bird, nearly allied to our common poultry. It is mostly kept in preserved places, such as inclosed woods, and coppices; for no attempts have yet been made to rear this bird for domestic uses, though it would seem to be an easy matter from the great resemblance which it bears to poultry in its habits and modes of feeding, &c. though much less hardy. While young, these birds mostly feed much upon insects, ants, and other similar kinds of food, but when they are full grown they are great devourers of grain, for which they often quit the woods and coverts, and are taken and destroyed by sportsmen.

They are often taken while young by nets or other means, the sportsman in these cases first discovering the haunts of the eye or breed, and then disposing his nets accordingly.

The time of shooting this bird commences later than with the partridge, as in October, and it is a rule among sportsmen in general only to kill the male birds.

PHLEUM, the title of a genus of grasses, some of which have been found useful in the field. It is the cats tail grass.

Phleum *nodosum*, the knotty cats tail grass, which is said by some to be a fine exuberant grass fit for dairy pastures and where cow hay is required, as it affords rich milk and cows are fond of it; but horses and sheep are said to reject it in favour of the poas, though not in other cases. It is found in the dry hilly pastures.

Phleum *pratense*, the meadow cats tail grass. It is coarse and late, but answers best in moist soils and situations. When kept well fed down, it is said to be useful on the moist loamy soils where the substratum is of the clayey marl kind. It is asserted to

furnish a principal part of the herbage in the meadow lands in America. It affords much seed, and is the plant known by the title of timothy grass. It is wholly rejected by some as unworthy of cultivation.

PHYSIC, in *Farriery*, a term employed to signify the remedies made use of in curing the diseases of animals.

PHYSICKING *horses*, the practice of giving them purgative medicines when well, with the view of preserving them in health, and rendering them more active.

It has been remarked by a late veterinary writer, that an indiscriminate use of purgatives, is so prejudicial in practice "that more valuable horses have been lost by improper courses of them than from any accidental cause. It is surprising, says he, that the erroneous notion that horses frequently require to be purged should prevail, and that this important undertaking should so generally be left to the direction of a groom. Reasoning from analogy, would a man, whose strength was daily declining from some defect in the digestive organs, submit to the experiment of taking two or three doses of drastic purgatives, to recover the tone of his stomach, and repair his strength? Certainly not! For every man must know so well the debilitating effect of purging, as to be certain that such a course would tend only to diminish still more his remaining strength. This evinces the absurdity of that common practice of giving horses physic in every disease. Discrimination and judgment can alone determine when purgatives are requisite, and when, on the contrary, they are injurious."

It is likewise added, that "so great is the prejudice against new forms, that men of the most cultivated minds will frequently rather hazard the lives of their horses, through the ignorance of a groom, than discard from the purging remedy employed, any article that is not merely inert, but even pernicious. It is commonly known that, besides aloes and calomel, employed as purgatives, there are many others, as jalap, rhubarb, salts, and syrups of various kinds, in daily use, from the supposition that the efficacy of the medicine must be increased by the number of ingredients."

The same writer thinks, "the safest and only certain purgative is aloes. In particular cases calomel is also necessary. Large doses of other medicines employed for the human subject have no effect upon the horse, as experience sufficiently confirms. This may easily be conceived by those who are acquainted with the structure of the horse's stomach, which differs essentially from that of the human, exclusive of the difference in length of the intestinal canal. Unless therefore the stimulating quality of the medicine remain long after it has passed from the stomach, it will have no effect on the bowels; a circumstance which accounts for the failure above mentioned. The horse, in a state of health, requires a constant supply of food, to repair the waste of the body. As this aliment occupies a large space, the natural motion of the intestines is slow, so as not to expel their contents, before the nutritious part is completely absorbed. Again, the quantity of matter remaining in the small intestines requires the constant stimulus of the bile, to propel it into the large ones. A constant supply of bile being therefore required, the horse does not stand in need of a reservoir for that fluid, and therefore is not provided with a gall-bladder; the bile, as it is secreted by the liver, flowing from its duct into the intestines. Considering therefore the length of the intestines, and the slowness of their motion in the horse, it is natural to suppose that a powerful dose of physic will so increase this action, and forcibly propel their contents, as to produce in some part of the intestines violent pain and spasms, succeeded by inflammation, which frequently terminates in the death of the animal; too many instances of which preclude the possibility of its being doubted."

On these accounts, he judiciously advises, that "in all cases where the strength of the animal is not exactly ascertained, a small dose should be first given, which may be afterwards increased, if found necessary: thus every advantage will be secured, without hazard; for horses of the same breed, and size, differing as much in constitution as the human subject, the same dose, at different times, will produce very different effects."

The cases in which purging physic may be used with advantage, are thus stated: "Horses coming from camp into warm stables, should have one or two doses of mild physic administered. Many of those inconveniences that arise from a sudden change of temperature, as swelled legs, inflamed eyes, colds, &c. would also be prevented, by having the doors and windows kept open, to admit a free passage of air during the few first days. It is likewise advantageous to give each horse a cold mash or two daily, and afterwards close the doors and windows gradually, to prevent any bad consequences from the transition which might otherwise be hurtful." And young horses should have always two or three doses of physic; and afterwards sufficient time allowed them to get to condition before they are sent into the riding school. The service loses annually many valuable horses, by their being too hastily formed for the ranks; which generally produces inflammation of the lungs."

It is also added, that "horses require physic after having been long fed on green food; and also in the autumn before preparing them for the field. Those also that have swelled and cracked heels, from their high feeding or irregular exercise, will be much benefited by purging physic."

It does not seem that working horses can stand much in need of purging physic, as they feed in a regular manner, and are fully exercised. The following forms have been found extremely useful where purging is necessary:

Take of Barbadoes aloes, in fine powder, four drachms;
Ginger, in fine powder, one drachm;
Treacle, enough to form the ball.

This is well suited to blood horses.

Take of Aloes, in fine powder, six drachms;
Ginger, in fine powder, one drachm and an half;

Treacle, enough to form the ball.

This is adapted to horses used in hunting, on the road.

Take of Aloes, in fine powder, one ounce;
Ginger, in fine powder, two drachms;
Treacle, enough to form the ball.

This is proper for labouring horses.

The doses may be augmented where it is found necessary. And where mercurial physic is necessary, it is a good practice to give a calomel ball in the evening, and an aloetic purge the following morning, such as these:

Take of Calomel, one drachm;
Aniseeds, in powder, half an ounce;
Treacle, enough to form the ball.

Take of Calomel, one drachm and a half;
Aniseeds, in powder, half an ounce;
Treacle, enough to form the ball.

Take of Calomel, two drachms;
Aniseed, in powder, half an ounce;
Treacle, enough to form the ball.

The second aloetic ball should be given after the strongest mercurial, which will mostly be sufficient.

In courses of this kind, the following is the method of treatment advised by Mr. Denny: "Mashes of scalded bran, with an handful of corn in each, should be given for one or two days previous to taking the ball, which is to be given early in the morning. Two or three quarts of warm water only to be allowed for the first four hours. Afterwards give a warm mash, which is to be repeated two or three times during the day. The water given should be warm, but not in larger quantities than usual. A small allowance of hay is proper at night. If mashes and water be refused, as is often the case, gruel must be given instead of them. Next morning the horse should be walked out, for half an hour or longer, if necessary, at which time the physic generally operates. He may be exercised again in the middle of day. Mashes and warm water are to be continued until the evening. His feed may then consist of equal parts of dry bran and oats; and the following day his food be as usual."

It is added, that "horses under physic require additional covering; they being then more susceptible of cold than at any other time. The practice of trotting horses violently, to assist the operation, is both absurd and dangerous. Almost every instance of physic failing to produce its proper effect is in consequence of mismanagement or neglect in the stable. An interval of eight or nine days must be allowed before the second dose is given, during which period he should have one or two hours walking exercise daily, taking care that he be well groomed on his return to the stable, and regularly fed." See *Purging*.

PICKLE, a sort of brine or liquor used for steeping grain, to preserve it from disease.

Many different compositions have been at different times employed as steeps or pickles, for freeing grain from disease; but those which are the most in use at present are such as are described below, though very strong solutions of common salt, and other similar substances have been often employed.

Arsenic pickle.—Much advantage is said to have been found by Mr. Young, from the use of half a hogshead of strong lixivium of wood-ashes, put in a cast iron boiler, with seven pounds of common salt, and one pound of arsenic boiled well, and kept in the boiler for use when cold. And which without the salt was employed with benefit by Mr. Andrews.

Salt pickle.—This is "prepared, according to Mr. Summerville, sometimes with plain water, into which common kitchen salt is put, till it is of such a strength as to float an egg. In many cases, however, sea water is used, and salt added to it, till it will also carry an egg; the advantage of using sea water is, that less salt is required. The pickle, thus prepared, is, he says, put into a large open vessel, that will hold perhaps 30 or 40 gallons: the wheat is then poured into it, in the quantity of, from a bushel, to two bushels at a time, and well stirred round, either with a broom or a stick; during the stirring, the light grains rise to the surface and are skimmed off; the vessel is then lifted up, and the contents poured into another of equal dimensions, upon the mouth of which a sieve is placed; the sieve retains the grain, and suffers the pickle to pass through it into the vessel beneath. The same quantity of wheat is again put into the pickle, and the same process repeated, till the whole has been washed and pickled; and progressively as it is taken out of the water, some new slaked lime is sifted upon it. The whole is then carefully mixed up with a wooden shovel, and frequently turned over, till it attain a sufficient degree of dryness, in which state it is committed to the earth without any further preparation or management."

Urine pickle.—This is prepared in this way, according to the same writer: "A quantity of urine, in as stale a state as possible, is put into a vessel, in the same manner as for the salt pickle, into which the grain is put and well stirred. The contents are then poured through a sieve, and the process continued till the whole of the wheat intended to be sown is moistened." It is then sprinkled with lime, as in the former case, and committed to the earth. It is, however, added that "in many cases, instead of mixing the whole of the grain with the urine, it is common to spread the wheat upon the barn floor, and sprinkle the urine upon it, either with a watering pan or a kind of brush made of straw; when it is sufficiently moistened, lime is made use of as before, and the grain sown.

Italian pickle.—This is that recommended by J. B. Scandella an Italian physician, which "is prepared in this manner: Take of nitre, three pounds; alum, one pound; vitriol, six ounces; verdigrise, three ounces; wood-ashes well sifted, six pounds; boil the whole in a copper with five pails of water for an hour, then remove them from the fire, and pour them into a large vessel; then add sixteen pails of water, in which half a bushel of quick lime has been previously dissolved; mix the whole intimately, and

allow them to stand till they are quite cold. In this steep, two bushels and a half of wheat are to be plunged, and left for about six hours, stirring it up frequently with a wooden shovel, and skimming off what rises to the surface; the wheat is then to be withdrawn, and spread out till it is dry enough for sowing. The process is thus to be continued until the whole quantity of seed intended to be sown is pickled. The above steep is generally, it is observed, sufficient for preparing about twenty-four bushels of wheat."

On these different pickles or steeps, the ingenious writer has made several pertinent reflections. On the first he remarks that "as far as his own observation, aided by the testimony of the most respectable farmers, can be depended upon, it has never been known to fail in a single instance, where it has been judiciously applied; that is to say, it has always prevented the crop from suffering by smut. But though it has answered this purpose most effectually, and the proofs in favour of it are too numerous to be disputed, there is little doubt, that under certain circumstances it may be highly injurious to the crop." And that "while the grain steeped in this pickle continues in a moist state, it may be kept for any length of time, without much injury to its vegetative powers; a circumstance of no small consequence, as it not unfrequently happens, that after the grain has been pickled and made ready for sowing, a sudden fall of rain prevents it from being put into the earth for several days, perhaps weeks. But though the pickle is thus harmless while the grain continues in a moist state, repeated trials convince him, that it is quite otherwise when well dried and exposed to a certain degree of heat. He does not hazard this merely as an opinion, but speaks from conviction when, he says, that if wheat, which has undergone this preparation, and has had lime in a very active state mixed with it, is sown early in the autumn, (as in August) upon dry warm land, and no rain falls for a considerable time after, a thing by no means uncommon at that season of the year, a great proportion of the grain will be either entirely destroyed, or materially injured by the dry caustic crust with which it is surrounded; the mischief in this case is certainly done by the action of the lime, and in many instances is, he supposes, very considerable."

In order to avoid this inconvenience, the writer states that from much inquiry, as well as "numerous trials of his own, he is perfectly satisfied, that the most valuable part of this preparation consists in immersing the wheat in the brine, and that the lime is only added afterwards as an absorbent to dry up the superfluous part of the moisture, and make the grains separate and sow more readily: if this is admitted, and it certainly is the case, he thinks it will be extremely easy to reap the whole benefit of the salt pickle without any of its defects, merely by substituting some other article in the place of lime, and for that purpose nothing seems better calculated than powdered chalk, or common whitening. The former is known, in its unburnt state, to be entirely destitute of any caustic or corrosive quality; and the latter consists of burnt limestone, which has been completely saturated with moisture, and afterwards dried, by which process its activity is destroyed; both of these articles can be obtained in sufficient quantity in most situations, and as neither of them are expensive, they will be found good substitutes for lime, and if properly managed will, he thinks, answer every purpose that can be expected from it, without the smallest degree of risk.

In respect to the urine pickle, he asserts, "that there is no article at present employed, that requires to be used with more circumspection; nor is there any where the risk or loss attending its use has a chance of being so great." He is "ready to admit, that where the urine is sufficiently stale, and the grain properly moistened with it, every insect, or animalcule contained therein, will be completely destroyed: but to counterbalance this, he has, he says, to state, that as yet there has been no test established to ascertain the necessary degree of staleness; and as it is known, that urine which is not stale will not destroy vermin, there is an absolute certainty, if it is used in that state, it will be of no service." And that "on the other hand, when urine is completely stale, it abounds with volatile alkali, which, in its naked state, is known to be hurtful, when applied either to seeds or plants; but when united with lime, it then forms what is called caustic alkali, in which state its strength and dangerous qualities are very considerably increased. This compound, though an excellent manure when applied to the soil, and allowed to operate properly upon it before the crop is sown, is completely destructive both to seeds and plants when brought into contact with them. When wheat, therefore, has been completely moistened with urine, and is afterwards mixed with quick lime, the crust with which it is surrounded will be of the most acrid nature, and nothing but throwing the seed immediately into a tolerably moist soil can possibly save it from destruction. Accordingly it has often happened, when wheat pickled in this way has, by bad weather or any other accident, been prevented from being sown even for a single night, nine tenths of the seeds have been known to perish. He has said that nothing can save the seed thus crusted over from destruction but sowing it instantly upon land containing a certain share of moisture: if the soil happens, however, to be of a warm nature, is very dry at the time of sowing, and the weather continue warm and dry for any considerable time afterwards, an immense deal of the seed will perish by the action of the pickle." And these objections to the urine pickle, which every man who is in the slightest degree acquainted with its chemical properties will readily understand, apply to those cases where the pickle has been most faithfully prepared and administered, and that is when the grain has been completely immersed in it. The other method, viz. that of laying the wheat upon the barn floor, and sprinkling it with a wisp of straw dipt in the urine, is also liable to many objections. He has already hinted, that we have at present no test for ascertaining the necessary degree of staleness in urine; the want of this must always subject the use of it to very great uncertainty; but admitting that it were in all

cases sufficiently stale, there is no possibility of applying it properly or equally, when the wheat is spread upon the floor; some of it will have more moisture than it requires, some will be very imperfectly moistened, and many of the grains will not be moistened at all: he need scarcely add what the consequences of such management will be. The part of the seed, which has got an overdose, will be subjected to all the risks he has mentioned, from the caustic quality of the urine and lime; and the remaining part, which has been either imperfectly moistened, or not moistened at all, will, by the vermin not being destroyed, produce blighted or smutted ears. When speaking of the salt pickle, he has said, that if powdered chalk, or common whitening are used, it will destroy the insects as effectually as lime, and that without the least risk to the grain, and has accordingly recommended it to be prepared in that way. The urine pickle he decidedly condemns, as it is in every point of view liable to insuperable objections; for whether the urine is used singly, or in conjunction with lime, great mischief may, he thinks, be done by it, if the wheat is either prevented by any accident from being sown, even for a single night, or if it is sown upon dry land, and the weather continues warm, and no rain falls for a considerable time afterwards; but if the urine pickle is ever had recourse to, it will certainly be much milder, if chalk, or whitening, are employed as absorbents in place of lime, than under other circumstances."

He adds that he is "fully sensible that much opposition will be made to the doctrine here laid down concerning these pickles, especially by those who have been long accustomed to the use of them; and who without knowing the risk with which they are attended, have generally ascribed the failure, or deficiency of their wheat crop to other causes; but the ideas here held forth are by no means the offspring of conjecture or a warm imagination: careful trials have been made of each, under almost every variety of circumstances that can occur, with this result; that though in a few fortunate cases, both the salt and urine pickles may be used without any seeming loss or inconvenience, yet in a majority of all the instances in which they are employed, more or less of the seed perishes from their effects." He has, he says, "for several years past made trials of both pickles upon a given number of seeds sown at different periods of the season, and under different circumstances of heat and moisture, and he has uniformly found that when wheat pickled with salt and lime was sown either upon ground containing a moderate share of moisture, or had a light shower soon after it was sown, scarcely one grain in ten perished; whereas, when it was sown upon warm dry land, and no rain fell for perhaps two or three weeks afterward, nearly a third of the seed never vegetated." And further that "when the urine pickle was used, even under the most fortunate circumstances, two grains out of ten, or one fifth part of the whole, was generally the least failure that happened, even when it was sown immediately after being pickled; but in cases when it was kept a night or two in the pickle, nine tenths of the seed have been known to perish, and when sown upon very dry land, and much dry warm weather followed, the loss has also been very great. These trials having been made with a given number of grains, the writer was enabled to ascertain, with perfect accuracy, the proportion which perished in each experiment."

With regard to the last sort, or Italian pickle, it has not hitherto been sufficiently in use to fully ascertain in what respects it may be injurious or beneficial when made use of in preparing seed corn for being put into the ground. From the nature of the different ingredients, it would, however, seem to be a preparation of an active nature, and which should be employed with caution, till more full experience has shown its effects.

Pickle, a term sometimes applied to the grains of wheat in discriminating its quality, thus we have a *lean* and a *hungry* pickle, &c.

Pickling *of grain*, the art of steeping it in pickles.

It is sufficiently obvious from what has been observed in respect to pickles that they are liquors of a very active nature, and which must be employed with considerable care and nice attention to the circumstances of the weather and state of the land, as without this, much injury and disadvantage instead of benefit may be the result. The length of time for effecting the purpose in the safest manner, must also be had in the mind of the farmer, as the steeping of grain from twenty to twenty-four hours in solutions of wood ashes, and arsenic, as well as in lime-water, gave clean crops from extremely smutty seed, while, the retaining it in these mixtures only a short time, had but a comparatively trifling effect. In all cases in using these pickles, great attention should likewise be paid to having the grain as equally as possible imbibed and impregnated with the liquors, as in this way the most beneficial effects must be produced. The subject will be more fully explained hereafter. See *Steeping of Seed Corn.*

But whatever danger there may be in pickling seed corn for the purpose of preventing its being affected with the smut, it is a practice that is seldom or ever neglected in the northern parts of England and in Scotland, without the farmers in these parts suffering from such omissions.

PIE, a provincial term applied to signify a receptacle for preserving potatoes and other roots.

When these are for potatoes they are usually formed with dry earth in a dry situation, being made in the ridge or conical form.

Pies are likewise made use of for curing rape seed, being built in the field with platted straw. The form, according to Mr. Marshall, is that of a corn bushel, the diameter seven or eight feet, the height three or four feet. "This large straw basket-like receptacle is filled, says he, with rough seed to the brim, topped up in a conical form with straw, and the whole secured with a coat of thatch." This is mostly done, he says, when the markets are bad at the period of thrashing, as the seed may be preserved any length of time in these pies, if there is a sufficiency of pulls

among it, and the quantity of seed deposited in them be not too large.

PIECE-WORK, that sort which is done by the great or piece. It is sometimes called task work.

This mode of working is becoming more general and necessary daily on account of the increasing price of labour; but in letting it, it requires that the farmer should be well acquainted with its nature, and the time that it will take in performing it, or he will be liable to much imposition. He should likewise be a good judge of the proper manner of performing the work. See *Work*.

PIG, a small animal of the hog or swine kind. See *Hog* and *Swine*.

Pig-*stie*, the name of the place where hogs are kept. See *Hog-stie*.

Pig-tail, a provincial term sometimes applied to a small slip of ground generally in the state of grass.

PIGGERY, a term applied to the place where hogs or swine are lodged. See *Hog-stie*.

PIGHTLE, a provincial term applied to a small inclosure or croft.

PIGEON, a well known domestic bird. There are only two sorts of pigeons, the wild and the tame; the tame rough-footed ones differ not much from the wild, only they are somewhat bigger, and more familiar: the wild usually perch upon trees, being more seldom seen on the ground. They are such as breed in woods, sea-rocks, &c. and the tame such as are bred in dove-houses.

The varieties are numerous, and distinguished by a variety of different names, as carriers, croppers, powters, horsemen, runts, jacobines, turbits, helmets, nuns, tumblers, barbs, petits, owls, spots, trumpeters, shakers, turners, finikins, &c. from which, when differently paired, are bred bastard pigeons, such as are called from the cropper or powter, and the carrier, powting horsemen; from the tumbler and the horsemen, dragoons. These, however, deserve little attention, being only kept for fancy, and not profit, though the same method is used in breeding them.

There are different sorts of runts, one called Spanish runt, generally of a blood-red or mottled colour: they are very loose feathered, and large bodied, but breed not so often as the smaller sorts.

Horsemen are excellent breeders, and are not easily took; the common English runt is also a good sized pigeon, and breeds well.

The pigeon called the Leghorn, is a sort of runt, only distinguished by a little wattle over his nostril: he is a full bodied pigeon, whose feathers lie close to the body, and is an excellent breeder, and generally of a grizzled colour, ermined round the neck.

Those who keep pigeons for the purpose of breeding, should have bastard bred pigeons, such as powting-horsemen, powting dragoons, from a powter, or cropper, and a Leghorn; as such pigeons will sometimes breed nine or ten pair of young ones in the year; and when they have young ones they feed them well.

Of those kinds which are bred in pigeon houses, the grey pigeon, inclining to ash colour and black, is the best; and generally shews fruitfulness by the redness of the eyes and feet, and by the ring of gold colour which is about the neck.

There are two seasons in the year at which the pigeon house may be stocked: the first is May; for these pigeons having much strengthened themselves during the winter, are in a condition soon to yield profit to the buyer. Secondly, in August, when there are a great number of young pigeons that have been well fed with corn, from the harvest in that season.

Pigeons will live eight years, but they are only prolific for the first four years; afterwards they are worth nothing, for when they are once past that age all they do is, to prevent the profit that might be reaped by others that are younger. It is something difficult to know how to distinguish their age.

The runts may be distinguished again into greater or smaller: those which are commonly called the Spanish runts are much esteemed, being the largest sort of pigeon, but are sluggish and more slow of flight than the smaller sorts of runts: but the smaller runts are better breeders, and quicker of flight, for which they are esteemed. As for the colours of their feathers, they are uncertain, so that a judgment cannot be made of the sort by them.

The next which makes the largest figure, but is not in reality the largest bird, is the cropper, so called, because they usually, by attracting the air, blow up their crops to an extraordinary bigness, even so as to be sometimes as large as their bodies. This sort is the most valued, according as it can swell up its crop.

The bodies of this sort are about the bigness of the smaller runts, but are somewhat more slender; this sort also is of various colours in the feathers.

The shakers are of two sorts, viz. the broad-tailed shaker, and the narrow-tailed shaker: these are so called, because they are almost constantly wagging their heads and necks up and down; the broad are distinguished from the narrow, in that the broad-tailed sort abounds with tail feathers about twenty-six in number; but the narrow-tail shakers have not so many.

These, when they walk, carry their tail-feathers and crest spread abroad like a turkey-cock: they have likewise a diversity of feathers.

The jacobines, or cappers, are so called on account of certain feathers which turn up about the back part of the head: some of this sort are rough-footed; they are short billed, the iris of their eye of a pearl colour, and the head is commonly white.

The turbit, which some suppose to be a corruption of the word corbeck, or curtbeke, as they are called by the Dutch, which seems to be derived from the French, courtbeck, and signifies a short bill, for which this pigeon is remarkable; the head is flat, and the feathers on the breast spread both ways; these are much of the same size with the jacobines.

The carriers are those pigeons which are said to have been employed sometimes in carrying letters, &c.

They are about the size of common pigeons, and of a dark blue, or blackish colour, which is one way

of distinguishing them from other sorts: they are also remarkable for having their eyes compassed about with a broad circle of naked spongy skin, and for having the upper chap of their beak covered more than half from the head, with a double crust of the like naked fungous body. The bill or beak is moderately long, and black.

The barb or Barbary pigeon, is another sort, whose bill is like that of the turbit, short, and thick, having a broad and naked circle of a spongy white substance round about the eye, like that of the carrier pigeon; the iris of the eye is white, if the feathers of the pinion are inclinable to a darker colour, but is red if they are white, as is observed in other birds.

The smiters are supposed to be the same the Dutch call dragors: this sort shake their wings as they fly, and rise commonly in a circular manner in their flight, the males, for the most part, rising higher than the females, and frequently falling and flapping with their wings, which makes a noise that may be heard a great way off, which often is the cause of their breaking or shattering their quill feathers.

These very much resemble the tumbler pigeon; the difference chiefly is, that the tumbler is somewhat smaller, and in its flight will tumble itself backward over its head; the diversity of colours in the feathers makes no difference.

The helmet pigeon is distinguished from the others, because it has the head, the quill-feathers, and the tail-feathers, always of one colour, sometimes black, sometimes white, or red, or blue, or yellow, but the other feathers of the body are of a different colour.

The light horseman; this is supposed to be a cross between a cock cropper and a hen of the carrier breed: because they seem to partake of both, as appears from the excrescence of flesh upon their bills and the swellings of their crops; these are not inclined to leave the place of their birth, or the house that they have been used to.

The bastard-bill pigeon is something bigger than the Barbary pigeon; they have short bills, and are generally said to have redeyes, though probably those coloured eyes belong only to those that have white feathers.

There is a pigeon called the turner, which is said to have a tuft of feathers hanging backwards on the head which parts like a horse's mane.

There is also a pigeon of the smaller sort, called the finikin, but in other respects like the former.

There is another pigeon called the spot, supposed to take its name from a spot on the forehead, just above the bill; and the feather of its tail is always of the same colour with the spots, and all the other feathers are white.

The Mahomet, or mawmet pigeon, supposed to be brought from Turkey, which is singular for its large black eyes, but the other parts are like those of the Barbary pigeon.

Great care must be taken to make convenient places to breed in; each pair of pigeons must have two nests, those with baskets in them are best, as before one pair can go out of the nest, or feed themselves, the old ones will be sitting again. When the young ones are taken, clean out the nest, or put in a clean basket, for cleanliness is a circumstance of great consequence.

It has been observed, that, notwithstanding pigeon houses are common on many farms, it is in very few instances that this kind of stock, when the various disadvantages of it are considered, can be converted to much profit by the farmer. It has been well remarked by Mr. Pitt in his Corrected Report of Staffordshire, that the increase of pigeons beyond a certain degree must, doubtless, be injurious to the cultivation of grain: within due bounds they do little harm; but increased beyond it, they prove pernicious vermin, both to the new sown crops, and the early part of harvest. They are particularly voracious in early peas; therefore, the advantages arising from their increase for consumption as food are more than counterbalanced by the mischief occasioned by their depredations. And Mr. Kent says, that, in Norfolk, pigeons are much fewer than formerly, as many of the pigeon houses have been dropped, on account of the injury which the pigeons do to thatched buildings. And the same is the case in Kent and other counties. They are particularly injurious to the grain crops first at the time of harvest, by settling in large flights upon the standing corn, and in this way doing more mischief by beating it down than by the quantity they consume, as Mr. Parkinson has observed in his Experienced Farmer. It is stated that where this sort of stock is kept warm sheltered, sunny situations are the most advantageous, as the pigeon delights in warmth and in being exposed to the full influence of the sun. See *Pigeon House.*

And it is also of importance in the economy of these birds that the floor of the house be nearly upon a level with the holes where they enter, and that these holes be not too large nor too numerous: the holes where they form their nests should not be much enclosed, as pigeons delight in being at liberty. Salts and strong scents, such as assafœtida, are said to be agreeable to these birds, so as frequently to attach them to their habitations, when they would not under other circumstances.

These birds seldom lay more than two eggs at one laying, sitting about twenty days, the male and female alternately. They are capable of breeding frequently, but in general produce only two or three broods or flights in the year. Of all the several sorts the common blue pigeon is probably the most productive. The tumblers are small but very domestic. The author of the Experienced Farmer, after recommending the harvest flight as the most proper for the purpose of stock, as being the strongest to withstand the winter season, gives the following directions on the management of them: in regard to feeding them, it is advised as only necessary during the season between seed time and harvest, when it should be done by three or four o'clock in the morning, as they rise early. If you serve them much later, they will keep hovering about home, and be prevented taking their necessary exercise. If fed the year round, they will

not feed near so well as if forced to seek their own food, for they pick up in the fields what is pleasant and h althy to them, and from the beginning of the harvest to the end of seed time they find plenty. They may be fed with tares, grain, or seeds of any kind. He directs us to be cautious of not letting the first flight fly to increase the stock, but let every one of them be taken: as these will come in, in what is called beating time, that is between seed time and harvest. It is then, that pigeons are the scarcest; and many of the young ones would pine to death through weakness during that season, and that, at the latter end of every flight, care should be taken to destroy all those eggs which were not layed in a proper time. The proper time for the spring flight is in April and May. After the harvest flight cold weather begins to come on, which injures the old pigeon much if she sits late: and the young will be good for nothing if hatched.

It is very necessary to pay attention to cleanliness in the management of the dove-cote. Before breeding time the holes ought to be carefully examined and cleaned, for if any of the young die in the holes in the summer time, maggots are soon bred in them: they become putrid, and emit a putrid and unwholesome stench, very injurious to the inhabitants of the dove-cote. Pigeons are tenacious of their nests, as appears from the conduct of the wood-pigeon, which will breed for years in the same tree, and the mother forsakes her nest with regret; but, unable to endure the filth and stench of her dead offspring, she is obliged to quit the eggs she has laid for a second brood, and the prime of the season is lost. Every summer, immediately after the first flight, the nests should be all cleaned out, and the dung totally taken away, as it breeds filth. But remember to do this business early in the morning. The remaining eggs ought likewise to be destroyed, and a perfectly clean habitation made for the harvest flight of these birds. It is directed never to go into a dove-cote later than midday, but as early in a morning as convenient. Whatever repairs are necessary, either to the building or to the nests, should be done before noon: for if you disturb the pigeons in the afternoon, they will not rest contentedly the whole night; and the greatest part perhaps will not enter the cote until the next day, but will sit moping on the ground; and if in breeding time, either a number of eggs may be spoiled, or several young ones starved to death. It is added, that pigeons are supposed to be more productive from the breeds being crossed, in proof of which, a few tame pigeons were put into a dove-cote; and the consequence was, that a more early, and a more numerous hatch of young were produced than in any of the neighbouring cotes at the same season. It is further stated that these birds have a great antipathy to owls, which find their way sometimes into dove-cotes; and there is no getting rid of such troublesome guests but by destroying them. Rats are terrible enemies to pigeons, and will soon destroy a whole dove-cote. Cats, weasels, and squirrels will do the same. It will be necessary, therefore, to examine the dove-cote once every week at least, very minutely, to see that there are none of these intruders in the houses where they are kept.

In order to catch and destroy pigeons, where they become troublesome to the farmer, it has been directed to take a good number of small twigs, and bird-lime them well, laying them on the ground where pigeons, &c. frequent, and they will soon be entangled with them; and in order to allure them to the twigs, two or three pigeons may be tied to the ground, among the twigs. And another mode, is to cut some sheets of thick brown paper, each into about eight parts, making them up in the shape of a sugar-loaf, and bird-limeing the inside of them three or four days before intending to use them; putting into each paper, near the bottom, three or four grains of corn, and laying these papers up and down the ground, as much as you can, under clods of earth, early in the morning before the pigeons, &c. come to feed. When the pigeons come to feed on the corn, by thrusting in their heads to reach it, they get hood-winked by the paper sticking to their heads, which occasions them to take wing, and fly upright till they have spent themselves, when they tumble down and may be easily taken.

Pigeon-*Dung*, a manure of the bird dung kind, which, is supposed to possess many valuable properties. It is sometimes turned in like other light substances in the spring, and costs about one shilling a bushel heaped in some districts, and about a halfpenny a bushel more bringing to the land: it is used as malt dust, and answers in all seasons. See *Manure*.

Pigeon-*house*, a building or house erected for the purpose of keeping, breeding of pigeons, &c. It is sometimes called a dove-cote.

In order to erect a pigeon-house to advantage, it is necessary, in the first place, to pitch upon a convenient situation, of which none is more proper than the middle of a spacious court-yard, when it is sheltered, and has a southern aspect. With regard to the size, it must depend entirely upon the number of birds intended to be kept; but it is better to have it too large than too small: and as to its form, the round should be preferred to the square; because rats cannot so easily come at them in the former as in the latter. It is also much more commodious; as, by means of a ladder turning upon an axis, it is possible to visit all the nests in the house, without the least difficulty; which cannot be so easily done in a house of the square form. And in order to hinder rats from climbing up the outside of it, the wall should be covered with tin plates to a certain height, as about a foot and a half; which should project out three or four inches at the top, to prevent their getting up more effectually.

It should be placed at no great distance from water, that the pigeons may carry it to their young ones, in a proper state and more conveniently. Where the house is covered with boards, they should be well joined together, so that no rain may penetrate through. And the whole building should be covered with hard plaister, and white-washed within and without. There must be no window or other opening in the pigeon house to the eastward; these should always face the south; for pigeons are very fond of the

sun, especially in winter. Other coverings are better than boards, as will be seen below. In regard to the nests or covers, they may consist of square holes made in the walls of a size sufficient to admit the cock and hen to stand in them; the first range of these nests being placed at a proper distance from the ground; and these nests should be placed in quincunx order, and not directly over one another.

Any lord of a manor may build a pigeon-house on his land, but a tenant cannot do it without the lord's licence. When persons shoot at or kill pigeons within a certain distance of the pigeon-house they are liable to pay a forfeiture.

Nests may likewise be formed in other ways, as will be seen below.

It has been remarked in a late practical work, that "where pigeons are bred for the purpose of deriving profit from them, the pigeon house should not only be large and roomy, but be placed in such a situation that the pigeons may be fed with convenience, and without being disturbed by the different operations that are constantly going on about the farm-house. The form of the house is probably not a matter of much consequence, provided it be not made too deep in the inside; pigeons disliking to have their nests low down. The floor should be closely laid, and the sides well plastered," to keep out vermin. "The roof may be covered by any convenient and suitable material, but tiles and slates are by much the best; thatch being warm in winter and cool in summer may also afford a very good covering. The great objection to thatch for dovecotes is, that the pigeons are apt to scratch it off; but when the ridge is secured by ridge-tiles, and very light hurdles are laid on each side of it, that inconvenience may be prevented. The whole must be made perfectly secure against the entrance of rats and other vermin. Where buildings of this sort are quite detached from the other offices, it is, perhaps, the best and cheapest method to erect them on pillars of brick or stone, or strong posts of wood, about six or seven feet high from the ground. In the latter case, the upper parts of the house may, likewise, be principally composed of wood; and the under part will serve as a shed for various useful purposes. If a stable or cow-house the better, as it will have a tendency to keep the pigeons warmer in winter, which is material to their breeding early in the spring, when they are of most value in the market. The chief objection against wood cotes are, their being too cold in the winter, and too hot in the summer months." It is further stated, that "the apertures or openings for the entrance of the pigeons, should always have a southern aspect, as they delight in a sunny situation as observed above, and they ought not to be too large: the common size is larger by much than is necessary. The number of holes must be regulated by the quantity of birds that are intended to be kept; it is better, however, to have too few than too many; as a great number of holes renders the dove-house cold, and in any case but few are made use of by the pigeons. Above these holes a piece of weather boarding, sufficiently large for keeping off the wet, should constantly be fixed up. These boards are generally made so small that they do not keep off the wet effectually from the pigeons. And though it is the general practice to make square holes of board for the pigeons to lay and breed in; a neater method is that of employing small wicker baskets open at the top for this purpose: these baskets may either be composed of finer or coarser materials according to the inclination of the builder, or the expense he wishes to be at. Nests made in this way take up but little room, and are readily removed whenever it is necessary to clean them, especially if they be fixed up in a convenient method for the purpose.

PIGGIN, a provincial term applied to a little pail or tub, with an erect handle.

PIKE, a name given in some counties to a prong or what is generally called a fork used for carrying straw, &c. from the barn, cocking of hay, &c.

Pike-*Fork*, a fork of the same kind. It is sometimes written *pitch-fork*. See *Pitch-fork*.

Pike, a provincial word signifying a sort of stacklet or load cock of hay, &c.

Pike, a term in the midland districts signifying to glean.

PILE, a sharpened piece of wood driven down into the ground to protect the banks of rivers or other similar purposes.

Pile, a provincial word applied to the breaking off the awns of threshed barley.

Pile *of grass*, a blade of grass.

Piling-*iron*, a name provincially applied to a tool used in breaking off the awns of barley, and sometimes the tails of oats, an operation which with the farmers is called piling barley.

PIN-FALLOW, a provincial term applied to winter fallow.

PINE, the name of a forest tree, of which there are several kinds that deserve cultivating, namely:

The Scotch pine, which is so called from its growing naturally on the mountains of Scotland, is the tree that affords the red or yellow deal, which is the most durable of any of the kinds yet known. The leaves of this tree are pretty broad and short, of a greyish colour, growing two out of each sheath; the cones are small, pyramidal, and end in narrow points; they are of a light colour, and the seeds are small.

This sort grows well upon almost every soil; they have been planted in great numbers upon peat-bogs, where they have made great progress; also in clay soils, where they have succeeded far beyond expectation; and upon sand, gravel, and chalk, they likewise thrive well; but as they do not grow near so fast upon gravel and sand as upon moist ground, so the wood is much preferable; for those trees which have been cut down upon moist soils, where they have made the greatest progress, when they have been sawn out into boards have not been valuable; the wood has been white, and of a loose texture; whereas, those which have grown upon dry gravelly ground, have proved nearly equal to the best foreign deals: Those plantations, which have been made of late years of these trees, will in the next age, not only turn

greatly to the advantage of their possessors, but also become a national benefit.

There is another variety of this sort of tree which is called *pineaster*, which is a large timber tree, and naturally throws out very large arms, some of which will be nearly horizontal. "Some people think these trees are very ornamental on this account; for in the winter especially they appear naked, and are of a yellowish colour; and being spread abroad thus large, and without order, in the mixture of the more regular sorts of growing firs, they make a good contrast. It must be observed, that the leaves of this sort are very large and long, and of a lighter green than those of the Scotch fir, which is another circumstance to direct to its situation; and it must also be observed, that those long and large leaves which ornament the younger branches only, give the tree a majestic air; and as the larger arms appear naked to view, so the younger, being thus plentifully furnished, have a noble effect, besides what beauty it receives from its numerous cones."

Mr. Nicol remarks, that "the timber of the Scotch pine or fir, is found in highest perfection on the more bleak and gravelly sites. In light sand, it is also found durable. But in the richer, more loamy soils, although it grows apace while young, and flourishes exuberantly, it soon sickens, is short-lived; nor is the wood valuable, but short and brittle. On retentive, tilly clays, in which it is often planted, but from which, above all others, it should, he thinks, be excluded, it frequently becomes stinted, about the twentieth or thirtieth year of its age; or when the roots have exhausted the upper soil, and begin to seek pasturage in the sub-soil; insomuch, that the worms attack it on its limbs, anticipating, as it were, its dissolution.

The white or Weymouth pine is one of the tallest trees of all the species, often growing a hundred feet high. The bark of this tree is very smooth and delicate, especially when young; the leaves are long and slender, five growing out of each sheath; the branches are pretty close, garnished with them, so make a fine appearance; the cones are long, slender, and very loose, opening with the first warmth of the spring: so that if they are not gathered in winter, the scales open and let out the seeds. The wood of this sort is esteemed for making of masts for ships. As the wood of this tree was generally thought of great service to the navy, there was a law made in the ninth year of queen Anne, for the preservation of the trees, and to encourage their growth in America: and it is only within these forty years past that these trees have began to be propagated in England in any plenty, though there were some large trees of this sort growing in two or three places long before, particularly at the marquis of Bath's at Longleet; and Sir Wyndham Knatchbull's in Kent; and it hath been chiefly from the seeds of the latter that the much greater number of these trees now in England have been raised; for although there has annually been some of the seeds brought from America, yet those have been few in comparison to the produce of the trees in Kent: many of the trees, which have been raised from the seeds of those trees, now produce plenty of the seeds, particularly those in the gardens of the late duke of Argyle, at Whitton, which annually produce large quantities of cones.

According to Hanbury, the soil which this tree "delights in most is a sandy loam; but it likes other soils of an inferior nature; and although it is not generally to be planted on all lands, like the Scotch fir, yet he has seen it luxuriant and healthy, making strong shoots, on blue and red clays, and other sorts of strong ground; on stony and slaty ground, likewise, he has seen some very fine trees: so that, he believes, whoever is desirous of having plantations of this pine, need not be curious in the choice of his ground."

And in respect to this sort of pine, it will grow, Mr. Nicol says, in many different soils and situations, but seems to affect most a deep sandy loam. On chalky, gravelly, elevated grounds, it is found to luxuriate. It will also thrive in pretty strong clay, if lying on an open sub-stratum. It is impatient of stagnant water, nor will it flourish on a till. It is, he says, "an elegant tree, and worthy of a place in all extensive plantations."

He considers the timber as much superior in quality when "produced on mountains, to that produced on richer soils, and in more sheltered situations. In fine, as already said, except on sandy or gravelly soils, this tree ought not to be planted. The many observations he has made in the Highlands confirm him in this opinion. The value of fir-timber (and that reared in the northern parts of the island, in soil and situation as above, is inferior to none) is known to every mechanic; nor is there any one at all acquainted with the arts, who does not know, that from this tree is extracted rosin, tar, &c.: articles which are so useful for many, especially naval purposes."

The deciduous pine or larch is a lofty tree: its branches are slender, and incline downward: the leaves are of a light green; and, like those of the cedar, are bunched together in a similar manner to the pencils or little brushes of the painter. In spring, when the leaves and flowers are breaking out, it has a particularly elegant appearance; and in winter, it gives variety to a wooded scene by the bright colour of its naked branches: it is in good esteem as an ornamental tree, and its timber is of the more useful kind, being superior to that of most of the pine tribe.

The utility of its wood has been highly extolled by ancient writers, and there can be no doubt but that it is an "excellent wood for ship and house building. At Venice its wood is frequently used in building their houses, as well as in Switzerland, where these trees abound: so that without all doubt, the larch excels for masts for ships, or beams for houses, doors, windows, &c. particularly as it is said to resist the worm. It is remarked that "in Switzerland, their houses are covered with boards of this wood, cut out a foot square; and as it emits a resinous substance, it so diffuses itself into every joint and crevice, and becomes so compact and close, as well as so hardened by the air, as to render the covering proof against all weather. But as such coverings for houses would cause great devastation in case of fire,

the buildings are confined to a limited distance by an order of police from the magistrates. The wood, when first laid on the houses, is said to be very white; but this colour, in two or three years, is changed, by means of the sun and resin, to a black, which appears like a smooth shining varnish.

Mr. Marshall in his work on Planting has observed that "of the common larch there are several varieties. And that the flowers which the commonest sort exhibits early in the spring are of a delicate red colour; another sort produces white flowers at the same season, and these have a delightful effect among those of the red sort; whilst another, called the black Newfoundland larch, increases the variety, though by an aspect little differing from the others. There are also larches with greenish flowers, pale red, &c. all of which are accidental varieties from seeds. These varieties are easily distinguished, even when out of blow: the young shoots of the white-flowering larch are of the lightest green, and the cones when ripe are nearly white. The red flowering larch has its shoots of a reddish cast, and the cones are of a brown colour; whilst the cones and shoots of the black Newfoundland larch are in the same manner proportionably tinged. The cones, which are a very great ornament to several sorts of the pines, are very little to these. Their chief beauty consists in the manner of their growth, the nature and beauty of their pencilled leaves, and fair flowers; for the cones that succeed them are small, of a whitish, a reddish, or a blackish brown colour, and make no figure.

According to the above writer, "the larch tree will grow extremely well on almost any soil, as well in clays as in other sorts: it thrives amazingly on the declivities of hills, and sides of high mountains; it is hardy enough to resist the severest cold, therefore proper for all exposed places: and, as the timber is so valuable, and its growth so quick, it is a tree which may be propagated to the great advantage of the owner." In fact, he thinks, "it is almost impossible to say too much in favour of this tree. It grows on the barrenest soils, and in the bleakest situations. In rich genial sites it luxuriates too much, grows top-heavy, and either loses its head, or is bowed down into an unsightly form, and becomes unprofitable. Its timber, whether in the water, or in contact with the earth, is durable almost beyond comparison."

Mr. Nicol however, in his Treatise on Planting, observes that, "which soil, in this country, when in a state of full maturity, this noble tree may most affect, remains yet to be known. If we may judge from appearances, we shall decide, that it will be found in the highest perfection of timber in the lighter more gravelly soils, and in elevated situations. That it luxuriates beyond every other tree, in all soils and situations, excepting those of a low, humid kind, is, he thinks, demonstrated in every instance where impartial comparison is made."

It is observed by Marshall, that "the Norway spruce is a tree of as much beauty while growing, as its timber is valuable when propagated on that account. Its growth is naturally like the silver fir upright; and the height it will aspire to may easily be conceived, when we say that the white deal, so much coveted by the joiners, &c. is the wood of this tree; and it may perhaps satisfy the curious reader to know that from this fir pitch is drawn. The leaves are of a dark green colour; they stand singly on the branches, but the younger shoots are very closely garnished with them. They are very narrow, their ends are pointed, and they are possessed of such beauties as to excite admiration. The cones are eight or ten inches long, and hang downwards.

"The better the soil is, says he, the faster will the spruce fir grow, though it will thrive very well in most of our English lands. In strong loamy earth it makes a surprising progress; and it delights in fresh land of all sorts, which never has been worn out by ploughing, &c. though it be ever so poor."

"Why this tree has obtained the name of Norway, rather than Swedish or Danish spruce, is a question, says Mr. Nicol, of little importance. But certain it is, that many have been led to mistake on this account, supposing it to be the tree which produces the deal known by the name of Norway fir, and which is the produce of the Scotch fir beyond a doubt. The timber known by the name of memel log is the produce of the spruce."

"It will, he adds, like all the fir tribes, grow in very different soils; but is found in greatest luxuriance in deep sandy loams, where it hath freedom of space. On clays which are not retentive of water below, although moist of themselves, it will make surprising progress. On thin soils, and in bleak situations, it grows slowly; and may therefore become the best timber of any, on such: but here it becomes unsightly.

"It cannot be cultivated in this country with such advantage as the Scotch fir, in respect of timber; but as an ornamental tree, it outdoes it, where the soil is favourable. There are, he says, some majestic spruce firs at Duplin, the seat of Lord Kinnoul, which are supposed the largest in the kingdom." From this tree, pitch is also extracted in great abundance.

The American spruce fir, according to Mr. Marshall, "includes three varieties: the white Newfoundland spruce; the red Newfoundland spruce; and the black Newfoundland spruce; they however differ so little, he thinks, that one description is common to them all. They are of a genteel upright growth, though they do not shoot so freely or grow so fast with us as the Norway spruce. The leaves are of the same green, and garnish the branches in the same beautiful manner as those of that species, only they are narrower, shorter, and stand closer. The greatest difference is observable in the cones; for these are no more than about an inch in length, and the scales are closely placed. In the cones, indeed, consists the difference of these three sorts: those of the white species are of a very light brown colour; those of the red species more of a nut brown or reddish colour; and those of the black species of a dark or blackish colour. Besides this, there is scarcely any material difference; though it is observable, that this trifling variation seems to be pretty constant in the plants raised from the like seeds. These sorts will often

flower and produce cones when only about five or six feet high; and indeed look then very beautiful: but this is a sign of weakness in the plant, which it does not often fairly overget."

He adds that "in many parts of England this is a very difficult tree to raise. It spends itself in cones, and becomes stunted and unsightly. Nevertheless in the vallies of the highlands, it thrives with full luxuriance and vigour: forming a rich picturable outline, possessing more strength of feature than most of the pines. As a standard in polished scenery, there are few trees that equal it; as may be seen at Enville and Fisherwick."

Mr. Nicol says that "these trees seem to affect most a deep black loam of a middling texture, and which is also sub-humed of itself, but does not retain staguant water. They will also thrive well on sandy or gravelly loams of a moist nature. On dry shallow soils, they languish; nor will they thrive on very exposed sites. In deep, sub-humed vallies, are to be found those most stately in this country. They require full space; otherwise they become very unsightly, even in youth."

He adds that "this tree, in America, arrives to great magnitude, and produces that vast store of masts and spars exported thence to Europe. Of this tree they also construct many ships of great burthen. But, in this country, the larch far excels it in any situation, and, as timber, is more valuable for this and all other purposes."

He also asserts that "it becomes a fine ornamental detached tree on good soil, if allowed room to branch in its youth, and while nursing; but at the same time it requires shelter."

There are two varieties of the yellow leaved fir, of which "the silver fir is a noble upright, full growing tree. The branches are not very numerous, and the bark is smooth and delicate. The leaves grow singly on the branches, and their ends are slightly indented. Their upper surface is of a fine strong green colour, and their under has an ornament of two white lines, running lengthways on each side the midrib, on account of which silvery look this sort is called the silver fir. The cones are large, and grow erect; and when the warm weather comes on, they soon shed their seeds; which should be a caution to all who wish to raise this plant, to gather the cones before that happens."

But the other variety is "the balm of gilead fir, which has of all the sorts been most coveted, on account of the great fragrance of its leaves: though this is not its only good property; for it is a very beautiful tree, naturally of an upright growth, and the branches are so ornamented with their balmy leaves, as to exceed any of the other sorts in beauty. The leaves, which are very closely set on the branches, are broad; and their ends are indented. Their upper surface, when healthy, is of a fine dark green colour, and their under has white lines on each side the midrib lengthways, nearly like those of the silver fir. These leaves, when bruised, are very finely scented; and the buds, which swell in the autumn for the next year's shoot, are very ornamental all winter, being turgid, and of a fine brown colour: and from these also exsudes a kind of fine turpentine, of the same kind of (though heightened) fragrancy."

The silver fir is exceedingly hardy, and will grow in any soil or situation, but always makes the greatest progress in a good rich loamy earth.

Mr. Nicol also remarks, that the silver fir "grows most luxuriantly in deep loamy earth; but there its wood is soft and spongy. It will thrive on bleak exposures, and thin gravelly or sandy soil. But that in which we may expect its timber in highest perfection, is a sandy loam, lying on a gravelly subsoil, or dry rock. On the mountains of Switzerland, it is said to grow to a vast size, is excellent timber, and is used for many valuable purposes. In particular, turpentine is extracted from it; and it would seem that from this tree is extracted the true Venice turpentine; although there is an inferior kind extracted from the larch which also passes under that name. As an ornamental tree, it is admissible, he thinks, in all extensive designs; and even on a smaller scale where variety is studied."

"The latter sort must be planted in a deep, rich, good earth; neither will it live long in any other sort of soil. It matters little whether it be a black mould, or of a sandy nature, provided it be deep, and there is room for the roots to strike freely."

In respect to the raising of the trees, all the sorts are propagated by seeds, which are produced in their hard woody cones; the way to get the seeds out of these cones, which are close, is to lay them in the sun or before a gentle fire, which causes the cells to open, and then the seeds may be easily taken out. If the cones are kept entire, the seeds will remain good some years, so that the surest way to preserve them, is to let them remain in the cones, until the time of sowing: if the cones are kept in a warm place in summer, they will open, and emit the seeds; but if they are not exposed too much to heat, many of the sorts will remain entire some years, especially those which are close and compact; and the seeds, which have been taken out of cones of seven years, have grown very well, so that these may be transported to any distance, provided the cones are well ripened and properly put up.

The best time for sowing the seeds is about the end of March; when they are sown, the place should be covered with nets to keep off birds; otherwise, when the plants begin to appear with the husk of the seed on their tops, the birds will pick off the heads of the plants, and destroy them.

Where the quantity of seed to be sown is large, so as to require a good space to receive them, they should be sown on an east or north-east bed of fine mould in the nursery, where they may be screened from the sun, whose heat is very injurious to the plants at their first appearance above ground.

When the plants appear, they must be constantly kept clean from weeds, and in very dry seasons; if they are now and then gently refreshed with water, it will forward their growth; but this must be done with great care and caution, for if they are hastily watered it may wash the tender plants out of the

ground, or lay them down flat, which often rots their shanks: and when this is too often repeated, it will have the same effect; so that unless it is judiciously performed, it will be the best way to give them none, but only screen them from the sun.

If the plants come up too close, it will be a good method to thin them gently about the beginning of July. The plants, which are drawn up, may then be planted on other beds, which should be prepared ready to receive them, as they should be immediately planted as they are drawn up, because their tender roots are soon dried and spoiled at this season of the year. This work should be done, if possible, in cloudy or rainy weather, and then the plants will draw out with better roots, and will soon put out new fibres again; but if the weather should be dry, the plants should be shaded every day from the sun with mats, and now and then gently refreshed with water. In drawing up the plants, there should be great care taken not to disturb the roots of those that are left remaining in the seed-beds, &c. so that if the ground be hard, the beds should be well watered some time before the plants are thinned, to soften and loosen the earth; and if, after they are drawn out, the beds are again gently watered to settle the earth to the roots of the remaining plants, it will be of great service to them; but it must be done with great care, so as not to wash out their roots, or lay down the plants. The distance which should be allowed these plants, is four or five inches row from row, and three inches in the rows.

In these beds the plants may remain till the spring twelve-months after, by which time they will be fit to plant out, where they are to remain, as the younger the plants are, when planted out, the better they succeed; for though some sorts will bear removing at a much greater age, young plants put out at the same time will in a few years overtake the large ones, and soon outstrip them in their growth; and there is an advantage in planting them in saving the expense of staking, and much watering, which large plants require. It is often the case, with respect to plantations of pines, which were made of plants six or seven feet high, and at the same time others of one foot high planted between them, that in ten years the latter are better trees than the former, and much more vigorous in their growth; but if the ground, where they are designed to remain, cannot be prepared in proper time, the plants should be removed out of the seed-beds into a nursery, where they remain two years, but they should not continue much longer.

The best season to plant out pine-trees, is in the early spring, as March or the following month, just before they begin to shoot; for although the Scotch and some of the most hardy sorts may be removed in the autumn or winter, especially when they are growing in strong land, where they can be taken up with balls of earth to their roots; it is not a practice to be generally adopted.

Where these trees are planted in exposed situations, they should be put pretty close together, especially on the outsides, that they may shelter each other, and, when they have grown a few years, part of the plants may be thinned out to give room for the others to grow; but this must be gradually performed, lest by too much opening the plantation at once, the air should be let in among the remaining trees with too great violence, and stop their growth.

Wherever large plantations of these trees are designed to be made, the best method will be to raise the plants either upon a part of the same land, or as near to the place as possible, and also upon the same sort of soil; a small piece of ground will be sufficient to raise plants enough for many acres.

As the Scotch and larch kinds are capable of thriving upon the most barren sands, where scarce any thing else except heath and furze will grow, they may in many situations be extensively planted, as there are many thousand acres of such land, which at present are of little benefit to any body, that might by plantations of these trees, become of great value to their proprietors, and also a national benefit.

It is in general the expense of making such plantations that chiefly operates against such undertakings, though when properly managed it is much less than is commonly supposed, as the greatest of the expense is that of fencing them from the cattle, &c. for the other is trifling, as there will be no necessity of preparing the ground to receive the plants, and the charge of planting an acre of land with these plants will not be more than thirty shillings where labour is dear, exclusive of the plants, which may be valued at forty shillings more. Many acres of land have been planted with these trees, which were covered with heath and furze, merely by digging holes to put in the plants, and afterwards laying the heath or furze, which was put upon the surface of the ground, about their roots, to prevent the ground drying, few of which have failed; the plants being mostly four years old from the seed. In five or six years the pines have grown so well as to overpower the heath and furze, and destroy it, without their having had any further culture.

The distance at which they are generally planted in all large open situations, is about four feet, but always regular, avoiding planting in rows as much as possible; and in performing the work great care is necessary not to take up the plants faster than they can be planted out, some men being employed in digging up the plants, while others are planting. Those who take up the plants should be looked after to see that they do not tear off their roots, or wound their bark; and as fast as they are taken up, their roots should be covered to prevent their drying, and put into their proper situations as soon as possible. In planting them, it is advised that care should be had to make the holes large enough for their roots, as also to loosen and break the clods of earth, and put the finest immediately about their roots, then to settle the earth gently with the foot to the roots of the plants. Where these circumstances are duly attended to, and a proper season chosen for performing it, there will be very little hazard of their succeeding; but where plantations are made with plants, which are brought from a great distance, and which have been

so closely packed up, as to heat, and cause the leaves to become yellow, few of them grow.

After the plantations are made, the only care they require for five or six years, is to secure the plants from cattle, hares, and rabbits; for if these are admitted to them, they make great destruction in a short time; as where the branches are gnawed by hares or rabbits, it greatly retards the growth of the plants, if it does not wholly destroy them. In about this length of time after planting, the branches of the young trees meet and begin to interfere with each other, therefore they require a proper thinning out; some, however, advise pruning off the lower branches; but this must be done with great caution. The lower tier of branches only should be cut off; this should be performed in September, at which time there will be no danger of the wounds bleeding too much, and the turpentine will harden over the wounds as the season grows cold, and prevent the wet from penetrating them. These branches should be cut off close to the stems of the plants, and care be taken not to break any of the remaining branches of the young trees. This work should be repeated every other year, at each time taking off only the lower tier of branches: for if the plants are much trimmed, it will greatly retard their growth, as it does in general that of all trees; but as these trees never put out any shoots where they are pruned, so they suffer more from amputation than those which do. It is probably the best practice in all cases to thin out the trees so as to let them have sufficient room and air, as they can never be pruned in the branches without great injury.

In about twelve or fourteen years they will require more thinning where the plants have made good progress, but this should be gradually performed, beginning in the middle of the plantation first, leaving the outside close to screen those within from the cold, and by degrees coming to them, when those which were first thinned will have had time to get strength, and not be in danger of suffering from the admission of cold air. When these plantations are thinned, the trees should not be dug up, but their stems cut off close to the ground, as their roots never shoot again, but decay in the earth, so there can be no harm in leaving them, and the roots of the remaining plants are not injured. The trees which are now cut, will be fit for many purposes; those which are straight, will make good putlocks for the bricklayers, and serve for scaffolding poles, so that there may be as much made by the sale of these as will defray the whole expense of the planting, and probably also interest for the money first laid out.

As the upright growth of these trees renders their wood the more valuable, they should be left pretty close together, in order to draw each other up, and grow tall. The naked stems of the trees sometimes rise more than seventy feet in height, and as straight as possible, and as many boards have been sawn from one of them, as laid the floor of a room near twenty feet square. If these trees are left eight feet asunder each way, it will be sufficient room for their growth; therefore, if at first thinning a fourth part of the trees are taken away, the others may stand twelve or fourteen years longer, by which time they will be of a size for making ladders, and standards for scaffolding, and many other purposes: so that from this sale, as much may be made, as not only to pay the remaining part of the expense of planting, if any should be wanting in the first, but rent for the land with interest, and the standing trees for fortunes for younger children.

The great use and value of these sorts of trees will be seen more fully under the heads of *Plantation* and *Planting*.

It is from these trees that "pitch, tar, rosin, and turpentine, are made by a very simple process. In the spring time, when the sap is most free in running, the bark of the pine tree is pared off, to make the sap run down into a hole which is cut at the bottom to receive it: in the way, as it runs down, it leaves a white matter like cream, but a little thicker: this is very different from all the kinds of resin and turpentine in use, and it is generally said to be used in the making of flambeaux, instead of white bees wax. The matter that is received in the hole at the bottom, is taken up with ladles, and put into a large basket; a great part of it immediately runs through, and this is the common turpentine. It is received into stone or earthen pots, and is then ready for sale. The thicker matter, which remains in the basket, is put into a common alembic, adding a large quantity of water; and is distilled as long as any oil is seen swimming upon the water; this oil is separated from the surface in large quantities, and is the common oil or spirit of turpentine; the remaining matter at the bottom of the still, is the common yellow resin. When the whole has been thus obtained from the sap of the tree, it is cut down, and, after hewing the wood into billets, a pit dug in the earth is filled with the billets, and being set on fire, there runs from them, while they are burning, a black thick matter; this naturally falls to the bottom of the pit, and is the substance usually known by the name of tar. The top of the pit is covered with tiles, to keep in the heat: and there is at the bottom a little hole, from which the tar runs like oil; if this hole be made too large, it sets the whole quantity of the tar on fire; but if small enough, it runs quietly out without any danger. After the tar is thus made, it is put up in barrels, and, if it be to be made into pitch, they put it into large boiling vessels, without adding any thing to it: it is then suffered to boil a while, and, being then let out, is found, when cold, to be what is called pitch." See *Plantation* and *Planting*.

PINCHING, in *Horsemanship*, a term used to express a method of trying a horse's mettle, or vigour, and of shewing him off to a purchaser when the animal is on sale. Thus, when the rider is on his back, he makes him stand still, and keeping him fast with the bridle hand, applies the spurs to the hair of the sides. If the horse is impatient under this, and draws himself up, and wants to go forward, it is a sign of mettle. But the purchaser ought to try this himself on the horse's back; as jockeys have the art of making the dullest horse seem to have mettle in these trials. The purchaser must also distinguish between the restlessness of the horse under this treatment

that arises from vigour, and that which arises from the horse's being ticklish, and which goes off immediately on quitting him.

PIP, a disease among poultry, consisting in a white thin skin, or film, growing upon or under the tip of the tongue, which hinders the feeding. It is supposed to arise from the drinking of puddle-water, or eating filthy meat; and it is usually cured by pulling off the film with the fingers, and washing the part with a solution of common salt in pure water: it is sometimes written pep.

PISMIRE, a provincial name for the ant. See *Ant*.

PISSING *of Blood*, in *Farriery*, a disease in horses, which may proceed from different causes, sometimes from being ridden over hard, or laboured beyond their strength, and by carrying too heavy burdens. See *Staling*.

PISSING-BALL, in *Farriery*, a ball calculated to increase the secretion of urine. See *Ball*.

PITCH, a fork full of hay, corn, or straw, or as much as is raised to the load, stack, or mow, at one time.

PITCHER, the person who is employed in pitching.

PET-LAMB, a provincial word signifying a lamb raised by the hand, or a cade lamb.

PLANE-TREE, an elegant tall growing tree of the timber kind, of which there are two species, as the Asiatic, or oriental, and occidental or American; the first of which rises to a very great height, and in its native soil grows to a prodigious size: the stem is covered with a smooth bark, which falls off annually. The bark of the young branches is of a dark brown, inclining to a purple. The leaves are large and palmated, being deeply cut into five segments: their upper sides are of a deep green, and the under sides pale. The flowers are very minute: they come out at the same time as the leaves, which is in June. This, says Mr. Marshall, is very late, and is no doubt a blemish to the beauty of this nevertheless highly ornamental tree. The antients were very partial to this tree; which is not to be wondered at, when the extensive canopy it forms is considered, the impenetrable shade given by the number and size of its leaves, and consequently the grateful coolness it must afford in a sultry climate. This as well as the American sort has been considered as a forest or timber tree; and their wood may rank with that of the sycamore, which bears a considerable resemblance to them, and which in the north of England is often called the plane tree.

The second sort or American plane also grows to a great size; the stem not only swells to an immense thickness, but, rising erect, shoots up perfectly straight and cylindrical to an amazing height. The bark is smooth, and, like that of the Asiatic or former sort, falls off annually. The leaves are broad, with long footstalks, and are cut into angles at their edges, but not divided nearly so deep as those of the other kind. The upper side is of a light green, the under side paler. The flowers are small, and come out with the leaves about the same time as those of the Oriental plane. Mr. Marshall thinks that on the whole "this tree is peculiarly refreshing to the eye, and truly ornamental."

In addition to these species, there are two varieties of the first sort, as the maple-leaved plane, and the Spanish plane, the first of which differs from the other sorts, in having its leaves not so deeply cut as those of the eastern plane, but much more deeply than those of the occidental. The footstalks of the leaves are much larger than those of either of them, and the upper surface of the leaves are rougher. They might of course be taken for different species if it was not well known that they are produced from the same seeds.

The second or Spanish plane has larger leaves than either of the other sorts. They are divided in a similar manner to those of the maple-leaved plane. Some of them are cut into five, and others into three lobes: these are sharply indented on their edges, and are of a light green. It is by some called the middle plane, from its leaves being shaped between those of the first two sorts.

The first of these sorts may be raised from seeds, where they can be procured; but in other cases recourse must be had to layers. And the ground proper for raising them in, is such as is moist and shady, well dug, and raked until the mould is fine; then in the autumn, soon after the seeds are ripe, they should be scattered over the surface, and be raked in, in the same manner as turnip seed. In the spring, many of the young plants will appear, but it must not be expected that the general crop will come up until the second year; the spring after which they may be taken out of the seed bed, and planted in a nursery-ground in rows one yard asunder, and at one foot and a half distance in the rows. Here they should remain, with the usual care of digging between the rows, and keeping them clean, till they are of sufficient size to be planted out in plantations or other places, either as timber or ornamental trees. In the layering method a sufficient number of trees must be planted out for stools, on a spot of earth double dug. After they have stood one year, they should be cut down, in order to make them throw out young wood for layering. The autumn following, these should be laid in the ground, with a little nick at the joint; and by the same time twelve months they will be trees of a yard high, with a good root, ready to be planted out in the nursery, where they may be managed as the seedlings; and as the stools will have shot up fresh young shoots for a second operation, this management may be continued as the planter may think fit.

The second species or American plane is mostly raised by cuttings; which, if they be taken from strong young wood, and planted early in the autumn, in a moist good mould, will hardly fail of succeeding. They are generally planted thick, and then removed into the nursery ground, as the layers of the other sort: but if a large piece of ground was ready, Mr. Marshall says, these might be placed at such a distance as not to approach too close before they were of a sufficient size to be planted out to stand; and this would save the expense and trouble of a removal.

The oriental plane tree will also grow from cuttings, but not so certainly as this; and whoever has not the convenience of proper ground for the cuttings, must have recourse to layers, which, indeed, for either sort is the most effectual and certain method of proceeding.

These sorts of trees delight in a moist situation, especially the occidental sort. Where the land is inclined to be dry, the others are to be preferred. But in moist places, by the sides of rivulets, ponds, &c. the occidental makes such surprising progress, that it might be ranked among the aquatics. The bright colour of the plane-trees gives variety to groves and masses of wood; in groups and single trees they are singularly elegant; as may be seen in many parks and other places. In such situations and soils they may likewise be planted as timber trees with great advantage, as the wood is useful for a variety of purposes.

The proper season for planting out this sort of trees is in the early spring, as about March; but they may be set out in the autumn, where the soil is not of too wet a nature, with perfect success.

PLANET-STRUCK, in *Farriery*, a distemper in horses, proceeding from a deprivation of feeling and motion, for the parts remain in the same form as when the beast was first seized with it. It is sometimes called shrew-run.

This is a disease of the paralytic or spasmodic kind, and which requires a similar method of treatment. See *Palsy*.

PLANCH-SHOE, in *Farriery*, a kind of shoe, calculated to favour the growth of a horse's hoof, and to preserve the latter from being worn by stones or gravel. The use of it, however, is not consistent with the new principles on which horses are now shod.

PLANT, a vegetable production of which there are numerous kinds, such as herbs of various sorts, comprehending all the different grasses, liguminous vegetables, and esculents of other descriptions, trees, including those of the large or timber kind, and those of a more low or shrubby growth, whether under the name of shrubs, or under-shrubs. But in an agricultural point of view, it chiefly comprehends such grasses or plants of that nature as are employed as the food of animals, and such trees or other plants as are capable of being applied to the purposes of timber, or made use of in the business of husbandry.

It may be observed with respect to plants, that most of them are hermaphrodite, containing the male and female parts in the same flower; others having flowers on the same stem, some of which are male, and others female, as in the cucumber, melon, &c. Some likewise produce flowers over the whole without being followed by any fruit, while others of the same sort bear fruit with flowers, in consequence of which they are distinguished into male and female plants. There are many of this sort, as the hop, hemp, and the poplar tree. The female flowers are only followed by fruit, the hermaphrodites, in respect to this, being considered among the female. Plants are capable of being fecundated from very considerable distances, which is a circumstance that the farmer should carefully keep in mind in saving the seeds of particular sorts of plants.

Plants require nourishment and air as well as animals to support, and keep them in a proper state of healthy growth, the former of which is principally drawn from the earth or the surrounding atmosphere. The gaseous materials are chiefly drawn from the atmosphere by the upper surfaces of their leaves, while oxygen gas or *pure air* is given out during the sunshine by their undersurfaces. It is evident therefore that the means of support are provided in two different ways, the radical or root fibres of the plant taking up one part and the leaves drinking up another, the former from the earth, and the latter from the air that surrounds them. See *Manure* and *Food of Plants*.

PLANTAGO, the title of a genus of plants, some of which are cultivated as field grasses.

Plantago *Lanceolata*, ribwort plantain or ribgrass, which has a perennial root, which, when old, appears as if bitten off at the end. The leaves are all from the root, truly lanceolate, distinguished by five (sometimes three or seven) prominent ribs, pointed, entire, or sometimes having a few teeth near the base. According to Withering, in maritime situations they are toothed all along the edges. They are of a dark green, most hairy beneath, taper at the base into a long flat footstalk, ribbed like the leaf itself, and at their insertion are invested with long white wooly hair springing from the crown of the root. The scapes or flowering-stalks upright, longer than the leaves, from among which they spring; they are clothed at the base with the same kind of hair, and upwards are smoothish, round with five deep furrows, slightly twisted, and terminated by a short ovate spike, imbricated with black scales, and enlivened with the prominent cream-coloured anthers, in its more advanced state. A spike will sometimes contain one hundred and thirty small flowers, crowded close together, with an ovate pointed scale or bracte at the base of each. The capsule contains two oblong shining seeds, of an amber colour in each cell. The stalks continue to grow after the flowering is over, and sometimes shoot out to the length of two feet or more. When it grows in meadows the leaves are erect and drawn up; but in a dry barren soil, they are shorter, broader, and more spread on the ground. It grows spontaneously in dry pastures and other places, where it is often left untouched by cattle, to feed small birds with the copious produce of its seeds. It has often been considered as a weed, occupying the room of grasses and other useful herbs; but has lately been introduced into culture, as a good food for sheep, or to be made into hay for cattle in general. Haller has attributed the richness of the milk in the Alpine dairies, in some measure to this plant.

It has been remarked by Linneus, that it is eaten by horses, sheep, and goats, but that cows refuse it. Sheep, however, will eat it either green or dried, provided it be well gotten; but it does not answer for pasturage, without a mixture of clover or grasses according to some cultivators. It has been observed by Withering, that "the total absence of this plant, in marshy lands, is a certain criterion of their wretched

quality. In proportion as such soils are improved by draining, it will flourish and abound."

But others have suggested that "in this climate the produce of this plant, is not a criterion of excellence in a soil, but merely of its dryness." But though botanists do not speak favourably of this plant, as a pasture or meadow herb, practical farmers hold it in a degree of esteem.

It has been asserted by Mr. Zappa of Milan, that it "grows spontaneously in every meadow of Lombardy, especially in those which are irrigated; that it vegetates early, flowers at the beginning of May, ripens in five weeks, and is cut with the *poa trivialis*; that the height of the leaves is about one foot, and of the stalk a foot and a half; that it multiplies itself much by the seed and a little by the roots, which it continues for some time to reproduce; that it is eaten heartily by every sort of cattle, and in particular by the cows in grass, and the cows like it most in May, having great influence on the milk; that the hay is eaten more voraciously by cows, and has on them great influence in the flesh; in short, that it is one of the best plants either for the milk or the flesh." Where kept well fed down by stock, there can be no doubt of its being a very good and nourishing plant for both cattle and sheep.

Mr. Young, however, says, that he had long before recommended this plant for laying land to grass, and sowed it on his own farm. At the same time he thinks it extravagant to propose dandelion and sorrel, as plants proper for a cow pasture; and conjectures that those plants being found among good ones, have qualities given them, which do not properly belong to them; is likewise inclined to make the same conjecture in respect to narrow-leaved plantain, ribwort or rib-grass, and should even have preferred dandelion and sorrel to it: but he is cautious of opposing theory to practice.

It has been stated by Dr. Anderson that narrow-leaved plantain or rib-grass is well liked by horses and cattle, and yields a very good crop upon rich ground tending to dampness, if it is at the same time soft and spongy; but that upon any soil which has a tendency to bind, or upon dry ground, it furnishes a very scanty crop.

And it has been made use of in some parts of Yorkshire as a summer grass. As an article of pasturage for cattle and sheep it is there in high esteem: it is not however well eaten by horses; and as an article of hay it is held to be detrimental to the crop; retaining its sap an unusual length of time; and when fully dry falls into a small compass, or is broken into fragments and left behind in the field. One advantage of this plant is, that its seeds may be easily procured genuine. A small proportion of it may be eligible: it has now stood the test of twenty years established practice, and seems to be still in good estimation even among farmers that are the most attentive in grass husbandry. It has been stated by Mr. Marshall that he made a trial of it in Norfolk, as a substitute for clover, but gained no credit from the experiment: on which it has been observed that the fact is, horses do not affect it, and they are the principal consumers of the clover crop in that county. It is a plant that varies much in size as well as the breadth of the leaves, &c. The narrow leaves have only three ribs. The spike is sometimes surrounded by large leaves, instead of the usual small bractes: it sometimes becomes an abortive panicle: and it is found with two or three heads. Its qualities seem to be nearly the same with those of the following; and it is more used than that by the common people.

The sort which has been termed grass leaved plantain (*tenuifolia*) by Dr. Anderson, is probably only a variety of this. See *Rib Grass*.

Plantago, *major*, the great plantain. It affords more seeds than the former, and is perennial. The root when old is the thickness of the thumb, præmorse or stumped, laying strong hold of the earth by its fibres, which strike deeply, and are whitish The leaves petioled, seven-ribbed, or sometimes nine-ribbed, smooth, but somewhat hairy when young, about a hand in length, often remotely toothed about the edge. The petioles long, convex on the under side, concave above, each forming a kind of sheath at its base. The scapes upright, pubescent, longer than the leaves. The spikes cylindrical, very long, linear, composed of many closely imbricate flowers, under each of which is a lanceolate concave bracte. This is likewise a plant, according to Mr. Zappa, that may be useful as a cattle food. It grows, he says, not only along the roads, near dunghills, in damp and fat places, but in irrigated meadows also of every district in Lombardy, though more near the borders than in the centre of them; that it vegetates later than the above, flowering towards the end of May; that the leaf is six inches long, and the stalk almost a foot high; that notwithstanding it is not tender, every sort of cattle like it, and that cows are as fond of it as of the above sort. It has also been noticed by Mr. Curtis that cattle in general appear very ready to eat the leaves. Sheep, goats, and swine, also eat it well. See *Rib-grass*.

PLANTATION, a portion of land planted with timber or other trees.

It is obvious that plantations when judiciously made, not only afford great improvement to estates, but are highly ornamental to the country. They should therefore be more particularly attended to, where there are large tracts of poor barren lands, that cannot be converted to the more profitable purposes of tillage or grass. They have also a fine effect in the vicinity of habitations. And in many cases, the proprietors of estates, whether of large or moderate sizes, may reap great pleasure and advantage in allotting a part of them to this use, as they give an air of cultivation and fertility; and after eight or ten years, in many cases bring in great profit by the gradual thinning of the underwood, besides leaving a sufficiency of standards to attain full growth. The expense attending the making of plantations and the knowing that they must wait several years before the trees have made any considerable progress, or can afford any advantage, often proves an obstacle in attempting the prosecution of the business; but

the expense of planting where the plants are raised on the grounds, will not be so great as may be imagined, especially as a small spot of nursery-ground will raise plants sufficient in three or four years to plant a great many acres of land; and the expense of raising and planting, with the loss of time in waiting till the plants attain some growth, will be compensated by the first fall or thinning in eight or ten years, after planting; and the stools which remain, shoot up again in many of the deciduous kind, and afford a lopping every eight or ten years, exclusively of the due portion of standards, left at proper distances to attain full growth for timber.

And in making plantations, it is necessary to choose such trees as are the best adapted to the nature of the particular soil and situation. As to the proper sorts of trees, most of the deciduous and evergreen kinds may be employed with propriety, and young plants of from about two or three to five or ten feet in height always prove more successful than such as are older, as those of a younger growth always take root sooner, and establish themselves more firmly, so as to form considerably the finest plantations, at last, and are of longest duration: for though large trees of from fifteen to twenty feet in height, especially of the deciduous kind, may with care be transplanted, so as to grow, and probably thrive tolerably for some years, yet by not rooting firmly, like young plants, they often fail, and after some years standing, have hardly any shoots, and at last gradually dwindle and perish.

Where large plantations are to be formed of forest and timber trees, particular sorts must be chosen, consisting of deciduous and evergreen trees. Of the first kinds, the oak, elm, ash, beech, chesnut, hornbeam, birch, alder, maple, sycamore, plane, poplar, lime, walnut, mountain, ash, larch, willow, &c. and of the latter sorts pines, firs, &c.

In forming plantations, there are two methods practised, one is by raising the trees from seed at once on the ground where the plantation is intended to be, especially the deciduous kinds, and which is effected by sowing the seed in drills, a yard asunder, the plants remaining where raised, thinning them gradually; the other method is, by previously raising the plants in a nursery, till two or three feet high, then planting them out into the places allotted them: The former, or that of raising the plants where they are to remain, though it may be more expeditious, and at once gets quit of the trouble of transplanting, requires greater attention for a few years, till the plants have shot up out of the way of weeds, but the trees from their always remaining where raised, without being disturbed by removal, may probably make a greater progress. The latter method, or that of raising the trees first in the nursery, is probably the most commonly practised, as being thought the least troublesome and expensive, with regard to the attendance at first to the young growth. In respect to the preparation of the ground for the final reception of the seed or plants, it is mostly performed by deep ploughing and harrowing upon such ground as the plough can be employed on; but where this or other tillage is not practicable, only young plants from the nursery can be used, digging holes, &c. at proper distances, one for the reception of each plant where, however, the ground can be tilled, it will prove very advantageous by performing it a year before; sowing it with a crop of turnips, or other plants of a similar kind, and when these come off, ploughing and harrowing the ground again, for the reception of either the seed or plants the ensuing season. The most proper season for making this sort of plantation either by seed or plants is any time in dry mild weather, in the autumn, as from October till February, or later on moist soils. Where large tracts are to be planted, both the seed and plant methods must be pursued all winter at every favourable opportunity. The ground where the plantations are made, should be previously fenced in all round with a deep ditch, to guard against the encroachments of cattle or other animals. In respect to the after-management while the plantations are young, they must have some attendance to destroy weeds, which may be expeditiously executed by hoeing between the rows in dry weather, or occasionally by horse-hoeing; and this care will be needful for two or three years, especially to the seedling plantations, until the trees are advanced out of the reach of weeds; after which no further trouble will be required until the trees are ready for the first fall or thinning for poles, fagots, &c.

And after eight or ten years growth, they are mostly of a proper size to begin the first fall by a moderate thinning, which will serve for poles and fagot-wood, to repay some of the expense of planting, &c. But only a part of the plantation should be lopped the first year: thinning out the weakest and most unpromising growth first, leaving a sufficiency of the most vigorous plants pretty close, to grow up for larger purposes; the year following thinning another part, and so continue an annual thinning fall till the whole plantation has been gone over; cutting each fall down near the ground, leaving the stools to shoot out again, especially in the deciduous kinds; and by the time the last fall has been made the first will have shot up and be ready to be cut again. So the returns of the fallings may be contrived to be every six, seven, eight, or ten years, or more, according to the uses the poles or wood are wanted for: and if large poles, &c. are wanted, the fall may be only once in fourteen, eighteen, or twenty years, still at every fall being careful to leave enough of the most thriving plants for standards; being left pretty close at first, that they may mutually draw each other up in height, but thinned out in every succeeding fall as they increase in bulk, and so as to leave a sufficient quantity of the principal trees at proper distances to grow up to timber, which in their turn, as they become fit for the purposes intended, may also be filled according as there may be a demand for them, to the most advantage; having young ones from the stools coming up in proper succession, as substitutes, so as the ground may always be occupied as completely as possible.

The advantages that may be derived from the use

of different sorts of trees in plantations, have been stated as very considerable by different writers. In Mr. Mellish's experience, on a forest sandy soil of 3*s.* an acre value, as stated by Mr. Young in his Eastern Tour, in 1771, and made in different ways, as by cleaning the land in the manner as for grain, ploughing once and then setting the trees, by trench-ploughing and setting, and by not ploughing at all but setting in holes with the ground only cleared for them; the results were found nearly equal, but what superiority there was, was in favour of the ploughing method. The sorts of trees were Scotch and spruce firs, larch, oak, ash, chesnut, beech, birch, &c. the whole being mixed. The Scotch and spruce firs have grown much the fastest, and generally succeeded with scarcely any failures. The number set on the acre mostly 5000; the expense of inclosing, raising the trees and planting, 3*l.* the acre. In five years they require thinning, when the wood taken out about pays for the labour, the number thinned out being about a thousand.

"In five years more they are thinned again, he says, when another thousand trees are taken out, which make good hedge wood and hedge stakes, the value about five pounds more than pays the expense of the labour. When these thinnings have been performed 3000 are left, which have been found from experience to be then worth 6*d.* each on an average as they stand, and clear of all expenses, if sold. At this time another thousand should be taken out. Two thousand are therefore left, which at thirty years growth will, he says, be worth as they stand 1*s.* each: and at forty years they will be worth 2*s.* each. This is the produce of such poor forest sands; but this experienced planter has, Mr. Young says, many Scotch firs planted 35 years ago in good land, which are worth 40*s.* each, and a great many from twenty-five to thirty-five shillings. On these *data*, Mr. Young calculates the profit of the plantations at different periods:

Account of an acre of firs at the end of the fifth year:

	£.	s.	d.
First inclosing, raising, planting, fencing, &c.	3	0	0
Interest of above sum five years	0	15	0
Rent, fifteen shillings	0	15	0
	£.4	10	0

In five years more.

	£.	s.	d.
Reparation of the fences,	0	5	0
Interest of 4*l.* 10*s.* for 5 years,	1	2	6
Allow for compound interest,	0	15	0
Rent,	0	15	0
	2	17	6
First five,	4	10	0
Expense at the end of ten years,	7	7	6
Received for thinnings,	5	0	0
Excess,	2	7	6

At the end of twenty years.

	£.	s.	d.
Rent,	1	10	0
Reparation of fences,	0	10	0
Interest,	1	0	0
	3	0	0
Received for 1000, at 6*d.*	25	0	0
Value of 2000 remaining, at same rate,	50	0	0
	75	0	0
Deduct, as above, 3 0 0			
Excess at end of five years, 2 7 6			
	5	7	6
Clear profit in 20 years,	69	12	6
Which is per acre per annum,	3	9	1

He adds, that supposing the 2000 trees left ten years longer, the account will stand as under.

	£.	s.	d.
Received for 1000, at 6*d.*	25	0	0
Deduct, as above,	5	7	6
Profit, in 20 years, exclusive of trees remaining,	19	12	6
Which per acre per annum, may be called,	1	0	0

At the end of thirty years.

	£.	s.	d.
Rent,	1	10	0
Fences,	0	10	0
Interest,	1	0	0
	3	0	0
Supposing the plantation then cut down, the 2000 trees, at 1*s.* bring,	100	0	0
Deduct as above,	3	0	0
Profit,	97	0	0
First ten years expense,	7	7	6
Second ten ditto,	3	0	0
Third ditto,	3	0	0
Total expense,	13	7	6
Received second thinning,	5	0	0
Third ditto,	25	0	0
The 2000 remaining,	100	0	0
Total,	130	0	0
Expenses,	13	7	6
Clear profit in 30 years,	116	12	6
Or per acre per annum,	3	17	1

At the end of forty years.			£.	s.	d.
Expenses, as before,	-		3	0	0
Received for 2000 trees, at 2s.			200	0	0
Ditto first and second thinnings,	-	- -	30	0	0
Total	-	-	230	0	0
Deduct expenses, as before,	13	7 6			
Ditto, -	-	3 0 0			
			16	7	6
Clear profit in 40 years,			213	12	6
Or per acre per annum,	-		5	6	1

Mr. Young observes, that "this account of the expenses, produce, and profit, of planting forest land, at 3s. an acre, shews the amazing profit of such undertakings. Plantations have, in general, been raised with a view merely to beauty, or else through a very noble patriotic motive of being serviceable to the country; but it is evident, that they may be undertaken with very different views: with those of profit. So that a man may cut down the trees he planted himself, and expect to reap, in so doing, very considerable profit. If he cuts all down at the end of 20 years, and leaves not a single tree, he gains a profit clear of near 70l. an acre, which is 3l. 9s. per acre per annum from the first planting. Let me, says he, ask the most skilful farmers of this country, how they will exceed such a profit, by any system of common husbandry, on such poor land? It before appeared, he says, that common good husbandry, after some improvements, would yield but 1l. 1s. 11d. per acre profit: so that the planting, to cut in 20 years, is more than thrice as beneficial, and certainly much less exposed to accidental losses. But, supposing the trees left thirty years, in that case the thinnings pay, for the first twenty years, 1l. per acre per annum; and, at the end of the 30th, the account from the first planting, is 3l. 17s. 1d. per acre; and, in 40 years, 5l. 6s. 1d. After which time they may be supposed to decline in quickness of growth, and consequently had better be cut down, in point of profit." He adds that, "if beauty of situation is not, in some respects, commanded, we seldom see plantations of quick-growing trees; but it is evident, that poor soils should be planted upon the mere view of profit: a crop of firs, instead of a crop of wheat, barley, or oats, at 20 years growth, which so many men may expect to see out in perfection, they turn out far superior. One of the most profitable farms would be a thirty years lease of such land, with liberty to plant and cut down. One of twenty years, which is a shorter period than the generality of long leases, would, he says, thus applied, exceed common husbandry on such soils."

It is stated, that Mr. Mellish has a waste, inclosed with a ring fence of 700 acres, which he would let at 3s. an acre, tythe free. Suppose, says he, a person hired it under a lease of 30 years:

		£.
The raising, planting, &c. &c. would come to,	- - - -	2100
Rent of 700 acres, for thirty years,	-	3150
Reparation of fences, suppose,	- - -	30
Interest of 2100l. for 30 years, at 4 per cent.		2520
Total expense,	- -	7820
Produce—Thinning, in ten years, at 5l. an acre	- - - -	3500
—— Ditto, in 20 years, 1000 per acre, at 6d. 25l.	- - - -	17500
—— Cut down at 30 years, 2006 per acre, at 1s. or 100l. per acre,	- -	70000
Total produce,	- -	91000
Total expenses,	- -	7820
Clear profit,	- - -	83180

The able writer says, "this account is stated in the stile of a common farm: the first expenditure called stock, and compound interest not calculated. It is very evident, he thinks, that no man, possessed of such soils, who can hire them for 20 or 30 years, under a planting lease, need ever to be distressed at the idea of younger children's fortunes, or raising large sums of money in future. A moderate expenditure will, by planting, secure the certain possession of any sum that may in future be wanted."

In Mr. Bevor's experiments, as stated by the same writer, "Scotch firs, in 18 years, are found to be worth 2s. 6d. And a whole plantation of 50 years growth, worth 50s. on an average: they stand 20 feet square—which is 108 to an acre. In another plantation on a moist sandy loam, larches of 18 years growth, are worth 3s. 6d.: spruce firs among them not half so good, which Mr. Bevor attributes to their being trimmed up; others on same soil and growth, not served so, are almost double the size."

And Mr. Berney, at Bracon Ash, has, he says, made great improvements by planting land of 20s. an acre. "Oak, of 50 years growth, are worth 15s. each: they stand 15 feet square; this is 180 on an acre. Larch, in 18 years, (20 from the seed) are worth 6s. each: they grow out of underwoods that pays 20s. an acre. Some few of 20 years, worth 15s. each. Silver firs in the same wood not quite so large, but they beat both the spruce and Scotch. They all stand 15 feet square in the underwood." And, "in another plantation without underwood, Scotch firs, of 18 years, are 2s. 6d. each: they stand 8 feet square; which is 680 on an acre, or 85l.; that is, 4l. 14s. per acre, per annum, exclusive of thinnings. An adjoining plantation of spruce, of the same age and distance, are worth 4s. each, which is 136l. per acre, or 7l. 6s. per acre per annum, from first planting, and exclusive of thinnings. No husbandry, Mr. Young says, will equal this. A

man who would plant for profit must not regret land of 20*s.* an acre."

The "Weymouth pines, in 18 years, much larger than Scotch firs of 22 years."

In Mr. Fellowes' of Shottesham experiments, who has, Mr. Young says, "tried various trees, some years ago, so that he is now able clearly to judge which is the most profitable:"

Experiment 1. "A plantation of Scotch firs of 45 years growth, 20 feet square, on land of 15*s.* an acre, are now worth 20*s.* each on an average. At that distance there are 108 trees on an acre, or 108*l.*; which is 2*l.* 9*s.* per acre per annum, from the first planting, exclusive of thinnings, which would more than double it. But the grass under the trees would have let, for many years past, at 7*s.* an acre."

Experiment 2. "Another plantation of Scotch firs, 38 years growth, standing in rows 14 feet wide and 10 in the rows, are now worth 12*s.* on an average. This distance gives 300 on an acre; and at 12*s.* come to 180*l.* or 4*l.* 14*s.* per acre per annum, besides thinnings. The rent of the land 15*s.*; poor rates 1*s.* 3*d.* in the pound; and tythe, till 20 years old, 5*s.* an acre; the grass under them now 5*s.* an acre. It is sufficiently evident, Mr. Young thinks, that no husbandry can equal this."

Experiment 3. "Chesnuts in 38 years, on the same land, standing 14 feet by 10, are worth 15*s.* each. This is 225*l.* per acre; or 5*l.* 16*s.* per acre per annum, besides thinnings."

Experiment 4. "Scotch firs in 38 years, on the same land, measure 17 feet of timber on an average, for which Mr. Fellowes has been offered 11*d.* a foot: that is 15*s.* 7*d.* a tree. They stand 14 feet by 10. An acre would therefore be 233*l.* 15*s.*; or 6*l.* 3*s.* per acre per annum, besides thinnings. These trees are 60 feet high."

Experiment 5. "On the same land larch trees, of only 31 years growth, are as large as the firs of experiment, No. 4, which shews that the larch is a much quicker grower. Spruce by them not so large as either. The pinaster of 38 years, larger than the Scotch: The cedar of Lebanon, of the same age, would now cut into planks 12 inches wide."

Experiment 6. "A very striking comparison between the larch and the spruce fir, was tried by planting an old gravel pit levelled, surrounded by a plantation of Scotch fir, with those two sorts in alternate rows. The larch is from 6 to 12 feet high; whereas the spruce is but 2 feet on an average."

Experiment 7. "A large plantation of many acres of a poor gravelly land, at 8*s.* an acre, containing Scotch and spruce firs and larches, is now 16 years old; they are in squares of 10 feet, and are worth;

The Scotch, 2*s.* 6*d.* each.

The spruce, 3*s.* 6*d.*

The larches, 4*s.* 6*d.*

At ten feet, there are 435 trees on an acre.

The Scotch, at 2*s.* 6*d.* come to 54*l.* 7*s.* 6*d.*; or per acre per annum, 3*l.* 7*s.*

The spruce, at 3*s.* 6*d.* to 76*l.* 2*s.* 6*d.*; or per acre per annum, 4*l.* 15*s.*

The larch, at 4*s.* 6*d.* to 97*l.* 17*s.* 6*d.*; or per annum, 6*l.* 2*s.* All three exclusive of thinnings.—Suppose, says Mr. Young, we calculate these at no more than paying the rent, tythe, and town charges; and that the larch, in 20 years, come only to 100*l.* which is however under the truth: let any one calculate the profit of hiring land on a 21 (or more) years lease, and immediately planting. In what other application of the land can such great profit be made, as gaining 6*l.* an acre without any risk, and almost without any expense? It is true such a conduct cannot, like the culture of corn and grass, be general, for reasons obvious to every one; but as far as the whole demand of any neighbourhood extends, it is profitable, he thinks, to execute it."

"Suppose, says he, 5 acres of larch planted every year; at the end of 16 or 17 years, five acres will every year be cut down, of the value of 500*l.*: from that day a regular product of 500*l.* a year is gained from the application of 100 acres of land. Let to a tenant, these 100 acres produce 40*l.* a year; but planted, they produce 500*l.* a year. What an amazing difference!" or "suppose a single acre planted every year, after the expiration of 18 or 20, to cut annually 100*l.* a year from only twenty acres, which let, would yield but 8*l.* a year. How beneficial a conduct!"

Mr. Fellowes has also planted "plane trees, and finds them to thrive amazingly in low moist situations. They will, in such, grow much faster than the poplar. One he has of 30 years growth that will cut into planks 20 inches broad; but so vast a size he attributes in some measure to its standing on the edge of a ditch through which the drainings of a farmer's pigsties run. Poplars, in some parts of the kingdom, are planted in low situations to the exclusion of every thing else: it is of consequence therefore, to know that the plane will do better. But Mr. Fellowes in general, he says, recommends the larch as preferable to every other tree that he has tried; and which will pay a planter much greater profit than any of the rest."

In the 16th volume of the Transactions of the Society of Arts, Mr. Davis, steward to the Marquis of Bath, after observing that oaks and beeches planted on the *best* spots of ground, and nursed by Scotch firs, will not be so valuable at sixty years old, as the Scotch firs are on the very *worst* land at thirty, further states that "four firs will grow where one oak or beech will grow; for firs are the better, and deciduous trees the worse, for being crowded." And "that a great deal of poor heathy shallow land, which will produce Scotch firs in the greatest perfection (and a great deal of the land planted by Lord Bath is of that description), will not grow oak or beech at all, nor in fact any thing but Scotch fir. Even larch has failed universally on all those spots where the upper stratum is peat. Having lately, says he, had occasion to cut some rides through some extensive plantations of Scotch firs which were planted just thirty years ago, I measured the land, and the trees which were cut off it, very exactly, and the following result shews that the profit of planting Scotch firs has been full seven per cent. compound interest;

whereas no plantation of deciduous trees, within my knowledge, has paid five per cent. simple interest. Indeed we usually reckon, in valuing estates for sale, that the common growth, even of elm timber, on its most favourite soils, is seldom equal to more than three or three and a half per cent. simple interest.

	£.	s.	d.
336 Scotch firs, of 30 years old, cut upon a statute acre, average measure 3 feet per tree, valued at only 10*d.* per foot, viz. 2*s.* 6*d.* per tree, amount to, per acre	42	0	0
At the time of planting, this land, then newly inclosed from a common, was not worth above 2*s.* per acre, per annum, which, at twenty-five years purchase for the fee-simple, amounts to	2	10	0
And the cost of the trees and planting was not above	3	0	0
Total expense per acre, even supposing the land to be annihilated	£.5	10	0

£.5 10*s.* principal will increase, in thirty years, as follows:

	£.	s.	d.
at 5 per cent. simple interest, to only	13	15	0
at 5 per cent. compound interest, to	23	15	5
at 7 per cent. compound interest, to	41	17	4

So that the Scotch firs, which have increased £.5 10*s.* principal to £.42 in thirty years, have paid upwards of 7 per cent. compound interest."

The following statements shew the advantage of planting with ash, on his grace the Duke of Newcastle's plantations, with a valuation of the lands before they were planted, as drawn up by Mr. Mason.

	A.	R.	P.	Value per Acre. s.	d.	Yearly Value. £.	s.	d.
" Haughton.								
Bog Close, late Geo. Padley	10	0	22	8	0	4	1	1
Ditto, late Dewick	20	0	34	2	0	2	0	5
Great Kennel, in Dewick's bogs	3	2	0	7	0	1	4	6
Little Kennel, in ditto	2	0	0	5	0	0	10	0
Dobson Hopyard	1	0	0	10	0	0	10	0
Gosling Carr	8	1	37	5	0	2	2	0
Crow Park	5	2	0	9	0	2	9	6
Decoy Plantation, including the banks about Fat Close Ponds	7	2	0	15	0	5	12	6
Cross Close Plantation	3	2	0	12	0	2	2	0
Bog ground	61	3	13			20	12	0
Bevercotes.								
Farny's Plantation	51	1	0	8	0	20	10	0
Clay ground								
Walseby.								
Some pieces of land laid to Bevercotes wood	1	0	27	12	0	0	14	0
A piece of land laid to Nichhaghbush-wood	1	2	32	10	0	0	17	0
Clay ground	2	3	19			1	11	0
West Drayton.								
School-house Close Plantation	3	0	0	8	0	1	4	0
Bog ground								
Gamston.								
Land adjoining the wood	2	2	0	5	0	0	12	6
Ditto upon the common	5	0	0	10	0	2	10	0
Clay ground	7	2	0			3	2	6

	A.	R.	P.	Value per Acre. s.	d.	Yearly Value. £.	s.	d.
In Bothamsell and Elksley.								
In Patmour	41	0	0	5	0	10	5	0
Crookford	14	0	0	5	0	3	10	0
In Elksley hop-yards by the fish pond below Elksley wood	0	2	0	10	0	0	5	0
Bog ground	55	2	0			14	0	0
Ash Plantations collected.								
In Haughton	61	3	13	0	0	20	12	0
Bevercotes	51	1	0	0	0	20	10	0
Walesby	2	3	19	0	0	1	11	0
West Drayton	3	0	0	0	0	1	4	0
Gamston	7	2	0	0	0	3	2	6
Bothamsell and Elksley	55	2	0	0	0	14	0	0
	181	3	32			60	19	6
The above 180 acres, now planted, are worth upon a moderate calculation, 40*s.* an acre	180	0	0	40	0	360	0	0

The expense of planting the above 180 acres, at 15l. an acre, amounts to 2,700l. for which his grace will have an additional rent of 300l. a year.

The following is the calculation of the Bishop of Landaff of the probable profit of converting the waste rock lands in Westmoreland into plantations with larch. "A thousand acres of this sort of land might, says he, be inclosed with a circular wall six feet in height, (where the stones can be easily gotten, as they may in most parts,) after the rate of six shillings an acre, or 300l. for the whole; five hundred larches two feet in height (so as to enable them to resist the long grass,) might be planted on each acre for fourteen shillings; hence a plantation of 500,000 larches might be made for 1000l. Now 1000l. improved at compound interest, at the rate of 4l. per cent would, in sixty years, amount to the sum of 10,519l. this is the accumulated loss attending the inclosing and planting 1000 acres of rocky land in sixty years. The rent of 1000 acres, at one penny an acre, is 4l. 3s. 4d. a year; in eight years the larches would be out of all danger from sheep, so that the loss of rent ought only to be estimated for eight years; but 4l. 3s. 4d. a year, though improved after the same rate of compound interest, would not amount to 40l. in eight years; say, however, that it would amount to 81l. which is allowing more than two pence an acre for the annual rent of the land, then would the whole expense attending the plantation in 60 years be 10,600l. If the amount of 81l. for 52 years be taken into consideration the expense of the plantation in sixty years will be 11,222l. He has here supposed sheep to be shut out of the plantation for eight years; if it should be found that sheep will not crop the larch, and from more than one observation he has reason to believe that they will not, they need not be shut out at all; nor, on districts where nothing but sheep are depastured, need any fence be made. He knows the advocates for close planting, instead of 500, would require 5000 larches for each acre; he is not convinced of the utility of such close planting, except when it is intended to nurse up oaks, or other kinds of wood; but if that mode should be adopted, the thinnings, after twenty years growth, would pay the expense of it. At the expiration of sixty years, suppose that only 250 larches remained on each acre, or that one half had perished; the probable value of them may be thus estimated. From a great many experiments made by himself and collected from others he finds the annual increase in circumference of the larch at six feet from the ground, to be one inch and one half on an average of several years; and this inference has been drawn from the actual admeasurement of larches in different parts of England and Scotland, and of different ages, from ten years old to fifty. On this supposition, the larches would measure, one with another, ninety inches in circumference, at six feet from the ground. A larch which measures ninety inches, at six feet from the ground, would measure above seventy at twenty feet from the ground; but supposing seventy inches to be the circumference at twenty feet, and the length of the tree to be forty feet neglecting the remaining top; then will its solid content be eighty-five cubic feet, and the value of the tree at nine pence a foot, above three guineas. But as the trees are supposed to be planted in an high, bleak, barren situation, their annual increase may not be so great as is here supposed; instead of being worth, at sixty years after planting, three guineas a piece, admit that they are worth only ten shillings each, then would the whole plantation be worth 125,000l. and deducting the whole expense, 10,600l, as before estimated, there would remain a profit of 114,400l. The present value of 114,400l. to be received sixty years hence, is above 10,000l. (interest of money at 4l. per cent.) Ten thousand pounds at 4l. per cent. purchases an income of 400l. a year: by planting then, a barren estate, of a thousand acres, is improved from 4l. 3s. 4d. to 400l. a year, reckoning the value of a reversion as a present certainty. Sixty years is a great part of the life of a man; but it ought, he says, to be considered as nothing in the existence of a nation, or even of a family, which is a little nation. The waste lands in this and other countries, are a public treasure in the hands of private persons; all of them ought to be converted into arable, meadow,

or pasture land which are capable of admitting, with profit, that kind of improvement, and such of them as will not pay for that mode of improvement, ought to be covered with wood; the high parts, and especially the sheltered dells in the high parts, with larch, and the lower with oak, ash, &c."

In making plantations of this sort it has been advised by E. Harries, Esq. of Hanwood, to attend "to two circumstances, viz. situation and distance. The strong westerly winds are, he says, very apt to bend the upper part of the trees, especially if they stand single, or upon sloping grounds. To guard against this, a shelter of Scotch pines should be planted to the westward some years before the larch. In respect to giving the plants sufficient room: in eight years they may, he says, be twenty feet high, and their lateral shoots extend two yards every way from the trunk; and they should not then be suffered to continue nearer than five or six yards; and what are left may continue to be useful building timber. At first planting a distance of about seven feet should be allowed; they will then be furnished with sufficient lower branches, which give the tree a steady and tapering trunk. The knife should never be applied to them. There is no tree of quicker growth. He has larches that are twenty feet high in seven years growth, and sixteen or eighteen inches round. At thirty years growth they measure from four to five feet round, at five feet from the earth."

As the larch and fir are so much in use in forming plantations, it may be proper to take some further notice of their properties.

In speaking of the larch, the wood, Dr. Anderson observes, "is possessed of so many valuable qualities, that to enumerate the whole would appear extravagant hyperbole. It is known to resist water without rotting almost for ever. The piles of this timber on which the houses of Venice were built many hundred years ago, are still found as fresh as when first put in. Stakes of it have been tried in the decoys of Lincolnshire, which, between wind and water, have already worn out two or three sets of oak stakes, and do not yet discover any symptoms of decay. It is also known to possess the valuable quality of neither shrinking nor warping when put into work, nor is it liable to be pierced by worms in our climate."

It is likewise added, that "it is known to be one of the quickest growing trees, remarkably hardy, and extremely beautiful. It is much more easily reared than the oak, and could be spread over a great extent of mountains, if sufficiently bare of herbage, at little or no expense, by the natural shedding of its seeds. It would be valuable not only for ship-plank; but even crooked timbers might be obtained by using a little art to bend it when young. For flood-gates in navigable canals and wet docks it would exceed every thing that can be obtained in this climate; for barrel staves it would be inimitable; and in building it would answer all the purposes to which fir is now applied, being much stronger and more durable than that wood. When, says he, it is also adverted to, that it is next to incombustible, it deserves to be strongly recommended to planters in this country, particularly in the most rugged and barren districts; where at a very trifling charge estates might be brought to a hundred times their present value." And he thinks "that it is so much more valuable than the Scotch fir that is now universally preferred to it, for plantations of large extent, in almost every situation. That as it has only been of late introduced into Britain, the qualities of the wood are not sufficiently understood: for before the last thirty years it was cultivated rather as an ornamental tree than with a view to profit. But wherever it has been introduced it grows so freely; is so beautiful when in leaf; so highly ornamental when covered with its abundant pink blossoms in the spring, and is so elegant in its form, that it is sure to become a favourite with the planter."

However, in the opinion of "Mr. Harte, it grows slowly the first four years; but in twenty years will exceed a fir tree both in height and circumference that is double its age."

It has been suggested, that in "making a plantation of larch the thinnings may be applied to a variety of useful purposes whilst they are yet of a small size. In six, eight, or ten years, according to soil and circumstances, the trees will have attained a size sufficient to be made into hay-rakes. They grow so straight, and the wood is so light, strong and durable, as to be peculiarly calculated for this purpose; and from its shrinking less than any other wood, these rakes will remain longer firm than those made from any other. About two feet cut off from the root end will form the rake-head; and five feet above that, with a very little taken off from the thickness of the under part, will form the handle. No wood is more proper for the teeth of the rake, than some of the red wood of an alder tree, because it is not only tough, but little liable either to split or shrink. The bow may be made of ash, or of the laurel leaved sweet-scented willow, (*Salix pentandra*) which is still better. Nothing is so fit for shafts to hoes; for it is nearly as strong and much more durable than ash. Handles for brushes, brooms, scythes, &c. would occasion a vast consumption of these small spars. And light, neat, and strong chairs, for rush bottoms, might be made of larch wood at this age." It is likewise supposed that "nothing will answer better for hop-poles; for one set of these would outlast two or three sets of ash. Hurdles, spars and gates, may be made of it both lighter and more durable than of any other wood: and when the trees are of a size sufficient, they may be split down for cart shafts; and in mining countries they might be employed as posts for supporting the roofs of the mines. And the small tops cut off in making these various works, would furnish a neat, elegant, cheap and durable kind of railing, to be put upon the top of low walls, especially for preventing light sheep from over-leaping them. One end might be let into the coping, whether of sod, clay or lime; and the other end received into a slip of sawn larch wood, with holes bored through it to receive their points. From the straightness of the wood, this kind of rail would be very neat without much expense. In the same manner hencoops, crates for packing glass, &c. might be made of those materials. But one of the most exten-

sive and beneficial uses of this kind of small wood, is for the purpose of inclosing. These spars, when the root is thick enough, may be slit up the middle by a saw, and cut into lengths of five or six feet; or if smaller, they may be employed whole. As they are always straight, and nearly of an uniform thickness, if driven into the ground for a few inches in a row at the distance of a few inches from each other, with the split sides all one way, they would make one of the neatest and most complete fences that can be seen. The tops of these uprights may be received into a piece of sawed plank with holes bored in for that purpose; and supported at due distances by sloping pieces reaching from the ground to the top."

It has however been remarked, that it "must stand to be of a sufficient age before the timber acquires its best qualities of strength and durability. The largest of the larch trees on the Duke of Athole's lawn at Dunkeld was measured in the month of March, 1796, and the following are the dimensions of it:

	F.	In.		F.	In.
"At the height of	1	8	from the ground the circumference is -	11	11
	3	0	———	10	0½
	6	0	———	9	0
	9	0	———	8	6
	12	0	———	8	2
	18	0	———	7	11
	24	0	———	7	7

The whole height was eighty-five feet. There are several larches upwards of one hundred feet in height, which are five or six years younger, but none of so great a girt. The largest of Mr. Drummond's was ninety-seven feet high, but less in circumference."

It has been stated that "for a trial, the Duke of Athole has applied larch to a variety of purposes, such as mill-axles, flooring in houses, window frames and doors, posts and rails, and boat building: for all of which it appeared to answer so well that it is the greatest acquisition of wood ever introduced into Great Britain, especially as it attains a considerable size on high grounds and bleak exposures, where even Scotch firs either die or become stinted. Fishing boats made of larch under forty years growth, last nearly three times as long as those built of Norway fir." It is added, that "the late violent winds blew down a larch in the duke's lawn of fifty years of age, eighty-six feet six inches in height, containing eighty-two feet of solid wood; for which four pounds sterling was offered as it lay on the ground." And as it is not ascertained "whether larch wood is capable of resisting the sea worm; Dr. Anderson has proposed to prove it by sinking a piece of the sound, well ripened wood, with another piece of sound oak wood in the river Medway at Rochester bridge, where it is well known that every other kind of wood is very soon perforated by the sea-worm."

It is therefore concluded, that "on account of the valuable qualities of the wood the larch deserves to be cultivated in this country." And "another recommendation of it is, its quickness of growth. Eight trees being measured in the spring and autumn of the year 1794, the average of their increase in height was nearly three feet nine inches and a quarter; and one of them increased three inches in circumference at two feet above the ground. In another plantation, the trees at eight years growth measured above twenty feet in height on an average; the trees were from six to nine inches high when planted. At twelve years old they measured, on an average, from thirty-four to thirty-six feet in height. This plantation was on a good soil and in a favourable situation. Nor is it only while the tree is young that it makes these vigorous shoots; for it appears by the measurement of the trees in Dunkeld, that this in a great measure continues even till a period of age beyond that which they have as yet attained: for 120 feet in fifty years gives an average of nearly two feet and an half in height for each year of their growth."

Vast improvements have been made in the northern parts of Scotland by means of plantations of Scotch pine, upon the barest moors, and in the bleakest and most inhospitable situations: the returns of such plantations having been such as fully to satisfy the owners. And "when the collateral advantages are adverted to, the improvements, Dr. Anderson says, are very great indeed: for in the neighbourhood of such plantations, horses can be reared at so little expense, and the roofs are so much better than ordinary, as to induce settlers to make their dwellings much neater and more commodious than in other places; rails and other dead fences can be so easily obtained, that poor people are first enabled to have good well fenced gardens, and then commodious inclosures of larger extent; the branches afford fuel to the settlers; cutting and manufacturing the wood furnishes employment to many; population is thereby augmented; hence a desire for land to produce the necessaries of life, and a consequent increase of rent to the proprietor. In this way, says he, Mr. George Dempster sees fields rapidly converting into cultivated grounds on his estate, and yielding to him ten or twelve shillings an acre rent, not only without any expense to him, but after having derived a considerable profit from the sale of woods of his own planting, which grew upon land that five and twenty years before was not worth, to him, above twopence an acre, and which might have remained in that state for ages to come had it not been planted." He adds, that "a plantation of Scotch pine can be made at much less expense than any other tree in the northern parts of Scotland, because the young plants can be afforded at a smaller price. In Aberdeenshire, plants of two years old, and above that age no experienced planter will ever buy them, sometimes sell at four-pence a thousand, consisting of 1200; and they seldom exceed eight pence; and there are men who will undertake to complete the whole inclosing, and planting at the distance of a yard from each other, and supply the deficiences for five years at the rate of from ten shillings to thirty shillings the Scotch acre, according to the size of the inclosure and the nature of the fence."

And it is further stated, that "it is found by experience that there is scarcely a soil so bad or any exposures so bleak, where this tree will not live, if the plantation be of sufficient extent, and not upon the very summit of high peaked hills. They do not indeed bear the sea air very well; nor is the wood ever of a good quality, or the tree long lived, upon clayey soils. Several persons in the south of England have found that the pinaster bears the sea

blast much better than any of the other pines. The spruce fir will bear a still more exposed situation than the Scotch pine, and after a few years it shoots up with still greater luxuriance. But the cones not being to be had in an equal abundance, and the plants being more difficult to rear, they are sold at a much higher price. Silver fir in a good soil, prospers well, and is a beautiful tree, but the price of the plants is too great to admit of large plantations of them being made."

He thinks, that "where the situation is bleak and much exposed to strong blasts of wind, the plantation must not only be of considerable extent, but the trees be planted very close, so as to be not more than from two to three feet asunder: the more exposed the situation the closer they must be; for it is observed that until the branches intermingle, and thus serve to give a mutual support to each other, the trees never begin to advance with vigour. Where the plantations are thus thick, there is a necessity for beginning to thin them out from the tenth to the fifteenth year after planting. Where the plantations are extensive, these thinnings sell at a small price, but there are few situations in which they will not do more than pay for the expense of cutting them out."

It is further suggested, that the leaves and branches of the Scotch pine afford a very wholesome nourishment to cattle and sheep. In mountainous countries, where snow sometimes lies upon the ground for many weeks together, the benefit that may occasionally be derived from such plantations will be very great: and the larger branches that are left make excellent fire wood in such cases.

PLANTING *of Timber-trees;* the act of making plantations with these sorts of trees, which is a practice that has lately been more attended to than formerly; probably from the advantages of it being more fully understood and more correctly ascertained. The particular sorts of land that may be converted to this purpose with the greatest chance of profit have been already noticed.

In the accomplishing of the business the principal difficulty consists in properly adapting the trees to the nature of the soil, as without that be the case, the success is far from so great as it would otherwise be. The land should also be in a proper state of preparation for the reception and growth of the trees, and the work be executed at a proper season in a proper manner, and at suitable distances according to the nature and quality of the soil and that of the trees; the whole being well fenced in from the attacks of cattle.

It has been observed, that "the particular kinds of soil best adapted to the cultivation of the different sorts of timber trees, and in which some or other of them will be found to grow in the most perfect manner, are gravelly or light sandy soils, with free porous subsoils; gravelly or sandy loams on porous subsoils; loamy, sandy, or gravelly soils on retentive subsoils; gravelly, chalk or chalky loams on porous subsoils; loamy clays or clayey loams on porous subsoils; and strong clayey or loamy soils on retentive subsoils. Likewise thin moorish heathy soils on gravelly or porous subsoils, also on clay or retentive subsoils."

In the able Agricultural Survey of the County of Argyle in Scotland, Mr. Smith says, that "the grounds which ought to be marked out for this improvement, are such as are mentioned below. The best land would no doubt, he observes, bear timber best; and if arable land could be spared for the purpose, the return might be expected to be in proportion to the value of the soil. But in this county little or no arable land, meadow, or good pasture, ought to be laid under planting. It should have only those waste grounds which are capable of this improvement, and of no other." And "of these we may reckon, he says, first, those extensive dry mosses and moor-lands, in the hollows and on the declivities of hills, especially in the inland parts of the county. These lands are generally covered with short heath, mixed with so little grass, that they are not worth 6*d.* the acre. The trunks of trees generally found in them give, however, a sufficient proof of their aptitude to grow timber, and they can never be turned to better account than by planting them; and that with the same kind of timber that is found in them. This is generally fir, and sometimes oak. Whatever it be, follow nature, and you cannot err. It may be said that some of these situations are far from water carriage. But the whole county is so indented with seas, and so well accommodated with roads, that almost every mountain is accessible by the one or the other. Or, if any of them be not, still it may be profitable to plant it, were it only with a view of converting a great part of the wood to the purposes of extracting from it turpentine, tar, pitch, rosin, and of making pot-ashes." And "another kind of ground which ought to be planted, and of which we have large tracts, is, he says, that which is covered with brushwood, such as hazel, birch, &c. seldom allowed by the cattle to rise above two or three feet high. Here nature, which could not be mistaken in the soil, has planted wood, though it has not been allowed to grow, and has marked out the ground as fit for planting. This brushwood will prove an excellent nurse to young plants, by giving them shelter till they raise their heads above it; after which they will destroy the brushwood by excluding the sun and air from it, and reduce it to a manure which will help their growth. Among this brushwood, however, there may sometimes be found some sprouts of oak and ash, which ought to be cut over a few inches above the ground; after which they will shoot up and thrive exceedingly, from the abundance of roots which they have to nourish them. Patches of dwarfish oak, which the cattle never allow to rise one foot from the ground, are also common in many parts of the county. If these spots were brought within the enclosure of a plantation, and the bushes cut over a little above the surface of the ground, they would soon be valuable. In England, he says, even oak plants are often cut in this manner after one or two years, when they have taken to the ground, and the second shoot is trusted to for the tree; as it is found to grow with greater luxuriance than the first, which was checked by transplanting."

It is further suggested, that "stools of natural wood, wherever they are, furnish much room for planting; and at a trifling expense, when they are already enclosed. Every vacancy in them ought to be filled up with oak, ash, elm, and other valuable kinds of timber. The ground is suitable for planting; the natural wood will shelter it; and thus it will thrive well, and improve the coppice. The properest time for improving a natural wood with planting, is immediately after it is cut, when the fences are in best repair, and when the sun and air will get at the plants which may be set among bushes of less value. These bushes should afterwards be cut down, if they are found to hinder the growth of the planting. The duke of Argyle has, he says, done much in this way, and lord Stonefield, sir James Campbell, and several other proprietors, have thus improved their natural woods very considerably. Last year, he says, Captain Campbell of Kintarbet, with a spirit yet uncommon amongst the most of the proprietors of this county, planted among his natural woods no less than 20,000 trees of valuable timber. At this rate, he will, in a few years, lay the foundation of a sure and large fortune."

And "a fourth kind of ground that should be devoted to planting, is, he thinks, that on which a number of venerable native firs are still growing. These memorials of our former forests, are not unfrequent in some of the upper parts of the county, particularly in Glenety and Glenurchay; and they deserve more attention than they have hitherto met with. From the seed which they shed in winter, and which is driven to a distance by the storm, a beautiful plantation, he says, rises up in spring; but when the cattle are driven up to the mountains in summer, this precious crop, the hope of future forests, is for ever destroyed. This is the more to be regretted, as the quality of this fir is so excellent, as not to be surpassed by any in the world. The seed of this fir is, he says, precious, and a single cone of it, if possible, should not be lost. But then, in order to preserve its valuable quality, it should be sown where it is meant it should grow, without passing through the medium of a seed-bed or nursery." And "it appears necessary, he adds, in order to preserve the quality of the timber, that we should follow nature, and sow the seed directly where we intend the tree should grow. The seed too will thrive where plants would fail."

He adds that, "after some hesitation about parting with any thing that we call arable ground, he shall mention one other kind of land, which it may sometimes be proper to devote to planting. He means some high fields, which, under the old system of cultivation, were subject to the plough, but never to much advantage. These poor gravelly fields were manured by folding cattle on them at night. But now, where this system is given up, they lie neglected, and many of them are already covered with heath. With little expense, and much advantage, they might be converted to plantations. The earthen dikes which surround them might be faced with stones, of which the dikes themselves would furnish a great proportion. The tops of the dikes might be planted with firs, if not with quicksets, for more fence and shelter. The fields should then be ploughed, and, if at all convenient, dressed with some lime or other manure, and sown with the seed of the native Scotch fir, and with acorns. By this preparation of the ground the trees would, he thinks, thrive amazingly, and the wood retain its native quality."

The following is a tabular form taken with some alteration from the Agricultural Survey of the county of Kent, showing the nature of the soil in which different sorts of timber-trees are found to succeed in the most certain and perfect manner, with the uses to which they may be applied in different cases:

Surface Soil.	*Subsoil.*	*Common Growth.*	*Planted Growth.*	*Uses of.*
Heavy and gravelly Loams.	Heavy Loam with Chalk.	Birch, Hornbeam, Oak, Ash, Hazel, Beech, &c.	Oak, Ash, Chesnut, Willow, Lime, Walnut.	Timber, Hop Poles, Cord Wood, Hurdles, Bavins for Bakers, and Lime.
Sandy Loams.	Heavy Loam.	Ditto.	Elm, Beech, Weymouth Pine, common Spruce.	Ditto.
Flinty strong Loam	Heavy Loam.	Ditto.	Willow and Chesnut.	Timber, Fencing, Poles and as above.
Gravelly and sandy Loams.	Gravelly Loam.	Ash, Beech, Oak, Hazel, &c.	Chesnut, Ash.	Hop Poles, Fencing Poles, and all as above.
Gravelly, sandy and flinty Loams.	Heavy gravelly flinty Loam.	Ash, Beech, Hornbeam, and Oak.	Ash, Beech, Larch, &c.	Timber, Fencing, Hop Poles, Cord Wood, for Charcoal, Bavins, &c.
Flinty dry poor gravelly Loams.	Chalk at 2 feet depth with gravelly Loam	Beech, Oak, &c.	Beech, Larch, &c.	Cord Wood, Bavins, and Hop Poles.
Flinty and gravelly Loams.	Chalk 4 ft. with deep gravelly Loam.	Ash, Oak, Hazel, &c.	Ash, Larch, &c.	Cord Wood, Hop Poles, Bavins, Stakes, Ethers, &c.

Surface Soil.	*Subsoil.*	*Common Growth.*	*Planted Growth.*	*Uses of.*
Flinty and gravelly Loams.	With a few Flints, but nearly as above.	Oak, Hazel, Beech, and Ash.	Chesnut, Ash, and Willow.	Hop Poles, Fencing Poles, Stakes, Cord Wood, &c.
Lightish black Loam.	Dry sandy Gravel.	Birch, Elm, Ash.	Ash, Elm, &c.	Various Uses in Husbandry.
Flinty gravelly Loams	Strong Loam with Flints.	Oak, Ash, Beech, &c.	Ash, &c.	Poles, Bavins, Cord Wood, &c.
Chalky flinty gravelly Loam.	Chalk with some gravelly Loam.	Ditto.	Ditto.	Ditto.
Gravelly Loam.	Heavy flinty and poor Loam.	Oak, Ash, Hazel, and Beech.	Ash, Oak, &c.	Common Produce a few Poles, Cord Wood, Bavins, &c. Plantation many Poles, and the above.
Gravelly and chalky Loams.	Gravelly Loam with Chalk.	Oak, Ash, &c.	Ash and Chesnut.	Poles, Cord Wood, &c.
Gravelly Loam.	Ditto.	Ash, Oak, and Beech.	Oak, Larch.	Ditto.
Ditto.	Gravelly Loam and heavy Loam.	Ditto.	Scotch Pine.	The same.
Sandy Gravel.	Gravelly and Sandy Loam.	Ditto, Scotch Pine.	Larch, Chesnut, &c.	Poles, Stakes, Ethers, &c. &c.
Stone Shatter and gravelly Loam.	Strong Loam with Ragstone.	Oak, Hazel, Birch, &c.	Birch, Oak, &c.	Oaken Tillers, small Timber Poles, &c.
	Gravelly Loam with some Stone.	Oak, Birch, Aspen, Hazel, and Ash.	Ash, Chesnut, and Willow.	Fencing Poles, Hop Poles, Cord Wood, &c.
Gravelly Loam.	Gravelly Loam with some Stones.	Oak.	Chesnuts.	Hop Poles, Fence Poles, &c.
Sandy Loam.	Gravelly Loam.	Birch, Oak, Hornbeam, &c.	Chesnut, &c.	Fence Poles, Hop Poles, &c.
Sandy Loam and Stone Shatter.	Gravelly Loam with Ragstone.	Oak, Beech, Birch, Hazel, Ash.	Ditto.	Ditto.
Gravelly Loam and Stone Shatter.	Deep Loam, heavy Clay, and Gravel.	Ditto.	Ditto.	Ditto.
Ditto.	Gravelly Loam.	Ditto.	Ditto.	Ditto.
Gravelly and sandy Loam.	With strong Clay and Loam.	Oak, and ditto.	Ash, Larch, &c.	Poles, Fire Wood, &c. as above.
Gravelly Loam flinty.	Gravel with Clay, and some Flint.	Scrubby Oak, Hazel, &c.	Oak, Ash.	Timber and ditto.
Wet spungy Land.	Moist and boggy Earth.	Alder, Willow.	Alder, Ozier, Willow, &c.	Hurdles, Hop Poles, &c.
Drier ditto.	Ditto more dry.	Poplar.	White Poplar, Willow.	Hop Poles, &c.
Light sandy Loam.	Dry gravelly Earth.	Mountain Ash, Ash.	Scotch Pine, Silver Fir.	Hop Poles.
Light gravelly Loam.	With dry Gravel.	Ash.	Sycamore.	Timber, Turnery, &c.

It is likewise remarked by Mr. Nicol, that "in planting, where it is performed on the more elevated or mountainous tracts, warmth and shelter are to be considered, as without these the trees seldom thrive in a perfect manner. In such situations there is, in general, the most difficulty and the least progress made in the raising of timber-trees; the success of the planter depending greatly upon fixing on such sorts of timber-trees as may in future become the most highly valuable, on planting thickly with plants of not too large a size, and on a considerable plat or extent of ground both in length and width being planted." It is also stated that, "in these unfriendly situations to the growth of trees, small plants must consequently be chosen and planted thick on the ground; as the winds are very prejudicial to trees of a large stature, by loosening the roots and frequently breaking the fibres; but though this is the most disadvantageous situation for planting, it is possible, with proper care in the above respects, to rear young timber in it. Where it is intended to cover a mountain from its base, it will be most conveniently done by planting round the base in the first instance, rising gradually; by which means an artificial shelter will be forming, from the progress that will be made by the trees that were first planted, especially if the extent is such as to require several seasons to complete the planting. The portion first planted should be pretty extensive, in all such cases especially where shelter is principally intended."

And it is farther stated by the author of Practical Agriculture, on the authority of the same writer, that "the kinds of trees to be chosen for such situations must be regulated, in a great measure, by the soil. The pine would perhaps be found to flourish most, but the larch is preferable as a nurse. The mountain-ash, the beech, the ash, the sycamore, the birch, the fir, &c. may all be planted with reasonable hope of success; and where the soil is deepest and richest, the oak." But "in low sheltered situations, where the inconvenience of exposure to the winds is obviated, timber-trees may be planted with greater certainty of success; the chief care necessary in this case being to fix on trees of a proper kind, and placing them at proper distances, according to their sorts and sizes. As these situations admit of most kinds, on the more sheltered parts, the oak, larch, elm, beech, horse-chesnut, walnut, lime, spruce, and silver fir may be suitable; and on the less sheltered portions, the ash, birch, sycamore, hornbeam, mountain-ash, and fir, with a mixture of larch." It may likewise be noticed that "the banks of rivers and canals are mostly favourable for the planter's purpose, and most sorts of timber and other woods may be raised in such situations; the oak, elm, poplar, willow and ozier, according as they are more or less dry; but the preference must depend on the local circumstances of the different cases."

In situations near the sea coast, as they are in general inimical to the growth of timber, the beech and sycamore will be mostly found the most proper, as bearing the sea air better than other sorts. At least they are of great use in nursing the other sorts of trees till they acquire sufficient strength. It is advised in such places, as the best mode of performing the business, to plant, where the banks rise high, in the face of them much within the level of the tops, in order to afford a screen for the trees within till they have attained a sufficient height; but when they are flat, to have recourse to planting in belts, commencing the work as close to the edge of the water as possible, putting the plants in, in a very thick manner in the first rows, as at the distances of not more than about thirty inches, and using such plants as are stout, well-rooted, and not of more than eighteen inches growth.

The different methods of providing the plants have been already noticed under the nature of plantations, but the most useful are either by raising them in nurseries near the spot to be planted till of proper sizes, or by purchasing them from nurserymen in the neighbourhood. For extensive tracts of ground the first is the most advantageous mode, but when only small tracts are to be covered, the latter may often be the most advisable. In forming the nursery grounds, great attention should be paid to having them properly situated in respect to warmth, and the soil well broken down and enriched by proper manures. In Nottinghamshire, in the Duke of Portland's extensive plantations, a well situated and sheltered valley as contiguous as possible is fixed upon for the purpose, and a space of ground sufficient for the purpose is well fenced in; large boarded gates being placed at each end, with a road down the middle proper for admitting carriages to convey away the young trees. When "after the fence is completed the ground on each side the road is trenched about twenty inches deep, which may be done for about 3l. 10s. or 4l. per acre, according as the land is more or less gravelly. It is best done in the spring, when the planting season is over. If, after the trenching, two or three chaldron of lime be laid on an acre, the land will produce an excellent crop either of cabbages or turnips, which being eaten off by sheep in the autumn, will make the land in fine order for all sorts of tree seeds: but as the oak is the sort of tree cultivated in general, this is the method pursued in raising and managing that most valuable species. In the autumn, after the cabbages or turnips are eaten off, the ground requires nothing more than common digging. As soon as the acorns fall, after being provided with a good quantity, sow them in the following manner: draw drills with a hoe in the same manner as is practised for pease, and sow the acorns therein so thick as nearly to touch each other, and leave the space of one foot between row and row, and between every fifth row the space of two feet for the alleys. While the acorns are in the ground, great care must be taken to keep them from vermin, which would very often make great havock amongst the beds, if not timely prevented. Let this caution serve for most other sorts of tree seeds."

"After the acorns are come up, the beds require only to be kept clean from weeds till they want thinning; and as the plants frequently grow more in one wet season, where the soil is tolerably good, than in two dry ones, where the soil is indifferent, the time for doing this is best ascertained by observing when the tops of the rows meet, which is done when that is the case by taking away one row on each side the middlemost, which leaves the remaining three rows the same distance apart as the breadth of the alleys. In taking up these rows, the workman ought to be careful neither to injure the plants removed, nor those left on each side. The rest of the young oaks being now left in rows at two feet apart, let them again stand till their tops meet, then take up every other row, and leave the rest in rows four feet asunder, till they arrive to the height of about five feet; which is full as large a size as is ever wished to be planted. In taking up the two last sizes, the method is to dig a trench at the end of each row, full two feet deep, then undermine the plants, and let them fall into the trench with their roots entire; as very much of their future success depends on this point of their being well taken up."

And a similar mode is necessary with other sorts of trees in providing them for the purpose of planting.

In the place of this method, the acorns as well as other seeds of trees are sometimes sown at first where they are to grow and remain. "This method, says the author of the Argyleshire Report, makes the best timber; the plants suffer no checks, nor feel the inconvenience of a change of soil, and the expense of raising an extensive plantation in this manner is very

trifling. Besides, it is found that these seeds of trees will grow in situations in which the plants have failed. The most expeditious way of sowing the seed in this manner, is, he supposes, by a party of three men working together. The first with a paring spade takes up a turf, the second stirs the earth with a spade, and the third distributes the seed and covers it. If any of the seedlings fail, they may be replaced by young plants raised on a similar soil, which will soon be reconciled, when very young, to their change of situation. Indeed the oak, when planted from the seed, or at most from the seed-bed, adapts itself wonderfully to almost any soil or situation; though it delights most in that which is dry and gravelly."

In many cases, after the plants have been kept in the seminary or seed-bed for about two years, they are removed to a nursery of this kind, and planted in rows or lines twelve or more inches apart according to their sort, and from three to five in the rows, where they remain for two years longer, and are then finally planted out.

When the plants have been raised in some of these methods, so as to be in a state fit for planting out, "the next point to be attended to, where the ground has been properly drained, is that of preparing it for their reception. In this business great care is necessary, as much depends upon its being in a good condition for the reception of the plants. It is performed by the plough or the spade, according to the different circumstances of the land. When coarse plants prevail, such as heath, furze, broom, &c. they must be fully destroyed by stubbing them up, burning, or otherwise clearing them away. When burning is practised, the ashes should be blended with the soil, as they are found of great service in promoting the growth of the plants; in the opinion of Mr. Nicol. And the mode of preparing by the plough on tillable sites, where the soil is thin, is the cheapest and most effectual of any; as where the land has been in tillage, it wants nothing more than two furrows and an equal number of harrowings, to render it fit for the reception of the trees. But where it is in lay, a crop of oats, &c. should be taken the season before planting; or, if it is stubborn, a second crop, perhaps of beans, turnips or potatoes, will be necessary; previously ploughing and harrowing well, and laying the land up in a perfect method. A trench plough is frequently used for this purpose, which stirs the ground to twelve or thirteen inches. In this method it is essential to plough to the full depth each time," in order that the roots of the plants may strike down more freely.

But "where the spade is employed, which must be the case in steep situations where the plough cannot come, and where there are rocks, stones, or other obstructions; the best planters advise, that the holes or pits should be made to the full depth of the soil, and sufficiently large according to the size of the trees. For those of eighteen or twenty inches in height, whose roots occupy about nine inches when spread out, holes of fifteen inches in diameter may be sufficient. This must, however, be regulated by the judgment of the planter." And "as it is of great advantage to the trees that the turfy matter should be well broken down and reduced before the time of planting, it may be useful to have the holes made a proper length of time before the trees are put in, to admit of this being fully effected, especially on the drier and more light soils," where there is a smaller proportion of this material.

With respect to the size of the trees, it is observed by Mr. Nicol, that "from the desire of early appearance it has been too much the case to plant forest-trees of too great growth." It is, however, found that there is not only much saving of expense, but a much greater certainty of success, in planting small young trees than such as are large and of greater age. Such as have been in the nursery two, three, or four years according to their kind, may in common be the most advantageous as timber-trees." Mr. Nicol also thinks that "deciduous trees of all kinds, except the larch, of from three to five feet in height, being carefully raised with good roots, will generally succeed." He has, however, shown, that "a one year's seedling larch, nursed one or at most two years, will outdo all others of its kind in any soil or situation, and therefore advises planting trees of this age only. Firs of any kind will succeed better if under than above thirty inches, even in the most favourable soil and situation. Most generally those of fifteen or eighteen inches in height are to be preferred. From this view of the subject, it may occur to some, that to plant seedlings only would be the most advisable and least expensive method. That it would be the least expensive method is obvious; but, that it is most advisable, except for the Scotch and spruce-firs, may, he thinks, be disputed."

It is added, that "as the chief property of any young tree intended for transplantation, consists in a multiplicity of healthy fibres; hence the necessity of nursing, in kindly soil, for a year or two, all tap-rooted plants, for the attainment of this object, and that we may commit them to the less genial soil and more untoward situation with greater probability of success. For, whether shall we, says he, suppose the plant which has both root and branch to make, or that which has the latter only, in the first season after so important a change of habit, is more likely to succeed?—the latter, certainly. From which alone may be demonstrated the cause why plants of this description surpass those of greater size as stated above. These are raised with unbroken, tufty, and fibry roots; those with maimed, lank, fibreless ones; nor do they, with the utmost skill and attention, bear such proportion to the top. Consequently the fibrils cannot afterwards, by the utmost efforts of human art, be induced so immediately to seek pasturage for the sustenance of the trunk." For though lopping may in a great measure obviate this, injury is thereby done to the tree. In all soils and situations it is the safest and least expensive method to plant young healthy well rooted plants, where they can be procured.

In what respects the distance and manner of planting, Mr. Nicol's directions are, that "for the most exposed, bleak sites, and barren soil, from thirty to forty inches may be considered as a good medium; varying according to circumstances. For in an extensive tract, it will hardly happen that there is not a variety of soils. Some parts may be deeper and more loamy; others more gravelly or rocky. In the former, the greater distance may be advisable; in the latter the lesser.

"For less exposed sites, and where soil is found above six inches in depth, from four to five feet will be a good medium; varying the distance according to circumstances, as above.

"For belts, stripes, or clumps, whose breadth or diameter does not exceed a hundred feet, lying in a bleak situation, and of thin soil, the margin, on all sides, should be planted at not more than two feet apart: the interior parts at three. Those lying on a more sheltered situation, and of deeper soil, may be allowed distance according to circumstances. But narrow stripes, or small clumps, even if the soil may be termed good, should generally be planted thicker than a more extended mass, that the plants may afford each other shelter.

"For the most sheltered sites, where the soil is deep, good, and where apparently every plant will grow, six feet will be a good medium distance. Wider than this he cannot approve in any case whatever; because, at this distance, the plants have room to grow till their thinnings become useful. But even where this is not an object, there is a greater; namely, that the plants may not grow too squat in their infancy, and that the "pruning hook" be not much wanted in the formation of stately timber." It is supposed that "he who plants too thin, with the idea of saving trouble in thinning, deviates as widely from the right path, as he who thins none at all." It is therefore contended "that thick, rather than thin planting, is the safer side to err on. By which mode also, there is a more equal crop on the ground, beeting or filling up vacancies being much less necessary." And in opposition "to the common practice, it is supposed that thick planting is most necessary where the plants are largest, as the greatest number die in these cases."

It is stated in the Nottinghamshire Report, that "in the Duke of Portland's plantations, where trees of various sizes are planted in an irregular manner, the number upon an acre is usually about two thousand; but in other cases the number is frequently much larger."

In what regards "the manner of setting the trees in the plantations, it is probably the best method, except where vegetable crops are to be cultivated between, to plant without any regular order, though the line or row manner is frequently practised, as being the least troublesome and expensive of any that can be adopted." With respect to the most advantageous manner of blending or intermixing the trees, it is observed that "some have advised the planting in groups, to prevent the supposed injury of trees of different sorts growing together: others, however, prefer the mixed method, not only as affording a better means of ascertaining what sorts of timber trees succeed best, but as enabling the planter to protect them more effectually." It has however been suggested by Mr. Nicol that "it matters little whether we plant in distinct groups or in indiscriminate mixture; provided, in the latter case, we ultimately retain the most profitable and flourishing kinds only: for, with the proviso that most of the kinds evidently adapted to the soil and situation be planted according to the mode of thick planting, a sufficiency of them will remain, after all others are thinned away, for a full and final crop. For instance: if it should be supposed that the soil is best adapted to the oak; that it is desirable to raise the most valuable kinds rather than the decorative; and that, exclusive of the larch for nurses, and a few firs to enliven the borders, six kinds are to compose the mixture; plant two oaks for one elm, two elms for one beech, two beeches for one ash, two ashes for one birch, and two birches for one sycamore. And thus, says he, will the plantation at once be formed, in uniform gradation, of kinds most likely to succeed each other, in the case of either disagreeing with the soil or climate; and which also succeed each other in respect of value as timber: doing justice, at least, to the patriotic intention of the planter, should the first and more valuable kinds fail."

The same writer conceives that "in all situations, and on all soils, except those termed humid, and which are adapted to the aquatic kinds only, the larch is without doubt the most proper nurse, and therefore should take preference of all others for this purpose. But that on sub-humid, or loamy soils, the Lombardy poplar and Huntingdon willow are good substitutes; and, when variety is the object, ought to be mixed with the larch, for the purpose of nursing the other more valuable kinds. And that on elevated, poor sites, the mountain-ash, for the first ten or fifteen years, is outdone by the larch only, in the office of nursing, and is justly admitted for the sake of variety. In all situations, this plant grows quickly in youth. In maritime situations, the sycamore is likewise eminently useful for this purpose. Few trees, says he, except the above, grow faster in youth; and none are more patient of the sea-breeze. Consequently, when the site is much exposed thereto, this tree should be freely planted in mixture with the larch for nursing the oak, beech, elm, &c. if the intention be the culture of ship-timber." It is likewise suggested, "that the common pine may sometimes be useful in this view, and afford greater variety. The proportion in which trees of this sort should be employed, must necessarily depend on the peculiarity of the situation, and other circumstances. Some recommend in thin soils, and bleak situations, tree for tree: and in less exposed situations, and better soils, one nurse for two principal trees; and in most sheltered situations, with good soil, one nurse for three, four, or five principal trees may be a sufficient allowance. On the most exposed and bleak situations, where the soil is evidently sterile, the safest way is

to plant too many rather than too few," as unless well sheltered the timber trees never succeed well.

In respect to the time of planting these sorts of trees with the most advantage, and the greatest chance of success, it differs according to the nature of the soils and the plants, as well as the state of the weather. It has been stated, " that in the more porous dry soils, with the hardier sorts of trees, the autumn, as from the middle of October to the latter end of November, may be the most suitable; as they will be better established against the summer heats, which are often destructive to new planted trees. But in the more heavy soils, especially those of the clayey and loamy kinds, and with less hardy sorts of trees, the early spring season, as from the middle or latter end of February to the beginning of April, may be the most proper. The condition of the land should be particularly attended to in this sort of work, as it is equally improper to plant when either in too dry or too moist a situation." The writer just mentioned says that " at a time when the soil is neither wet nor dry, the operation of planting is most easily, and also most successfully, performed. The mould adheres not to the spade, nor does it run in; it divides well, and with little trouble intermingles with the fibres; nor, in the operation of treading and setting the plant upright, is it wrought into a mortar, to the evident prejudice of the plant, whatever weather may ensue. Consequently, on a retentive soil, it cannot be proper to plant in time of rain, nor in many cases for a day or two afterwards; nor after a fall of snow, until for several days it has entirely disappeared. Whereas, on a dry absorbent soil, it may be very proper to plant in time of gentle rains immediately after heavy ones."

There is also another circumstance which ought to be regarded in this business, which is the difference in the forwardness of the vegetation of different sorts of trees, as it should regulate in some degree the time of planting, where those of the same sorts are only made use of. In this view, it is advised that the larch, elm, sycamore, lime, horse-chesnut, mountain-ash, birch, alder, poplar, willow, and some others, should be put in by the beginning of March; and that the oak, birch, ash, chesnut, hornbeam, &c. be finished planting by the beginning of April at the latest. The best season for the planting of many trees of the evergreen kind, such as the Weymouth pine, spruce, Scotch, silver, and other firs, is supposed by some to be in the latter end of July, or in the beginning of the following month, when the weather is inclined to be moist or cloudy.

With regard to the actual work of planting, it is advised that as soon as " the trees have been taken up with care, so as to injure the fibres of the roots as little as possible, and a few of the bruised extremities cut off, they should, when intended to be planted in mixture, be put together in proper proportions, and conveyed in this way to the place where they are to be planted. They must then be distributed on the ground, at the pits or other places, in order to be ready for the planters, as by this means much time is saved, which would otherwise be lost in sorting. But to prevent the roots from getting too dry it is necessary not to take up, or bring on to the land, more than can be planted in a short space of time." But where " only one or two sorts of trees are to be planted, the usual practice of carrying the plants along as the planting proceeds may be the most convenient method for performing the work. And the operation is the best and most readily performed by two persons: a man to do the work, and a boy to hold the plants. In executing the work, the labourer first stirs the mould well in the holes or pits that have been previously prepared, rendering it level, and fit for the reception of the plant: or forms new holes according to the mode of planting that is adopted. The boy then places the plant in the hole with all the fibres of its roots regularly spread out and unconfined, to the depth of about an inch more than it had stood in the nursery, holding it perfectly upright; while the man gently fills in the loose mould, moving the tree a little up and down to let it mix with the roots: the remainder of the earth is afterwards put in; and then the labourer proceeds to the preparation of the next hole, leaving the boy to set the plant erect and close the mould about it, which in soils of the stiffer sort should be only performed in a light manner, but in those of the drier kinds, as the sandy and gravelly, as closely as possible. In this way the work is to proceed till the whole is finished. There are other methods of planting sometimes made use of, such as by forming slits, nicks, or openings of other kinds, so as just to press in the roots of the plants; but these from the roots being confined and having no loose fresh mould to shoot into, seldom answer in any perfect manner." It is well remarked that " much of the success of the planter depends upon this part of the work being well executed; but that great care should be taken, particularly where the land is inclined to moisture, or of a retentive quality, not to plant at too great a depth. In planting on steeps, it is directed that the trees should be placed towards the declivity, being put in at the lowest part of the opening; which should, in completing the work, be left the highest, by which the moisture may be better preserved for the support of the plant."

It is stated by the author of Practical Agriculture, that " it seems not improbable, but that in many cases and situations the planting of small trees of the timber kind might be performed with great convenience and expedition by the assistance of a plough suitable for the purpose, as has been sometimes practised in setting hedge-plants." Where " trees of considerable growth are planted, great attention is necessary to have them well secured against the wind, as, when they become loose, the fibres are so broken and destroyed that they soon die. This has been commonly effected by means of staking: but as in this way the trees are often in danger of being injured by rubbing, a practice of ramming the earth closely about the roots has been attempted, which in some soils, and upon small scales of planting, has, it is said, been found to succeed; but in extensive concerns it is wholly inadmissible, from the trouble that must attend it."

In some cases when " the plants have been all put

in, it is a practice to sow or set the plantations with acorns, as it is found that sown oaks as well as other trees exceed in growth those that are planted." It is observed that "this work is done either by paring off the surface with a mattock, and setting the acorns with a dibble, or by putting them in slight drills by the hoe at the distance of about six inches. The best season for performing this business is in April, and it may be performed the first, second, or third year after planting the ground, but the first or second is probably to be preferred." It is advised that "great care should be taken to preserve the acorns well, by exposure to the air and frequent turning, as they are very apt to sprout soon after being gathered." The proportions of these and other sorts of seeds that are necessary are thus stated in the Nottingham Agricultural Report.

Quantities per Acre.

Of Acorns from four to six strikes.
— Ash keys, four strikes.
— Spanish chesnuts, one ditto.
— Hawthorn berries, one ditto.

It is suggested as necessary to bury the ash keys and hawthorn berries one year in beds or pots of sand before they are sown in these situations.

When the trees have been thus planted out, it is advised as necessary not to lose sight of them, as the young plants should be kept clean and free from the annoyance and choaking of coarse weeds of all kinds, for at least three or four years. This may be done by the hoe in many cases; but some have recourse to the culture of different sorts of crops in this view. In this method, however, much care is requisite not only to avoid injuring the plants, but to guard against the soil being too much impoverished, and their growth thereby retarded in too great a degree. And "where coarse plants abound, such as broom, furze, briars, and other similar productions, in all the less exposed situations, they should be wholly cut up and destroyed; but in bleak exposures it may be a better practice to only clear them to a distance round the trees, so as that they cannot do any injury by rubbing or striking against them, the others being left for the purpose of sheltering and protecting the young trees during their young growth."

There is another circumstance likewise to be attended to in this business, "which is that of filling up the vacancies that are caused by the dead plants. Where the ground is kept perfectly clean, this may be done at any proper season; but in other cases, when the dead plants cannot be so easily detected, it may be better to delay the business to the third or fourth year, when the deficiencies can be more perfectly ascertained. If this sort of business be done too early, many plants are frequently removed that would have thrown out from the bottom, on account of their not being dead in that part, though wholly gone in the top." It is advised that "the plants employed in filling up these vacancies should never be too large, as, where that is the case, they are liable to die."

In addition to these there is still another kind of planting which is frequently practised, but the propriety of which is not yet well ascertained. It is that of setting hedge-rows with trees of the timber kinds. The utility of the practice is maintained by some on the ground of the degree of shelter and ornament that it affords, and its being a means of raising much useful timber at little or no expense; while others condemn it as highly improper and disadvantageous, on the principle that much injury is not only done to the crops, especially when of the grain kind, by the dropping and the spreading of the roots, but also to the hedge in the places where they stand, by their producing gaps and openings. The author of a late practical work, however, observes, that "though some inconvenience and injury may be sustained where this sort of planting is much in use in arable districts; yet from these being in a great measure capable of being obviated by proper training and pruning, and from the naked appearance which is exhibited without them in a country, but more particularly from the vast benefit that may be derived in the way of timber; it would seem that some extent of planting in this method should be attempted in most situations." Mr. Middleton suggests, "that it would not be an easy matter to make an accurate estimate of the advantages to be derived from such a measure: but in order to gain a slight idea as to the quantity of hedge-row timber, let it, says he, be considered that, in well inclosed, hedged, and cultivated districts, the hedge-rows occupy from a twentieth to a tenth of the whole surface. Even including the common fields, and cultivated slopes and borders of sheep-downs, the average quantity of land occupied by hedge rows, at this time, amounts to a twentieth, or two millions of acres; all of which might, probably, be made to produce timber: more than half of it, however, would no doubt do so, by only trimming the lowest side branches off to the height of ten, twelve, or fifteen feet from the ground. This would permit the air to circulate freely, give every advantage to the occupier's crops; and would leave sufficient tops upon the trees for all the purposes of growth and rural ornament. Under management like this, the hedges would every where present healthy, vigorously-growing, and handsome timber; would add very much to the profit of the land owner, to the security of the country, and to the pleasures of the traveller." But in performing the work of planting in such cases; the nature of the land, the sort of husbandry that it is principally conducted under, and the kind of exposure in which it is placed, should be well considered, and the sort of trees properly adapted to it. In dry soils, most sorts of timber trees, as has been seen, may be planted; but in those more stiff and heavy kinds, the oak and the elm may be the most proper. The ash should, perhaps, never be had recourse to where the land is almost wholly under the plough; but on lands under the grazing or grass system, it may be planted with advantage. In bleak and exposed situations, the beech is probably the best for this use; and near the sea the sycamore. The trees where the

ground is mostly in an arable state should be planted at much greater distances than under the contrary circumstances, and such trees as run most to tall clear stems be preferred. It is recommended that the young trees in this sort of planting should be larger than in other cases, being kept in the nursery two years longer than has been here advised, and shifted so as to produce more fibrous roots. When about five or six feet in height they are probably in the most suitable condition for being planted out in these places.

With respect to "the most proper time of planting in hedge-rows, it is when the fields are first broken up from the state of lay, as at that time, from their being continued in the state of tillage for some years, there will be less trouble and expense in protecting them from cattle by palings, &c. as well as less danger of their being injured by the browsing of live stock, as they will be advanced beyond their reach by the time the land is restored to grass."

And where the planting is performed in the hedge rows of grass lands, the trees must always be perfectly secured from the croppings of cattle, as well as the rubbing of sheep, or other animals, as, where this is not the case, they are soon much injured and frequently wholly destroyed. The work of planting in these cases should be carefully performed in the manner described; and where the trees do not stand perfectly firm against the wind, be well secured by stakes, or other proper means, as they never thrive well when not kept perfectly fast and steady in the soil.

The injurious practice frequently employed of converting the hedge-row timber trees into pollards by lopping off their top branches, should constantly be guarded against as much as possible, as it is the destruction of timber. It is observed that, "where pollards abound, they are mostly cropped once in from about nine to fifteen years, the profits of which in general belong to the tenant. This work should be constantly finished by the end of February where it is in use."

After the trees have acquired a tolerable growth, "it is necessary to attend to the proper pruning and thinning of them occasionally as they advance, in order to prevent their growing in an improper manner, and their injuring each other by rubbing or being drawn up weak. In the first intention, they are therefore to be occasionally looked over after the third season from planting, and such headed down, or otherwise cut, as may appear necessary for their more regular or perfect growth. When this has been done, the only thing further will be to encourage a leader, by shortening all the other branches that appear to contend with it to nearly one third of their length, in order to strengthen their main stem. The whole that is afterwards necessary is that of properly thinning the strong top branches, and those on the sides, which may be done by a light bill. This is however only applicable to trees of the forest kind; those of the fir and evergreen sort require nothing more than the regulation of their leaders, as that of keeping them single where they throw out double. The less the side branches are touched the better in all these sorts of trees, as they are very much hurt by cutting."

The writer of the survey mentioned above thinks that "the soil and climate in that county is well suited for timber; and that thousands of acres in every parish, at present of little value, are capable of this improvement and no other: that the worst land by this management may be made to yield more profit than perhaps the best arable land in the kingdom on any other plan: that this improvement beautifies the country, benefits the nation, gives employment to the poor, creates work and a fund of opulence for posterity, and in the meanwhile, yields rational pleasure to the planter, with the near prospect of large profits to himself and a sure fortune to his family." In short, he conceives, that in the present state of the country, planting is without doubt the most productive improvement that can be attempted.

PLASH, the bough or stem which is laid down by means of a nick or cut being made on the upper side of it, in repairing or restoring old hedge fences.

PLASHING, the operation or process by which this sort of work is performed. The usual mode of executing it is as follows, according to Mr. Nicol: "the stronger stems are selected, at as regular distances as possible, and generally at about thirty inches apart. These are called the stakes; and are commonly headed over at four or five feet above the surface, according to the general strength of the hedge in question, so as they may all range in line, and at one height. The more pliable branches and small twigs are interwoven, in the basket manner, among the stakes from top to bottom, as closely as possible. Such as will not bend, in a pliable manner, and afterwards remain in due position, are snagged half-through with the bill, to make them more obedient. The strong stems, that cannot be laid in, and are not wanted for stakes, are cut close by the surface. In places where stems strong enough, and fit for stakes, are wanting, the deficiency is supplied by dead stakes. After the plashing is finished, the hedge is dressed smooth on both sides with the bill," or some other similar instrument. It is a method that is much practised in Hertfordshire. See *Fence*.

The only objection, according to the above writer, to this mode, which is certainly the cheapest and most easily performed, is that the stakes, or cut-over stems, shoot forth strongly, to the detriment of the under part of the hedge, which, by over-shadowing, they retard in growth, and keep naked of spray; and which probably suggested an improvement, which he has seen, which is that of cutting none over at all, but weaving in the tops of the stakes along with the plashes. The propriety of this mode is, he thinks, at once evident; for, besides that the above complaint cannot possibly attach, the stems cut by the surface send up a strong growth, which, intermixing with the plashes, renders the whole more close and impenetrable than would otherwise be the case.

It is added that in "cases where two rows of quicks have been planted, according to the common method, at the distance of a foot from each other, the *back* row being plashed in some of the above modes, and the

front one being cut down to the stub, would be the most effectual method of preserving the present, and producing a new fence. It is however conceived that this operation can only be effectually and *handsomely* performed in cases where there is a good portion of spray and long pliable shoots or branches; and when the hedge has, if not youth, at least vigour on its side, to send forth a luxuriant growth, and cover the naked appearance the plashes would otherwise have. And that for the more handsome performance of this business, there is also a season more suitable than another, which is the fall, or beginning of winter, as at this season, the shoots are more pliable than in spring, when the sap begins to rise and circulate; at which time the shoots of all plants are most brittle. It is added that after the hedge is plashed, the ditch, provided there be one, should be scoured out, and dressed up; and, that where the fence is properly attended to, in regard to pruning and cutting, it may last for many years."

The manner of executing this sort of work in the Hertfordshire mode will be fully explained in speaking of the nature of restoring hedge fences. See *Fence*.

PLASTER, in *Farriery*, a composition made of oils, wax, rosin, gums, roots, and many other ingredients reduced to powder, but so compounded and mixed with adhesive materials that it keeps a solid form, and adheres closely to any part to which it is applied. All outward intentions of ripening, drawing, deterging, and repelling, are aimed at by plasters; and in some cases they are very serviceable, though they are but little used to horses, because of the hair, which makes them somewhat difficult and troublesome. As some of them are hard, to make changes a softer kind of plasters has been preferred, in the practice of most farriers. In some cases plasters are, however, more convenient and useful than these; their effects being of longer duration.

Some of the more useful forms are given below.

The following is the red-lead plaster, sometimes made use of in farriery.

Take of Red lead, nine ounces;
Oil of olives, one pound and a half;
Vinegar, six ounces.
Boil to a due consistence.

It requires much the same care in making as diachylon, and is good in all the same intentions.

And the following is the same sort with soap:

Take of Olive oil, two pounds;
Red lead, one pound;
Castile soap, half a pound.
In the making of this sort of plaster it is necessary first, to boil the red lead and oil, till they are well incorporated together; adding a little vinegar to separate the parts of the red lead, and till the watery parts are evaporated. This may be known by letting a little of it cool, and squeezing it between the fingers: if it sticks, and no water squeezes out, it is enough. Then add the soap in thin slices; and when all is thoroughly incorporated, take it off the fire, and make it up into rolls for use.

It is said to be a good plaster, and proper for horses after old strains by hard labour, or other accidents.

The following is a sulphur plaster often made use of in farriery:

Take of Balsam of sulphur, three ounces;
Yellow wax, half an ounce;
Rosin, three drachms;
Melt them together, and then add
Myrrh in fine powder, three ounces and a half.
Make them into a plaster.

It is a useful salve to dress wounds and ulcers, and proper for horses that are obliged to travel during the time.

The hemlock plaster, with ammoniacum, is prepared in the following manner:

Take of Juice of hemlock, four ounces;
Vinegar of squills,
Gum ammoniacum, of each eight ounces.
Dissolve the gum with the juice over a gentle fire; and continue stirring, till the liquor is evaporated, and the whole brought to the consistence of plaster. This is a discutient plaster, and may be applied to dissolve hard knotty swellings, in any part of the horse or other animal.

A good strengthening plaster is prepared in this way:

Take of common Pitch, half a pound;
Red-lead plaster, or diachylon, six ounces;
Common turpentine, two ounces;
Oil of olives, half an ounce;
Melt all these together, in a pipkin, continually stirring them; and, when they are dissolved, add
Bole in fine powder, four ounces;
Dragon's-blood, one ounce;
Myrrh,
Aloes, in fine powder, of each an ounce and a half.

Another is likewise prepared as below:

Take of Diachylon, four ounces;
Common pitch, half a pound;
Yellow wax, two ounces;
Oil olive, eight ounces.
Break the pitch into small pieces; cut the plasters and wax into thin slices, and dissolve them in the oil; then add
Frankincense,
Myrrh,
Mastich,
Aloes, in fine powder, of each an ounce;
Dragon's-blood,
Bole armoniac, of each two ounces;
Powdered galls, an ounce and a half.
Mix them all together, and constantly stirring them will bring the whole into a mass fit to be formed into rolls.

These are advised to be applied to parts that have been newly strained

Various other applications of this sort are in use.

PLASTER FLOORS, such floors as are constituted of plaster prepared from such lime as possesses a strong binding property; they are highly useful in

cottages and farm houses, as affording much security against fire. In constructing them, it is observed in the first volume of Communications to the Board, that the joists are laid in the usual manner; after which a sort of strong reed which is found in Huntingdonshire is nailed on, upon which the plaster is applied, but in order to save it, there is frequently a thin coat of common lime laid on first, to fill up the crevices and inequalities. On this the plaster is then spread out to the thickness of about two inches, being laid on with as much expedition as possible. The plaster is sold at the kilns in the midland districts at six pence the bushel. And the expense of laying it on, if burnt and prepared, is five pence the square yard; but if to be burnt and prepared by the workmen, about as much more. The floors are said to be excellent and cheap. Where reeds cannot be procured, laths may be made use of, but they come much higher.

Floors of this sort are much in use in Nottinghamshire, as well as in Rutlandshire at the Earl of Winchelsea's, where the upper floors of his farm-houses are made of it.

These sorts of floors should be more attended to in constructing small houses both of the cottage and other kinds, as being cheap and readily laid.

PLASTER *of Paris*, a substance of the calcareous kind in combination with the vitriolic acid which has been sometimes made use of as a manure. See *Gypsum* and *Sulphate of Lime*.

PLAT, a term provincially applied to the mould-board of a plough.

PLAT-VEIN, a vein running on the inside of each fore-thigh of the horse, a little below the elbow: some call it the basilic vein. It is sometimes written plate-vein.

PLEURISY, in *Farriery*, is an inflammation of the pleura or membrane that lines the chest.

It is a disease that generally seizes one side only: while the peripneumony is an inflammation of the whole substance of the lungs, and when that is violent, the pleura is also for the most part inflamed. It is often occasioned by too hard riding, or by hard work of any kind, especially in young horses that have been highly fed, and have had but little exercise. Suffering a horse to cool too soon when he has been heated with exercise; riding a horse deep in cold water when he is hot; exposing him to stand long in a sharp cold or damp air, and such like imprudences, are most frequently found to produce internal inflammation.

The signs of this disease are much the same as those of peripneumony; with this difference, that, in this, the horse shews great restlessness and uneasiness, and shifts about from place to place. The fever, which at first is moderate, rises suddenly to a very high degree. In the beginning he often strives to lie down, but starts up again immediately, and frequently turns his head towards the affected side. This last has caused many to mistake a pleuritic affection for the gripes, the sign just mentioned being common to both; though there is this difference, that, in the latter, a horse frequently lies down and rolls. When the gripes are violent, he will also have convulsive twitches, his eyes will be turned up, and his limbs stretched out as if he was dying, his ears and feet being sometimes excessively hot, and sometimes as cold as ice. He falls into profuse sweats and then into cold damps; strives often to stale and dung, but with great pain and difficulty, which symptoms generally continue till he has relief. On the other hand, in a pleurisy, a horse's ears and feet are uniformly and excessively hot, and his mouth parched and dry; and even sometimes, when he is near dissolution, his fever is continued and increasing. And though in the beginning he makes many motions to lie down, yet afterwards he runs back as far as his collar will permit, and makes not the least offer to change his posture, but stands panting with short stops, and a disposition to cough, till he has relief or drops down and expires.

In peripneumony, especially in the beginning, he is less active, and never offers to lie down, even during the whole time of his sickness. His fever is at the same time considerable. In pleurisy, the horse's mouth is generally parched and dry; but in peripneumony, when it is opened, a roapy slime will, for the most part, run out in great abundance, and he will gleet at the nose, much in the same manner as in a malignant fever, viz. a reddish or yellowish serum, or coagulable lymph, will adhere to the inside of the nostrils. In the pleurisy, the horse heaves and works violently at his flanks, has great restlessness, whilst, for the most part, his belly is tucked up; but in peripneumony he always shows fulness, and the working of his flanks is regular, except after drinking, or when any thing is administered with a horn; or at any time when, through uneasiness, he attempts to change his posture, then the heaving is stronger and more vehement than at other times: his ears and feet are, for the most part, always cold, and he often falls into damp sweats, with other symptoms common to malignant diseases, except that they come on more suddenly and in a more violent manner.

In respect to the plan of cure, the two diseases require the same management, except where accidental symptoms require some variation; as in fact it often happens that both are conjoined, and then it is hardly possible to distinguish them. Copious bleeding, and most other evacuations, are absolutely necessary in all such cases. In the beginning a strong horse may lose three quarts of blood at once, and the next day, or sooner, if the symptoms continue violent, two quarts more may be taken from him: if he be old or have any previous weakness, the best way is to bleed often, but take away a less quantity at a time. In the latter case, a horse may lose a quart or perhaps two in the morning, and a smaller quantity in the afternoon, which may be repeated the next day, or at a short interval, if the symptoms require it. Rowels are also beneficial. One may be put on each side of the breast, one on the belly, and one on the same side, where he seems to complain; or he may be rowelled on the inside of both his thighs. The actual cautery or blistering are also of great service.

All over his chest upon the foremost ribs, blistering, ointment may be rubbed, or in some cases the skin may be irritated with oil of turpentine. And internally all those medicines are proper that have been recommended in inveterate colds; especially where there is a suspicion of inflammation of the parts contained within the chest. See *Cold*, *Catarrh*, and *Peripneumony*.

It is advised by Gibson, that the diet and medicines should be both cooling, attenuating, relaxing, and diluting; and that the horse should have warm mashes, and plenty of water or gruel. The following balls are said to be useful:

Take of Spermaceti one ounce, rub it in a mortar with the yolk of a new laid egg.
Add Venice turpentine, half an ounce;
Nitre, in powder, one ounce;
Sugar of lead, two drachms;
Saffron, half a drachm;
Oil of aniseed, half a spoonful.
Make the whole into one or two balls, with a sufficient quantity of honey or syrup of corn poppies.

These are to be given immediately, with a pectoral decoction, and repeated twice a day or oftener.

Or "a pint of barley-water, in which figs and liquorice-root have been boiled, should be given after each ball; to which the juice of lemons may be added; and if the lungs are greatly oppressed with a dry short cough, two or three horns full of the decoction may be given three or four times a day, with four spoonfuls of honey and linseed oil. A strong decoction of the rattle-snake root is also much recommended in pleuritic disorders, and may be given to the quantity of two quarts a day sweetened with honey.

"And an emollient clyster should be injected once a day, where there is constipation, to which may be added two ounces of nitre, or cream of tartar."

It is added, that in two or three days the horse will probably run at the nose, and begin to feed; but should he not, and continue hot and short breathed, it may be necessary to bleed him again, and give the following clyster:

"Take of senna and marshmallows, of each two ounces: of fennel and bay-berries, each one ounce: boil them in five pints of water to two quarts, pour off the clear liquor, and add four ounces of purging salts, two or three of syrup of buck thorn, and half a pint of linseed, or any common oil.

"When by these means the horse grows cooler, and his pain moderates, the clyster may be repeated the next day, unless it operated too much; then intermit a day; and when he comes to eat scalded bran and picked hay, the balls should be left off, and only the decoction continued, with now and then a clyster."

It is observed, that "a horse seldom gets the better of these disorders, unless he has relief in a few days; for if the inflammation is not checked in that time, it usually terminates in a gangrene or collection of matter, which, for want of expectoration, soon suffocates him."

As these disorders are apt to leave a taint on the lungs, great care should be taken of the horse's exercise and feeding, which should be light and open for two or three weeks. Instead of the bran for a change, about a quart of barley scalded in a double infusion of hot water, that it may be well softened, may be given, and the water exhibited as a drink. His exercise should be gradual, in an open air and fair weather: and when his strength is recovered, a gentle rhubarb purge or two should be given.

PLOUGH, a well-known implement for breaking up the ground.

Ploughs are constructed in different ways according to the particular uses to which they are to be applied and the nature of the land on which they are to be employed: as it is obvious that no one sort of plough can be made use of in all cases with equal success, differences in the nature of the soils, situations, and methods of performing the work must necessarily require a diversity in their forms and modes of construction. Some of the more common and less complex kinds, may however be very generally applied in the cultivation of land, and of course are the most useful, especially on farms of the tillage kind.

These implements may with propriety be divided into the swing and wheel kinds, the former being such as are wholly destitute of any sort of machinery that can produce resistance in the way of friction about the end of the beam. It is of course the lightest of draught but, requires the experience of a good ploughman in using it. But these sorts of ploughs vary much in different parts of the kingdom. When well made they are however very effective, and capable of being generally employed in the ploughing of the lighter sorts of land. And they have in addition other advantages, which are those of not being so readily put out of order, and of affording less fatigue to the teams employed in drawing them. The latter sort are those which have the complex apparatus of wheels applied to them in some way or other, though they differ exceedingly in the manner in which this is done. From the steady manner in which these ploughs mostly proceed in their work, they are evidently capable of being managed by much less experienced ploughmen. It has indeed been suggested by the able author of the Middlesex Agricultural Report, that wheels seem to have been added to ploughs in consequence of the want of expertness in this sort of workmen; and that in all sorts of land, but especially in that of the stony and more stiff kind, they afford much assistance by enabling them to execute the work with greater regularity in the depth, and more evenness in the surface.

From the nature of the machinery with which they are loaded they are evidently more expensive in their construction, more liable to be put out of order, and from the friction that is produced require more strength in the teams that are employed in drawing them. And they have the disadvantage of being

more apt to be damaged in their course, by the occurrence of stones, clods, and other surface inequalities, than those of the former kind. An inconvenience attending these ploughs has also been noticed by Lord Somerville in the second volume of Communications to the Board of Agriculture, which is that "with *wheel ploughs* workmen are apt to set the points of their shares too low, so as by their inclined direction to occasion a heavy pressure on the wheel which must proceed horizontally." Of course he conceives the effect of this struggle to be an increased weight of draught infinitely beyond what could be imagined, on which account, he thinks that the wheel is to be considered as of no consequence *in setting a plough for work*; but that passing lightly over the surface it will be of material use in breaking old lays, or land where flints, rocks, or the roots of trees are present, and in correcting the depression of the shares from any sudden obstruction, as also in bringing it quickly into work again, when thrown out towards the surface

It is however supposed on the whole by the writer of the report just mentioned, that in comparing two extensive districts, one of which is managed with wheel ploughs and the other with those of the swing kind, taking every description of ploughmen that are met with in them, the wheel ploughs will be found to have the advantage in point of neatness of work.

The great weight of the carriage parts for the wheels, and the time and trouble which they require in adjusting and fixing them are however great objections to the use of this sort of plough in most cases, and particularly for the general purposes of tillage.

In the forming of all sorts of ploughs, the less they are encumbered with machinery of the wheel or other kinds the more *useful they will probably be found.*

Mr. Marshall, in his Rural Economy of Yorkshire, after noticing the similarity of the principles that are requisite in the construction of the ship and the plough, and considering the difficulty of fixing and reducing them to a regular theory, as nearly the same in both; observes that the art of construction in either case is principally attained by practice.

"In this district, says he, the ploughs of different makers pass through the soil, with various degrees of facility and execution: nevertheless, though he has paid some attention to the different makes, he finds himself, he says, entirely incapable of laying down such particular rules of construction as would do his country any service, or his work any credit. Even the general principles of construction he must mention with diffidence.

"The great difficulty, in the construction of a plough, is, he thinks, that of adapting it to all soils, in all seasons, and to all depths.

"If the soil break up in whole furrows, every inch of depth requires, in strictness, a separate plough, or a separate regulation. Here, says he, rests the main objection to the winding mouldboard, which admits no regulation in respect of depth.

"If the semi-arch or hollow of the hind part of the mouldboard be raised sufficiently high to turn a thick furrow completely, it is of no use in turning a thin one. On the contrary, if it be brought down sufficiently low to turn a shallow furrow properly, it is impossible to turn a deep one with it in a workmanlike manner. There is not room for it within the hollow or semi-arch-way of the mouldboard. The inevitable effect of this is, either the furrow is forced away wholly by the upper edge of the mouldboard, and set on edge; or the mould-board rides upon the furrow, raising the heel of the plough from the ground; the evil effects of which need not be explained.

"An upright stern, with a moveable heelplate to turn the furrow at any given depth, is in this point of view much preferable to a hollow mouldboard: and if its use in raising a crest of mould for the purpose of covering the seed be added, its preference is, he says, still more conspicuous."

Some of these inconveniencies have been obviated by the invention of moveable mould plates, as will be seen below.

In the construction of all sorts of ploughs, there are notwithstanding a few points or circumstances that ought to be particularly and in all cases attended to; such as the following: that part which perforates the soil and breaks it up, and which is usually termed the *throat* or *breast*, should have that sort of clean, tapering sharpened form, that is introduced with the greatest readiness, and which affords the smallest resistance in its passage through the ground. According to some, this part should be long and narrow, making an acute angle with the beam, as the length of the breast is supposed to have a tendency to preserve the *flag* from being broken, on account of the surface for its support being longer; which is a circumstance of consequence in the ploughing of old lays for wheat, peas, and other similar crops, as by such means the growth of weeds through the broken ground is prevented. And the resistance of the earth against the breast is likewise lessened in proportion to the acute angularity of that part against the beam of the plough.

The mouldboard should also have that sort of curved, twisted or hollowed out form which is best calculated to lessen resistance, and at the same time give the furrow slice the proper turn.

The beam and muzzle of these implements should also have such a construction as that the team or moving power may be applied in the best and most suitable *line of draught*, as this is a circumstance of great importance when several animals are made use of together, that the draught of the whole may coincide in the most perfect manner.

In the construction of every sort of plough much regard should likewise be paid to the weight, so that they may have sufficient strength for the purpose, without being unnecessarily heavy. Much may be done in this intention by lessening the quantity of wood in those parts of implements, where there is no particular stress, while it is retained so as to have full power in the others. This has been much less attended to in the making of ploughs, than its importance would seem to deserve.

Of each of the above descriptions of ploughs there are several in common use in different districts of the kingdom; but it is only necessary here to describe such as have been found to answer in the most perfect and general manner in practice.

Of the first or swing sort those most in use are

The *Rotherham Plough*, which is a light useful plough for all the less heavy sorts of soil, and which probably from its neat simple construction is in more general use than any other, especially in all the more northern districts of the kingdom. It has certainly much superiority where one plough is only required, and where the advantageous and economical method of performing the work with one man and two horses without a driver is had recourse to. It is in much estimation in all the west riding of Yorkshire, and is said in the Agricultural Survey of that district to have been invented by Mr. Joseph Foljambe of Eastwood, about seventy years ago. As constructed in that part of the island, the dimensions are as follow :

	ft.	*inch.*	
From the end of stilt on landside to point of the share -	7	4	whole length.
From the end of beam where inserted into it to ditto, of ditto - -	3	0	whole length.
Length of the beam -	6	0	
Width of the head in the widest upper part - -	1	4	
Ditto of ditto at lowest part	0	9	bottom working surface.
Ditto of share behind the wing	0	$3\frac{1}{2}$	bottom working surface.
Length of surface on which the plough touches the ground	2	$10\frac{1}{2}$	bottom working surface.
Height from ground to top of beam where coulter goes through -	1	8	
Width between stilts at the end	2	6	
Height of ditto from the ground	1	11	

Weight of wood and iron work, about $1\frac{1}{4}$ *cwt.*

It has also a copse or hock with teeth, to admit of more land being given to the plough, or the contrary, which is particularly useful.

It is remarked, that with a few trifling alterations it is made use of over the whole district, and that from being often called the *Dutch* plough, it is supposed to have been originally brought from Holland by the inventor.

Since its introduction it has received various improvements by different cultivators. In Mr. Bailey's attempts upon it the mouldboard, which is of cast iron, is so formed that the sod to be raised presses equally against it, in every part from the sock point to the place where it leaves it; and it varies from other mouldboards, in not beginning to take its rise from the bottom of the heel, but at least twelve inches farther forward towards the sock, and in being cut away at the bottom opposite the heel, about three inches high, from the sole, by which the turning of the sod or furrow slice is said to be much facilitated. Thus improved these ploughs have been found to answer perfectly in different trials, and have been allowed by those who have seen them at work to go with more ease to the teams than those of any other construction.

And Mr. Parkinson, in the Introduction to his Irish Farming, supposes, that the beam, from its crooked form, which is obvious in his improvement, by its being fixed so low down in the part next to the handles, makes the plough require less force, and to go in a more sliding manner. And that from the fore end of the beam being so much higher than the hinder part, the holder of the plough has more power, as the draught does not oppose so much resistance to him; for if the beam were fixed to the handles much higher, as is usually the case in other ploughs, this plough would, he says, be constantly rippling on the point, and in that way increase the weight of draught. And where it meets with any resistance, such as a stone, it is liable to rise up, while in this form it proceeds in a sliding manner, which affords a steadier motion, and renders it more easily held. Besides, it is much stronger; as in the part where the left handle and the beam are joined, underneath the mortice where the tenor of the beam is put in, there is a piece of wood or timber which rests on the ground and lies close to the end of the beam, by which the bearing of the ploughman on the handles does not in the least affect that part, which in other ploughs is the weakest. In this improvement of the Rotherham plough the mouldboard is so constructed at the breast as to have a slight degree of convexity, instead of being concave as is often the case, by which the furrow slice is supposed to be prevented from slipping down; and by the keeping the lower part from the ground, when it comes to the turn of the breast, it falls off; consequently, as the furrow slice has rested on or by the side of the breast, when the plough has advanced twelve inches the work is finished. By this improvement it is supposed that the plough will turn a furrow of any extent, from four to eighteen inches, where requisite, and the same in depth; as the plough that will produce a wide furrow and turn it well, is capable of ploughing deep: the convexity of the breast also causes it to clean itself better, which is a desirable property, as it is thereby rendered less heavy, and less resistance afforded by one earth being prevented from rubbing upon another, and at the same time the work performed in a more perfect manner.

The coulter has likewise a position so as to cut in a slanting manner, which causes any resistance to rise up more expeditiously, and the land to be opened with more facility than where it has a more perpendicular direction.

Where this improved plough is employed with more than two horses abreast, the additional ones must be put before the pair, as it has not land enough to follow single horses.

It has the excellent property of being small and light, while it is sufficiently strong to resist any power that may be applied to it. It is capable of ploughing any sort of land, and in larger proportion than any other except the Norfolk and Suffolk ploughs. The improvements which have been effected in the form of this plough, are stated to be in the breast and in fix-

ing the beam to the handles or stilts. There is also a cock or a sort of crank fixed by a screw and nut, so as to keep the share in its proper situation when the plough is drawn backwards.

A good representation of this plough with those improvements may be seen in the introduction to the work mentioned above.

Wheels have sometimes been added to these ploughs as a sort of improvement for particular purposes; and with either one or two fixed near the points of the beams, without any carriage parts, they have been found to pass through the soil in a very light, easy and steady manner, and where there are two wheels, to require no holder in many cases, except in setting in and turning out of the work at the ends of the ridges. As swing ploughs they are probably, however, capable of the most general application.

An improved plough of this sort, that is most generally made use of in the best cultivated districts of the kingdom, is represented at *fig.* 1 in *plate* XV.

Small's Chain Plough, is another plough of the swing kind, that is a very useful implement, and capable of very extensive application. It has its name from that of the inventor, who constructed it about forty years ago. It is neatly formed and very light in its appearance, but at the same time, from the addition of the chain, possessing great strength. It is therefore capable of being employed in strong rough sorts of soil, where other sorts of ploughs are liable to be destroyed, as when the share or even the coulter in this implement meets with any sudden impediment or obstructing cause, the stress is immediately thrown upon the chain instead of the beam. The sock is also formed with a fin or feather, by which the firm earth in the bottom of the furrow is cut and moved more readily, and in a more complete manner than could be done by the sock in the common plough. In this plough the mouldboard is mostly made of cast iron, having a gentle curve, by which the furrow slice is thrown off with the least possible resistance. It is supposed by Mr. Donaldson to be "on the whole one of the best constructed swing ploughs for all sorts of soils, in a proper state of cultivation, in common use in the island. It is capable of ploughing, with one man and two horses yoked abreast without any driver, more than an acre a day with the greatest ease. An improved plough of this sort is shown at *fig.* 2 in the same plate.

The *Somerville Plough*, is also an improved plough of this sort, in which the throat has a more clean sharpened form, and the mouldboard is rendered moveable in the manner that will be noticed in speaking of the *Double Furrow* plough. It is capable of being made use of with advantage, in breaking up deep stiff soils, as from the moveable nature of the extreme part of the mouldboard the furrow slice can be laid more or less flat, according to the particular circumstances of the case. It is consequently capable of a pretty general use.

This sort of improved plough is represented at *fig.* 3 in the same plate.

The *Suffolk Iron Swing Plough*, is another plough of this class that is found useful in different cases. It was, according to the author of the Agricultural Report of Suffolk, improved by an ingenious blacksmith in that district of the name of Brand, and made wholly of iron. It has been found to answer well in practice, in such lands as are of a strong heavy tenacious quality, and where much obstruction is afforded by the roots and fibres of different sorts of plants, and vegetable productions. Its useful properties have been fully experienced in breaking up the strong heavy rooty lands on his majesty's farm in the Great Park at Windsor, according to the author of Agricultural Survey of Berkshire, as it performs its work not only with more facility but in a better manner than most of those ploughs that are made use of in such descriptions of land. The cops by which it is drawn is said to have been constructed by Mr. Brand, and is extremely well contrived for the purpose.

An improved plough of this sort is seen at *fig.* 4 in *plate* XV.

Ducket's Skim-coulter Plough is another very useful implement of this sort, which is capable of being employed with great advantage where the surface is coarse or grassy, in order to bury it to such a depth as may prevent any inconvenience from its rising to injure the crops that may be sown upon such lands.

The principle on which this plough operates is extremely simple, and of course of a very useful nature, being merely taken from that of trenching ground in the practice of gardening, or that of depositing the surface spit of earth in the bottom of the preceding furrow, and placing the second or that taken from below upon it, by which means it is evident that that which was first turned down remains in a state of decay without any risque being incurred of the grassy material rising so as to produce inconvenience in the operations that may be going on upon the surface.

And it is capable of performing its work to a considerable depth, where the soils are sufficiently deep for the purpose.

It has been remarked by Lord Somerville in his tract on Sheep, Ploughs, and Oxen, that the skim requires a perpendicular direction, and that the coulter hole should be removed further from the throat and share, as in the common position it would choak when in work.

By this sort of plough the ground may be opened to any depth in separate horizontal portions of earth; and as the weeds or grassy surface are turned down in the first operation, and covered by fresh earth or mould from beneath, a larger proportion of nourishment is supposed to be provided for the crop, while at the same time it is rendered more clean, and the inconvenience of the roots of the grasses or other plants wholly got rid of. It requires a strong team in the heavier sorts of soil, but this is in some degree counterbalanced by the circumstance of one such ploughing being mostly sufficient for the crop. It is, says a late practical author, consequently evident that, considering the number of ploughings generally

given in the ordinary way of preparing lands for a crop of barley or turnips, and under the following system for wheat, and the labour and expense in the latter case, in raking, picking are burning weeds, the advantages of this plough are probably greater than is generally supposed. It has also advantages in another point of view, which is, that the soil is increased in depth, and the parts of it so loosened and broken down that the fibrous roots of the crops strike and extend themselves more readily in it, and of course are better fed and supported. The noble writer just mentioned thinks that in thin and sandy soils it is more particularly useful, because it cuts off all which is on the surface, at the depth of an inch or inch and a half, in order to its being laid in a state of decay, for a future crop, by which an increased depth of soil is given to every subsequent course of crops, and which often acts as a pan or support, to keep up manures in circulation, as their running through such soils too quickly is considered a great misfortune and disadvantage in such soils.

A figure of this valuable implement is given in *plate* XVI. at *fig.* 1.

It is also capable of being made use of without the skim-coulter as a common plough. When well made it costs from three to five pounds.

There is a sort of plough of this nature which has a double share, the one being fixed directly over the other. It is made use of in some of the southern districts, with advantage in putting in one crop immediately after another, as by it a narrow shallow furrow is removed from the surface, and another from below placed upon it, to such depth as may be thought most proper, it being capable of acting to ten inches or more.

In this manner many sorts of crops, such as rye and other green crops that have much height of stem, may be turned down without the inconvenience of any of the parts sticking out through the seams of the furrow slices, by which the farmer has a clean surface of mould for the reception of the grain.

The *Miner* is an implement of the plough kind that is very useful for the purpose of loosening the soil to a great depth without bringing it up to the surface, a mode of operation which is particularly useful for various sorts of tap-rooted plants, as well as for extirpating the roots of such weeds as strike deep into the ground. For these purposes it may be employed in the bottom of the furrow after the common plough.

It is constructed in a very strong manner, having only a share without any mould board.

The *Beverston Plough*, is another sort of useful tool of this kind, which was invented by Mr. Tugwell, and has been much employed in some districts in the more heavy kinds of land. It has its principle of draught given it in a very effective manner by an ingenious contrivance of iron work, in which, according to Lord Somerville, the " point of draught is *perpendicularly* above the *point* of *action*, or the throat or breast where the share fits on." A plough of this nature is shown at *fig.* 4 Plate XVIII. in which the dimensions of the plough are as follows:

				Ft.	In.
From	1	to	3	6	0
	3	to	4	3	8
	3	to	5	4	3
	5	to	6	2	5
	7	to	6	2	8
	1	to	3	1	5
	1	to	8	2	10
	1	to	9	4	8
Heel to tuck hole of share				2	6½
Tuck holes to point of share					8½
		a to b		2	4
		d to e		2	5
		c to d		1	4
		d to e		2	5
Diameter of wheel				1	9
		d to f		0	11
		g to h		0	10½
		e to i		1	0¼
		k to l		0	9
Breadth at heel				0	9
Breadth of fin				0	7
Top of beam at heel to ground.				0	8½
Mouldboard projects at top more than breadth at heel.				0	6

The *Double Furrow Plough*, is a kind of implement of this sort that has at least in its improved form been found highly useful and advantageous. Ploughs of this sort have been constructed in various ways, as with a double beam, and with a single beam only, which is the manner in which they are usually made at present.

The most improved plough of this nature is that constructed by Lord Somerville, and for which he has taken out a patent.

It is obviously advantageous in performing more labour in a given time with a certain strength of team, than other sorts of ploughs, as producing two furrows at a time. It has been found useful on the lighter sorts of land where the ridges are straight and wide, though some think it more confined in its work than those of the single kind. A principal advantage in which it excels other sorts of ploughs, is in the saving of the labour of one person, and in doing nearly double the work with but little more strength in the team, in the same time. It is remarked by his lordship in speaking of this sort of plough, in the Second Volume of Communications to the Board of Agriculture, that "the clean and sharpened construction of the breast and throat will warrant their breaking deep stiff land with infinite success; in this case the coulters should be set nearly straight with the throat and shares: in cross ploughing, or stirring, they may be set ¾ of an inch towards the land, thereby greater dispatch will be obtained in seed time. Should they carry too deep a furrow, the correction of their shares is, he thinks, obvious; should they hug too much to the land, or go unsteady to the ploughman, it must absolutely proceed from a want of setting them true, relatively to each other, and from an undue regulation of the cops; here, he says, a nice attention is required: their power also of cutting a furrow level at the bottom should afterwards be proved on

a level floor. The want of this practice in the master has, he says, condemned many a good plough, when the fault was in the ploughman only. It may suggest itself, he thinks, that two furrow ploughs are unfit for hilly ground, but the very reverse is the case. The effect of ploughing across the inclined plane, or hill, is that of carrying the soil in time to the bottom of the field, which must be carted bodily up again at a great expense: let such land, says he, be worked from the top to the bottom; let one furrow be carried with the hindmost or land share up the hill, and two down, so will the power be apportionate to the weight with which it has to contend, and needless toil to the team will be saved. That power which was required to carry two furrows up would, he observes, be superfluous in carrying the same down the hill, and the effect will be as 3 to 4, that is, an acre and a half, instead of two acres per day."

A plough of this improved construction may be seen at *fig.* 2 in plate XVI.

With respect to the improvement of these ploughs, his lordship observes in his tract on Sheep, Ploughs, and Oxen, that "from the design which represents a side view, it may be observed that besides the moveable plates, there are coulters, stays, &c. and how firmly the plough is put together, and how little waste there is of timber and iron work." And after noticing its construction in the breast so as to lessen resistance, it is added that "the double-edged coulter is formed also to produce this effect; in strength and substance it is equal to the common or narrow coulter, and being less broad, presents so much less for resistance: when in work, the stay gives a steadiness to it, the coulter being subject to frequent derangement, to correct which, must occasion frequent stops, alteration of the wedges, and loss of time."

It is afterwards well noticed by the same writer that "an economical and spirited system of farming labour already prevails in some districts; in none more eminently, with respect to ploughing, than in Essex, on both banks of the Tweed, in Suffolk, Yorkshire, and Norfolk. Here it would be no object, he says, to invade the system already established, for innovation is not palatable to farmers; nor should the first deep ploughing in Kent give way to any novel system; there can be no better husbandry; but, except for beans and tap-rooted plants, subsequent deep ploughings are injurious, both as to expense and effect. Dr. Hunter, in his Essay on the Roots of Wheat, points out the depth needful for the supply of seminal roots in wheat and wheat corn in general; that which is turned down then, in the first deep ploughing, should be rotting for the succeeding crop. Let not the bottom know what the surface is doing! Here, two furrow ploughs, even admitting them incapable of carrying a deep furrow, which is far from true, must, he thinks, come into admirable effect, for a twofold advantage can be taken, of the season in sowing, and the work being done at half the expense. But where men are chained down by long usage, and perhaps for the convenience of constant road work, to teams of heavy corn-eating cart horses, two furrow ploughs become, he supposes, objects of extreme importance, because their horses will not feel the difference between their own single furrow, working one acre, and the well constructed two furrow plough, with two acres per day: here, says he, is no system deranged, and double work done."

It is supposed that "the counties of Leicester and Stafford have profited much by their use under these circumstances, although their two furrow ploughs, in other respects good, have never, he thinks, been so constructed in the throat and breast as to destroy the means of resistance. Without doubt, obtusity in these particulars, must add incalculably to the weight, must break the furrow, and so spoil the work; moreover, let it not be forgot, says he, that removing resistance not only diminishes the labour of the cattle, but is also of equal advantage in increasing the strength of the implement;—the resistances with a well constructed, and with an ill constructed plough, in performing the same work, are, he observes, as different as the resistance of a well constructed king's cutter, and of a floundering Dutch merchantman, sailing with equal velocity."

It is further stated by the noble inventor "that in his own country these ploughs have met with a reception more favourable than could be expected in so short a period. On the 16th of October, 1798, two furrow ploughs were not, says he, thought capable of breaking up ley ground, although in constant use for fallowing, but from their construction requiring six oxen. On the 16th of October, 1799, a very large and respectable farming society gave, he says, a premium for two furrow ploughs, working ley ground only. On the day following, in the presence of many members of this society, one acre and a half of ley ground was broken up by four oxen, with infinite ease to themselves, in 3 hours 55 minutes, they having, as part of a constant course of work, ploughed 17 perches short of an acre of ley ground the same morning: this was done to *prove* the *effect* of *moveable plates* at the extremities of the *mould-board*, that the furrows might be laid more or less flat; for mould-boards, formed to lay furrows in ley, so as to give the most soil to harrows, cannot be of that form best calculated to make good work in stirring earths, more especially the last, which ought to be thrown up in small seams, as it were, that the seed may be duly buried. It has hitherto been held necessary to rip off the plate for this purpose, and drive in wedges, by which the mould plate must be injured. From the trouble attending this operation, it has, his lordship says, for ever been omitted, and the land, of course, imperfectly worked. But this inconvenience may be remedied, and the mould-board be adjusted with great facility and expedition, by the following means:—When the mould-board is formed, and its plate fitted as usual, let, says he, the parts marked *aa* be cut off, and again connected with the fixed part of the mould-board by means of flat hinges, or of thin flexible plates of tempered steel, or of hard hammered iron, so as to admit of those parts being set to have different inclinations with the fixed part of the mould-board: by means of two screws passing from the in-

side through the lower parts of the handle of the plough, opposite the backs of these moveable pieces *a a*; those screws may be made to keep them at any desired degree of inclination, according to the nature of the work to be performed." It is stated by his lordship that "ley grounds cannot be laid too flat, or seed earths too much on an edge; and by this improvement of the mould-board, the plough may be instantly adjusted for either purpose: when these moveable parts are screwed outwards it will cause a proportionate convexity inthe base of the furrow,and so give more earth to cover the seed. That plough which can give most mould to the harrow, is the best for a ley crop.—That part of the mould plate that is marked with the dotted line *c c* being found most liable to wear, should be made of a double thickness, that is twice the thickness of a new crown piece: it will then last nearly as long as the plough. The increased weight of draught when these moveable plates were extended, did not, his lordship says, appear, in a two furrow-plough, to be by the cops more than 12 pounds, in ley ground, at 6 inches depth. It is needless to state the success of these alterations; the friction in furrows required to be laid flat, was less than could be supposed, probably not more in both furrows than from 12 to 6 pounds."

In respect to this point of "the moveable mould-plate, and its operation on the furrow. If the breast of a plough be obtuse, the whole struggle, his lordship says, lies there—there is the furrow turned, and the hindermost part of the mould-plate has little or nothing to do: the furrow may be well laid for one particular sort of work, but the breast of the common plate can only be of one form, therefore can only turn one description of furrow; and this must be done at an increased weight of draught: this is, he says, beyond all contradiction. In these moveable plates, the furrow is not turned until it reaches the remotest point of action, at a distance of two feet from the point where the furrow is cut off from the land. By the gentle and progressive turn of the mould-plate, the earth hangs balancing, as it were, in the air, and the slightest pressure of the moveable plate lays it over. The principle of this plate is, as has been seen, to deposit the furrow at any angle required, and to qualify it thereby for the different purposes of husbandry. There is another principle in ploughing, he adds, equally well established; namely, that the base or bottom of the furrow must be cut level and true, or the surface of the work will be untrue, and the crop derive otherwise material injury. To effect this, the plough must go close at heel, and upright in its work, therefore the furrow must assume one form only. A third principle equally certain is, he thinks, that in ploughing ley ground, or for sowing on one earth, the furrow should be laid far more flat than is advisable in the last stirring or seed earth. As for barley, &c. hitherto, says he, we have obtained one of these objects at the expense of the others. No two-furrow plough could, for an instant, make work, except in an upright direction; for if it did, the 'land,' or left share, would be buried too deep, and the furrow, or right share, would be thrown out of work. But still further he will be bold to say, that no single-furrow plough, whether constructed in China, in France, or in England, has ever yet, or ever will be, able to answer all these purposes, without the aid of a moveable plate; and therefore, however good for a limited purpose it may be, it cannot be called a perfect implement; it is incapable of doing all that is for ever required of it to do. It would be the height of folly and extravagance to construct two implements where one would do. He therefore sits contentedly in the conviction, that these plates must be resorted to."

It is added that "in many cases, the moveable plate will probably supersede the use of the Turnwrest plough.

His lordship further observes that, "it cannot be deemed irrelevant to the subject, here to state the result of a challenge given to the owner of these ploughs, to plough 24 days' work successively, on his majesty's farm,either at Kew or Windsor, on the 10th of March last. The challenge was accepted, and it is a matter of regret, he says, that this challenger did not venture to appear, although repeatedly urged to do so; because, a trial for such a length of time, and between two breeds of cattle so distinguished for their powers in labour, must, his lordship supposes, have thrown great light on a subject of such importance to the farming world. That something, however little, might be proved, his majesty was pleased to allot, he says, the only piece of land then unstirred, 17½ acres, statute measure, which was ploughed by a two furrow plough, 4 Devonshire oxen, 6 years old, a man, and boy as driver, in six days and a few hours: the oxen were in good order at the commencement of their work,and finished it higher in order,as well as in flesh, than when they began. This is, he thinks, a strong fact; but numbers in the vicinity of London, he says, know it, and are ready to prove the fact. These oxen, as is the custom in their country, never tasted corn."

According to "Mr. Perrott of Evesham, these ploughs do their work well, and are on the best construction he ever saw."

And Mr. Westphaling, of Radvale near Ross in Herefordshire, observes, that this plough "certainly makes exceeding good work, and turns the furrows remarkably well. The time of its arrival was not, he says, the most favourable, as their soil, in general light and easy, is now, by the wet and sun,caked, and works with great difficulty; notwithstanding which, not one farmer but says it will be of great use in many instances. It is lucky for him, he says, that his ploughman likes it double, and is inclined to use it on all occasions." And Mr. M'Dougall observes, that "Mr. Shirely from Warwickshire, gives a good account of the double-plough; and sees no difference between the draught of four horses in the double and his own single furrow plough." A circumstance which has been noticed by others.

In regard to the advantage of these ploughs, his lordship offers the testimony of another person,personally a stranger to him; his partiality, therefore, is, he says, to the plough itself; not to the inventor. He is not

" disposed, he says, to draw absolute conclusions from ploughing matches, because much may depend on accident; besides that, exertions might be made for three hours, without much apparent distress, which nevertheless could not be maintained for three weeks, and so the public become misled. Yet, as this match was much talked of, and many questions on the subject put to him, he wrote to Mr. Tweed to know the particulars; his tale is, he says, plain and unvarnished.

" Mr. Tweed's land is strong and stiff in quality, and not a turnip has been sown there for more than twenty years past: it is what we term bean and wheat land. The practice of that country has been to allot 100 acres of land in tilth to four horses; therefore, let it be remembered, says his lordship, that the saving of expense obtained by the use of the two-furrow plough does not arise from a comparison on lands, expensively cultivated with four or five horses, incurring a charge of twelve, sixteen, or twenty shillings per acre; but in the county of Essex, and in the vicinity of Chelmsford, where it has long been a system to work these strong soils with two horses and no driver; and where this art is allowed to be as well understood, and practised with as much skill and economy as in any part of Europe, Flanders not excepted."

The following is Mr. Tweed's account of the business in a letter to his lordship: " In answer to the ' letter I have just had the honour to receive, I take ' the liberty of stating the experiments I have made ' with your two furrow-plough upon strong land, as ' well as the result of the only match I have yet been ' engaged in. I put my first plough to work with ' three horses and one man, against two of my own, and ' four horses, held by two remarkable good ploughmen, ' who are very much averse to any new implements: af- ' ter exerting themselves to the utmost every day for ' a month, upon clover lays, bean and pea etches, for ' wheat, they allowed, very much against their in- ' clinations, that it performed the work best, which ' is entirely owing to the superior form of the breast, ' and the great advantage derived from the moveable ' plates. This trial having perfectly convinced me ' that there is an absolute saving of five shillings a ' day every day they are used, I ordered a second, ' and soon after a third, and have ever since had all ' my work done with them, nine horses, and three ' men, which before employed six ploughs, twelve ' horses, and six men, causing a reduction of one ' fourth the horses, and one third of the men, and ' is, in my opinion, one of the greatest improvements ' that ever was made in agriculture, for which I con- ' ceive the public and myself highly indebted to your ' lordship. Being at Mr. Lovibond's rent dinner ' (the gentleman I live under), I made a proposal to ' the company, who were all farmers, to plough for ' a wager, two acres of any land with the two-fur- ' row plough and three horses, as well, and in the ' same time, as one acre could be ploughed by a ' single one and two horses. This was accepted by ' Mr. Gibling, of Hatfield, and a field of his fixed ' upon that had been sown with rye directly after ' harvest, (stubble) upon a wheat etch, and being ' fed by bullocks and sheep in wet weather, poached ' a great deal; and when the ploughing took place, ' was extremely dry and bound. A great number of ' spectators attended; at starting, the odds were three ' and four to one against the two-furrow plough, as ' it was supposed not to be able to break up, and ' turn hard work: after a fair contest, five farmers ' were appointed umpires, who were unanimous in ' their decision, that the two-furrow plough, having ' executed the work soundest and best, and in the ' least time, was entitled to the wager.

' I remain, &c.'

Sandon, 1802.

In a second trial, " the sweepstakes was adjudged by ' the umpires to the double-furrowed plough of Mr. ' Thomas Little Tweed, of Sandon. A double-fur- ' rowed plough was allowed, by the articles, to have ' four horses; but Mr. Tweed's was worked with ' only three, and ploughed two roods, not only in ' the best agricultural manner, but within consider- ' ably shorter time than the other common ploughs ' did their one rood.' The noble writer says, that in addition to this testimony he has only to add, that it has not been his ill fortune to verify the old adage, which says, ' A prophet is no prophet at home;' for these ploughs are spreading, with unexampled rapidity, over the county in which they originated: and at a very large meeting of farmers, held there lately, no ploughs of any other description appeared, and the prize given by subscription, was contended for by these ploughs only."

His lordship says, that " it has been argued, that a two-furrow plough, with the double mortised beam, has an advantage over that of the curved single beam, inasmuch as, by a screw, the beams can be brought nearer or set more apart, for the purpose of cutting a wider or narrower furrow. In common ploughing, no great benefit was, he says, contended to result from this power, but in sowing under furrow, great things were to be expected. Now let us, says he, look round, and see where the tillage husbandry is reputed to be good, and single-furrow ploughs in use, consequently, the size of the furrow is optional; let us see, he says, whether the wide or the narrow furrow is preferred. We can in a moment instance the usage of the country round Westham, in Essex, and Petersham and Moulsey, in Surrey. In both instances the land is level and good, and the broadcast husbandry very high in reputation, as their crops, on an average of years, are ready to testify. Here the seed is, he says, ploughed in at a ten or sometimes at an eleven inch furrow. We are not, however, he adds, to establish a general system on two or three instances—twenty or thirty might, perhaps, be adduced; but they are worth, at least, one assertion. It has been his determination, he says, to avoid, as much as possible, any comparison of other implements with his own; but he may say, that he learns from one, who is as good a judge of husbandry as any among us, and has compared the double beam two-furrow with that of the curved single beam

in mortising and iron work, and consequent tendency to derangement, there is an absolute difference of one horse in four in favour of the patent plough.

It is added that, "if land is inclined to be wet and stiff, the less trod it is, the better. Here Mr. Tweed's mode is to work three horses, one on the land, and two in the furrow one before the other, instead of three abreast: and it appeared by the regulation of the *cops*, i. e. an iron screw, acting through the end of the beam to regulate the depth of work, how little he has added to the weight of draught. It is almost needless to say, that the true point of draught should be exactly in the centre notch of the cops; any deviation to the right or left can only be for the purpose of counteracting a false friction or pressure, which must have added to the weight. The size of a furrow, provided it be of just proportions, is optional; that which he has preferred is nine inches and a quarter, and for every purpose of husbandry he knows of none better. It will give as much mould, or 'crumb,' (as we term it, provincially) to the harrow, as any other furrow whatever: this is the best object in ploughing for a ley crop. If ley peas are to be sown, every other furrow, at nine inches and a quarter each, there will be, he says, an interval of eighteen inches and a half between the rows; a distance as much approved as any we know. At every third furrow for beans, the interval will be twenty-seven inches three quarters: at every fourth furrow, thirty-seven inches: and it must be allowed, that if any implement be attached to a plough for delivery of pulse, or white grain in drills, the upright position necessarily belonging to the two-furrow plough, when in work, will qualify it admirably for this purpose."

These observations place the utility of double-ploughs in a point of view that seems to deserve the notice of the practical farmer in a much greater degree than has hitherto been the case.

The *Norfolk-Plough*, is a kind of plough that is held in much esteem, in that, as well as some other light land districts, as performing the work in an easy and expeditious manner without any great strength of draught. The carriage and wheels in all ploughs of this nature, however, form objections to them, and at the same time render them awkward, clumsy implements.

An improved plough of this sort is shown at *fig.* 1. in plate XVII.

In this kind of plough, the head and beam are short, while the carriage part and wheels stand very high, of course the fore end of the beam is much elevated, by which, advantage is gained in driving the horses or team, as it is usually drawn by two horses yoked abreast, the ploughman directing them by reins, by which there is a saving of one person.

The *Kentish or Turn-wrist Plough*, is another sort of strong plough, much used in the strong heavy, flinty or rocky soils in that district. It is a very powerful implement in such sorts of land, but extremely clumsy, heavy, and awkward. The expense of it, when complete, is mostly about five or six guineas. A representation of it is given at *fig.* 2 in the same plate.

In the Agricultural Survey of the County of Kent, it is described in the following way: It consists "of a beam of oak ten feet long, five inches deep and four broad, behind which is a foot five inches by three and an half, and three feet and a half long, on the top of which the handles are placed; the foot is tenoned to the end of the beam, and mortised at the bottom to the end of the chep. Through the beam, at two feet five inches distance from the foot, is a sheath of oak seven inches wide and one and an half thick, which is mortised into the chep in an oblique direction, so that the point of the share is twenty-two inches distant from the beam. The chep to which the share is fixed, is five feet long, four inches wide, and five inches deep. The share is of hammered iron, weighs about thirty-two pounds, is twenty inches long, and from four inches and a half to seven inches wide at the point. The upper end of the beam rests on a carriage with two wheels, three feet two inches high. On the axle tree is a gallows, on which is a sliding bolster to let up and down. Through the centre of the axle is a clasp iron, to which is fixed a strong chain called a tow, that comes over the beam, so fixed, as by means of notches (or a pin called a check) to let the whole plough out a greater length from the axle, thereby letting it down to a greater depth."

Besides these different sorts of ploughs there are various other kinds in use in different districts, as the *Single* and *Two-wheel Ploughs*, both of which are good ploughs for particular purposes; but as any of the light swing ploughs, that have been mentioned above, may be readily converted into wheel ploughs by the addition of that apparatus, it would be unnecessary to give any representations of them.

The *Hampshire* or *patent iron-Plough* is a very useful plough, and is seen in plate XVIII.

Ploughs have been contrived with more than one coulter, in order to reduce the surface more effectually; but these have in modern practice given way to implements of the harrow kind, such as cultivators, scarifiers, scufflers, &c.

Four-coultered Plough, where *fig.* 1. is a front view, *fig.* 2. land side, *fig.* 3. section shewing internal parts. An implement invented by Mr. Tull, as an improvement on the common plough, and which cuts the pieces of earth into four; by which it was supposed to divide the earth four times as much as the common plough. It differs from the common wheel plough in some respects, and is thus described in Tull's Horse-hoeing Husbandry. Its beam is ten feet long, whereas that of the common plough is but eight. The beam is straight in the common plough, but in this it is arched in one fourth part of its length near the plough head. At the distance of three feet two inches from the end of the beam at the plough tail, the first coulter, or that next the share, is let through; and at thirteen inches from this, a second coulter is let through; a third at the same distance from that; and, finally, the fourth at the same distance from the third, that is, thirteen inches. The crookedness of the upper part of the beam in this plough is contrived to avoid the too great length of the three foremost coulters, which

would be too much, if the beam was straight all the way; and they would be apt to bend, and be displaced, unless they were vastly heavy and clumsy. Ash is the best wood to make the beam of, it being sufficiently strong, and yet light.

The sheath in this plough is to be seven inches broad. The fixing of the share in this as well as in the common plough, is the nicest part, and requires the utmost art of the maker; for the well-going of the plough wholly depends upon the placing of this. Supposing the axis of the beam, and the left side of the share to be both horizontal, they must never be set parallel to each other, for, if they are, the tail of the share, bearing against the trench as much as the point, would cause the point to incline to the right hand, and it would be carried out of the ground into the furrow. If the point of the share should be set so, that its side should make an angle on the right side of the axis of the beam, this inconvenience would be much greater: and if its points should incline much to the left and make too large an angle on that side with the axis of the beam, the plough would run quite to the left hand; and if the holder, to prevent its running quite out of the ground, turns the upper part of his plough towards the left hand, the pin of the share will rise up and cut the furrow diagonally, leaving it half unploughed. To avoid this and several other inconveniences, the straight side of the share must make an angle upon the left side of the beam; but that must be so very acute a one, that the tail of the share may only press less against the side of the trench than the point does.

The great thing to be taken care of, is the placing the four coulters; for on this the success of the whole depends. These must be so set, that the four imaginary planes described by their four edges, as the plough moves forward, may be all parallel to each other, or very nearly so; for if any one of them should be very much inclined to, or should recede much from either of the other, then they would not enter the ground together. In order to the placing them thus, the beam must be carefully pierced in a proper manner. The second coulter-hole must be two inches and an half more on the right hand than the first: the third must be as much more to the right of the second, and the fourth the same measure to the right hand of the third: and these two inches and an half must be carefully measured from the center of one hole to the center of the other. Each of these holes is a mortise of an inch and a quarter wide, and is three inches and an half long at the top, and three inches at the bottom. The two opposite sides of this hole are parallel to the top and bottom, but the back is oblique, and determines the obliquity of the standing of the coulter, which is wedged tight up to the pole.

The coulter is two feet eight inches long, before it is worn; the handle takes up sixteen inches of this length, and is hollowed thus long, that the coulter may be driven down as the point wears away.

It is a heavy tool, difficult to manage, and fit only to break up meadow ground, or ground where there are very few or no stones, and has of course fallen much into disuse.

The *Marking Plough*, is used in straightening and regulating the distance of ridges where the drill system is practised.

The *Double mould-boarded Plough*, is a kind of plough often used with advantage in making furrows in setting potatoes, cabbage, and other similar crops, and in earthing up such as are planted in wide rows. Those whose mould-boards move on hinges, and may be set wide or narrow at pleasure, are the most convenient.

The *Single Hoe Plough*, is also often useful in stirring the mould in the intervals of different sorts of crops, and laying it to the roots of the plants, and thereby preventing the growth of weeds. The mould-board in this plough is so constructed that it can be raised or depressed at pleasure according to the nature of the crop, and the intention with which it is used.

Ploughs have likewise been invented and constructed entirely without coulters.

The *Argyleshire Plough*, contrived by the Rev. A. Campbell, is a plough of this sort.

It is observed that "as the common plough is very liable to be choked by an accumulation of stubble, &c. in the narrow angle under the beam before the coulter, and, not unfrequently, is thrown out of the ground, by catching small stones or shells, between the points of the coulter and sock, both these inconveniences have therefore been attempted to be obviated by throwing aside the coulter altogether, and supplying its place by an upright feather attached to the *land* side of the sock, and which serves the purpose of slicing off the furrow in the same manner as a coulter; for, being laid off on the same angle, it is found, in practice, to succeed to admiration. Small ploughs of this sort employed in horse-hoeing turnips, beans, cabbages, &c. of which the weight of the wooden part is about 40 lb. and of the iron work about 36, and cost about 2l. 10s. each, are made in a very accurate manner, by Messrs. Brown & Co. coachmakers, Abbeyhill, Edinburgh, who have made several, and can supply any number of them on demand.

It is remarked in respect to "the operative powers of this plough on the authority of experience, from having for some time used it, that it is found to answer extremely well, more especially in taking the earth away from the sides of a drill crop; for which purpose, it is conceived to have attained absolute perfection; as its broad upright feather, which operates as a coulter, completely shields the plants from all risk of earth falling on them from the left side of the plough, while, at the same time, the ploughman ascertains, to a certainty, that the part of the plough below ground, approaches no nearer to the roots of the plants, than the upper part does to their leaves; so that he can bring the plough to slice off the earth close in upon their sides," if necessary.

In point of draught, it is precisely the same as the common plough.

This plough obtained the premium from the Highland Society.

The same gentleman has likewise invented a very curious and useful muzzle or copse for ploughs, which by a single twist of a screw, gives both *earth* and *land*

or depth and breadth at the same time, or either as may be requisite, even in the most minute degree. It weighs from 10lb. to 13lb. according to the size of the plough it may be used for, and costs from 9s. to 13s. It is also strong and durable, and may be had as above.

PLOUGHING, the act of breaking up, and loosening the soil by means of a plough.

This or some other mode of loosening and turning up the upper parts of soils, are in all cases necessary to render them suitable for the reception of the seed and the growth of the crops. As it is only by some such method that a proper bed for the roots of the young plants can be prepared, and a proper condition of the land for supplying them with due nourishment be provided; in performing the operation it is a matter of great utility for the farmer to have particular attention not only to the state and nature of the ground, but also the season of the year, and kind of crop that is to be cultivated, as in this way the preparation of his lands may be rendered more perfect and suitable, and at the same time some of the natural defects under which they labour be removed. In almost every sort of soil it has been observed that "ploughing them up before the latter part of the autumnal or beginning of the spring season commences, renders them capable of imbibing and retaining a large proportion of moisture for the succeeding summer; while the turning them up during the spring and summer, causes much waste and discharge of moisture by evaporation and other means.

"Where the soil in its natural state is too dry, and possesses too little tenacity for the growth and support of such crops as are necessary to be put into the earth in the spring months, the land by being fully brought into a state of preparation for the crop in the autumn, and the seed introduced without any additional ploughing in the spring season, may be preserved in a more moist and adhesive condition, consequently in a more proper state for the growth of such crops; but where the soil is naturally moist, and the crops that are to be cultivated require that it should be dry and mellow, when they are put into the ground, the ploughing, by being deferred for the winter and performed as late as possible in the spring months, when it is become a good deal dried, will be the more advantageous for the crops that are to be grown upon it."

In addition to these it is observed, that there are other circumstances that constantly demand attention in the process of ploughing land. "In all the stiff, heavy, and more adhesive kinds of soils, that are much disposed to the retention of moisture, whether they be perfectly clayey or have more of a loamy quality, it should be a common rule never to plough or turn them up when wet in any great degree, except where the nature of the crop requires it: as when such sorts of land are ploughed under such a condition, the parts of which they are composed are very apt to cake and run together into hard lumps, that require much trouble and difficulty to be afterwards reduced into a fine state. And further, great injury is produced by the treading of the team, as well as a much greater power necessary in performing the operation." They should not however be suffered to become in such a state of dryness as to oppose too much resistance before the work is undertaken. It is however suggested in the third volume of Communications to the Board of Agriculture that in all such lands where the clayey material is the most predominant, the ploughing may be performed when the ground is wet without injury, where the work is executed before the commencement of the frosts in the winter, while in the spring the teams should not be suffered upon the ground until it be in a properly dry condition.

In all those sorts of land where there is a considerable depth of vegetable earthy matter, as those of the moss, moor, peat and fen kinds, the ploughing of them when under the state of tillage should be executed where they are in a favourable condition in respect to dryness, as under the contrary circumstances they can rarely be ploughed with benefit, and in many cases not at all.

In most of the more light dry sandy gravelly sorts of land, and perhaps in some of the more mellow descriptions of the loamy kinds, the work of ploughing may be had recourse to, especially in putting in the crops, when they are in a considerable degree impregnated with moisture, without any disadvantage being sustained, and sometimes even with benefit, as they are liable to part with their moisture in too quick a manner. This circumstance should indeed direct the farmer in such sandy sorts of land, to stir them as little as possible when the season is hot and dry, so as merely to keep down the weeds, as much mischief may otherwise be done by the exhalation of moisture that may be caused. These sorts of land are of course managed with much less trouble and expense of teams, as well as with less difficulty in respect to the state of the weather.

It is evident that the depth to which lands should be ploughed should in some degree vary according to the nature of the soil and the crops that are to be grown. It would likewise seem proper that the seed furrow should have less depth than those ploughings that may have preceded it; and perhaps in general deep ploughing is not so necessary as has been supposed, except in the cases of tap-rooted plants. It has indeed been well remarked by Mr. Kent in his Hints to Gentlemen Farmers, that though deep ploughing has been much advised by different writers lately, on such sorts of land where the bottom and surface are of opposite qualities and neither of them good; as a mixture may in such cases be advantageous, and may be effected by their going below the usual depth. But that in instances where the top and bottom, to the extent of eighteen or twenty inches, are similar, he does not think it ever proper to exchange the surface part, which has been gradually for a great length of time increasing in fertility, for the under part, which has only the property of being more fresh, He has stated, he says, that ploughing deep except for certain sorts of crops as above is never requisite or advisable. The growth of the common crops of corn or grass do not require any great depth. He like-

wise remarks that where ground is ploughed to a great depth the roots of weeds are only turned over, without being removed or thrown upon the surface to decay, while clean light or shallow ploughing dislodges them in a perfect and effectual manner, In some districts, as that of Cornwall, where the soil is extremely shallow, a large produce is afforded; and in several other counties the land is found to be injured by deep ploughing, or going below the usual depth, to which the lands have been ploughed. It is added that hand-hoeing is known to every one to be more effectual in cleaning land than a ploughing: and the process of paring and burning renders land perfectly clean, though it be only two inches in depth. All these seem, he says, to show that ploughing to a great depth is by no means necessary in the cleaning of land; and it cannot, he thinks, but be generally admitted that the longer the manure is kept within three or four inches of the surface the better, especially on light soils, through which it is apt to sink and escape too quickly.

Mr. Young has, however, remarked in his Calendar of Husbandry, that "in some of our well-cultivated counties, the shallowness of the ploughing is remarkable; when almost every other point of management is very spirited and complete, a deficiency in this may not be at once perceived in the crops; but he has no doubt but failures are often caused by it, though attributed to other circumstances." He therefore suggests the following hints: "1. An additional depth should first be gained in autumn, that a successive change of seasons may take effect in atmospheric influences before any seed is ventured in the raw stratum brought up. 2. The quality of that stratum should, he thinks, be examined; it is sometimes steril by reason of an acid, discoverable by boiling in water, and putting that water to the test of blue infusions. 3. Animal and vegetable manures cannot, he says, be *buried:* at whatever depth they are deposited, their constant tendency is to rise to the atmosphere. 4. Fossil manures are, he asserts, extremely liable to be buried, having a constant tendency downwards. Chalk marle and clay are sufficiently soluble, or so miscible with water, as to sink in a regular mass; and are sometimes found much below the path of the plough. 5. In soils of a poor *hungry* quality, there should, he thinks, be some proportion observed between the depth of ploughing and the quantity of manure usually spread; but this does not hold good upon better soils. 6. Soils are, he supposes, rarely found that ought not to be ploughed, in common, six inches deep; many ought to be stirred eight inches, and some ten. 7. One deep ploughing (to the full depth) should, he conceives, be given once in 12, 18, or 24 months; if this be secured, shallow tillage by scaling, scarifying, scuffling, shimming, or broad-sharing, is in many cases, he says, preferable to deep working oftener, and especially for wheat, which loves a firm bottom."

And in regard to the depth of breaking up grass-land, it should, he says, be considered according to the manner of performing the business, as by the process of paring and burning, and by that of merely ploughing. In regard to the first, it is, he observes, nearly a general opinion in almost every part of the kingdom, that the first ploughing after the operation should be shallow. It cannot, however, be admitted, he thinks, that though the notion be far spread, it is therefore just, as the same thing prevails every where with respect to dung and the sheep-fold; in which cases there is, he supposes, great reason to think it erroneous. Manures that putrify, and of course become volatile, cannot, he contends, be buried, as has been seen above: plough, says he, as deep as you please, they all rise sooner or later into the atmosphere; but with fossile bodies, and probably with the ashes of paring and burning, the case may in a good measure be different, and the great success of the usual management affords reason to justify the principle on which it proceeds. It may, therefore, he says, be deemed a safe maxim not to plough after this operation for the first time, more than three, or at most four inches in depth.

In the other mode of breaking up grass-land after much experience, he has not found much difference either in the produce or effects on gravelly, clayey, or sandy loams when executed in either way. In districts where they usually plough as deep as six or eight inches, he has observed (and it has been his own practice) that they plough up old grass-lands shallower, that is not above four inches deep, or at most five; the crop being every where put in upon this earth, except in the case of summer-fallowing peaty or moory lands. By not ploughing deep, the atmosphere, he says, has a more direct influence in assisting the putrefaction of the sod covered, as it is with the crop which is probably one of the smothering kind.

He remarks, that two circumstances are here to be attended to, which are the use of the skim-coulter plough, and that of sowing on a stale furrow.

This plough he considers as one of the most effectual and applicable implements for breaking up this sort of land. "It is well known that when this is done by a common plough, there is a seam between every furrow-slice of grass and weeds that grow through the summer to the injury of the crop; but which is wholly prevented by this plough, which is applicable in all cases, except where there are roots or stones."

With regard to sowing on a stale-furrow, "it is a good practice in breaking up old ley when done in soils that are not ticklish to get upon. On wet clays and loams, where not well drained, the business of sowing is often obliged to be delayed too late in the spring, if ploughed in the winter, in which cases it is safer to plough and dibble at once; but on other sorts dry enough, such as dry loams, sands and chalk, it is, he says, better to plough in autumn and plant early in the spring: the frosts and successive variations of weather, sweeten the freshly turned up soil, and crumble the surface enough to give a little mould, and not so much as to impede the person employed in dibbling.

"In all the heavy strong sorts of land a great improvement has been effected by ploughing the lands

in the early autumn, so as to avoid as much as possible all spring tillage. In this way the summer-fallows intended for barley and oat crops; the pea, bean and tare stubbles which are to receive the same sorts of crops, as well as the white corn stubbles which are designed for any sort of spring crops, should at this season be ploughed in a careful manner in the proper form, so as to be the future seed earth, no further ploughings being admissible on any account. In this method, it is stated by Mr. Young, in his valuable Calendar of Husbandry, that the crops are much larger and the expenses considerably lessened. "The leading principle is, he says, this: if the land is so laid in autumn on to ridges of that exact breadth which suits the tools (whatever they may be, whether harrows, scarifiers, scufflers, or drills) so that the horses which draw them may walk only in the furrows, the frosts will have left so fine and friable a surface that any of these operations may be performed long before the land in the common system would be ploughed. The seed is usually in the ground long before the old fashioned farmer thinks of moving. If he ploughs, he turns down a dry crumbling surface, and brings up the stiff wet *clung* bottom: if rain comes, then he is in the mire and must wait for a season: if a drying sharp north east wind comes, his furrows are converted to oblong stripes of a stony hardness. In one case he is plagued with mud, in the other with impenetrable clods; he was possessed of just the surface he wanted, and which, once lost, is not often regained. This surface may be scuffled and immediately drilled securely." In this practice the lands or ridges should be laid out with great exactness.

Besides these, there are other points that require attention in the ploughing of land: the furrow slices should be disposed in a different manner, according to the nature of the grounds: the views of the farmer and the crops to be grown upon them, circumstances which have been already noticed in speaking of ploughs. The seed furrow, and those where advantage is to be derived from the effects of the atmosphere, should be laid much less flat than in other cases. The breadth of the furrow must likewise be regulated by similar circumstances.

There is another point that has been noticed by Mr. Kent, in his Hints to Gentlemen Farmers, which is, that, on all the lighter sorts of soils, it is essential to preserve at the depth of from six to eight inches below the surface of the land, what in the language of farmers is denominated a *pan*, which is an unbroken bottom at such depth; in consequence of which, it is supposed that manure may be kept longer in the top part: and that in such seasons as are very dry, the less the depth of this pan the less liable the grain will be to burn, especially where it consists of earth and not of rock, as the roots of the grain will, he supposes, find more moisture, by striking against a body of compact earth, than in a greater depth of hollow earth, as the former obviously preserves more moisture in such dry seasons. There is also, he imagines, another advantage in this pan, which is, the having a less proportion of mould to work and keep in a state of fertility. In such cases, where deep ploughing is had recourse to, this compact bottom or pan must be broken and destroyed, from which a great deal more manure will become requisite, he thinks, to keep the land in proper condition for the supporting of crops. On these accounts, care should be taken in such cases, not to go so deep with the plough as to injure this firm earthy crust, and increase the difficulty of cultivating such soils.

The frequency of ploughing lands must, in a great measure, be directed by the state or condition in which they are, and the nature of the crops which are to be grown upon them. It has been observed by Dr. Dickson in his System of Practical Husbandry, that "the stiff, clayey, loamy, and even chalky soils will, in general, stand in need of more frequent stirring, either by means of the plough, harrow, or some other implement, in order to separate and break down their tenacious particles, than those of the sandy or gravelly, and more light kinds, in which there is much less adhesion. Besides, where lands have been in a course of tillage for some length of time, whether they are of a clayey, loamy, or even sandy quality, they may require less frequent stirring than where the contrary is the case. And where the method of putting the seed into the ground by means of drill machines is to be had recourse to, a fine state of tilth will, in general, be indispensably necessary." But, that "the nature of the crop that is to be cultivated must, in most cases, direct the number of ploughings that may be necessary, as some demand a much finer state of tillage than others; though in most cases a well-reduced earth is favourable." It has, indeed, been asserted, he says, by Mr. Tull, in his Horse-hoeing Husbandry, "that the finer land of any kind is made by tillage, the richer, and more capable of supporting plants it becomes. A proof of which may often be met with in lands where a part has, from accident or other causes, been better tilled than the rest, as, though they be afterwards constantly managed in precisely the same manner, the part so treated always affords better crops than those which have not had the advantage of such tillage."

And he further states, that "where the nature of the crop is such as to be greatly retarded and injured in its growth, by the occurrence of other plants, as in wheat and barley, the land will constantly require to be rendered fine and mellow, either by frequent stirring by the plough, or the growing of such preparatory crops as have a tendency to bring it into a friable and clean state, by the shade which they produce, and the repeated tillage and culture which they receive while growing." And also that "where such plants as produce large, knobby, or tap roots, in or upon the soil, are to be grown, it will be necessary to have the land well broken down, and rendered mellow by repeated turning over, in order that they more readily push down, or extend themselves in other directions." It has likewise been found, he says, that "a fine state of tilth is always the most favourable for affording the nourishment and

support of crops in a free and equal manner, both on account of its admitting the fibrous roots of the plants to spread and extend themselves with more facility, and the manures to become more minutely divided, and more intimately blended with the soil: as well as from the substances that constitute the food of the plants being more readily and more copiously formed by the chemical combinations and decompositions that take place under such circumstances. And further, by means of such degrees of pulverisation and mellowness, the seed, especially when it is of the smaller kind, is not only more equally and more perfectly covered, but its vegetation more quick, from its becoming more fully in contact with the mould, and from the moisture being more minutely diffused and retained in the ground, which is an advantage of much importance in the cultivation of many sorts of crops."

The business of ploughing may in most cases, with any of the light well formed ploughs that have been described, be well executed with two horses without a driver, being managed by reins by the ploughman; and where double ploughs are employed, three horses may mostly be sufficient for effecting the purpose, being directed in the same manner; though in the usual method of performing the work, with the common awkward ill-formed ploughs, in practice in many places, three, four or more horses are in general made use of, and the business executed with more difficulty and less dispatch. The advantage of having recourse to the improved sorts of ploughs in this expensive sort of work, must, of course, be extremely obvious. It has been stated by Dr. Campbell, of Lancaster, in the third volume of Communications to the Board of Agriculture, that it has been lately found in his trials, that in a light loamy sort of soil, Small's plough with two horses abreast and the ploughman driving them by means of reins was capable of executing its work with equal expedition and to a better depth when necessary, than the common ploughs of the district with four horses, a ploughman, and boy as driver. This great advantage is considered as depending upon the excellence of its construction, and the team possessing the greatest purchase in the draught, by being placed so near the plough: the least variation in the formation or proportional distances of the different parts being, however, capable of destroying the effect.

After this view of the nature of performing this important operation in the cultivation of land, it may be useful to state the facts on the subject as they have been collected in the best arable districts of the kingdom by the surveyors employed by the Board of Agriculture. In West-Norfolk, as stated by the secretary to the Board, there is much difference in performing the work. "On some farms he has remarked the furrow to be cut flat and clean; but, on others, *wrist baulked*, by tilting the plough to the left, which raising the share fin makes that inequality, and is partly the occasion, he says, of his having found so many ploughs at work, which would not go a single minute without holding." In East-Norfolk, Mr. Marshall has observed that "the ploughmen, to prevent the soil when moist from turning in whole glossy furrows, which they term "scouring," tie a piece of strong rope yarn round the plate or mould-board, which by these means is prevented from acting as a trowel upon the soil." And Mr. Young "found this the practice at present; but was informed that it was not so generally wanted as formerly, which they attributed to better constructed *plats* or mould-boards."

In relation to the depths of ploughing, he states that "Mr. Thurtell, at Gorlstone near Yarmouth, has a great opinion of deep ploughing. Three or four inches are a common depth about him, but when land is clean he always ploughs five, and sometimes six or seven; he is careful however not to do this on foul land; he has no apprehension of breaking the pan, having many times gone depth enough for that without any inconvenience, and as to bringing up a dead soil he has not seen any ill effects from it." The land on which this practice has been pursued is a good sandy loam on a clay marle or gravel bottom. But "Mr. Everit, of Caistor, is of a different opinion; he is not fond of deep ploughing; he thinks four inches deep enough: his ideas on this subject, however, seem, Mr. Young says, to have been chiefly the result of a trial made by his father, who broke the *pan* by trench-ploughing a piece of land, which has ever since been full of charlock, &c. The difference of their soils will not, he thinks, account for this opposition of sentiment: Gorlstone is a very good sandy loam at 20s. or 25s. an acre, though certainly inferior in depth and goodness to the land at Caistor. In discourse with these two gentlemen on this subject, Mr. Everit remarked, he says, to Mr. Thurtell, that if he ploughed deeper than common, he ought to add manure proportionably to the quantity of soil stirred; an old idea of his, and he remembers well, combated by his friend Arbuthnot." It is added that "Mr. Francis, of Martham, ploughs four or five inches deep." And "Mr. Cubit, of Honing, on a fine sandy loam, always as shallow as possible; and at East Ruston, where the soil is exceedingly good, the same: he thinks the smaller quantity of muck by this means answers" the purpose.

It is further stated that "they do not plough four inches deep at Scotto; Mr. Dyble remarked, it is observed, that a piece was there ploughed five or six inches deep, and damaged for seven years: three inches enough: the soil much of it a fine sandy loam, manifesting no want of depth."

But "Mr. Palgrave, at Cellishal, applies, he says, deep ploughing in one case with singular judgment: he brings by water from Yarmouth, large quantities of sea ooze, or haven mud; this, on dry scalding gravels and sands, he trench-ploughs in without fear of burying, and finds, on experience, the effect very great, forming thus a cool bottom, so that the surface burns no more." And "Mr. Johnson, of Taurung, thinks that it is common to plough too shallow; nor does he believe that any mischief results from depth.

He has made a ditch one year, and thrown it down again the next, and the benefit was seen for seven years, without the soil being acted on by draining, or wanting it: nor is he nice to have his muck ploughed in shallow, having no fear of burying it. By ploughing a good pitch for turnips, they come, he says, slow to the hoe, but when they do get hold, thrive much faster than others." He also finds "Mr. Reeve of Wight an advocate for deep ploughing; he goes five inches deep; if he did not he should *get* no turnips." And "Mr. Dursgate approves of deep ploughing; remarking, that he breaks up his *ollonds* deeper than most people." And "Mr. Willis observing the marle on his land was sunk below the common path of the plough, turned it up again by going a deeper pitch, and found it to answer nearly as well as a new marling; and he suffered no inconvenience." It is added that "the two furrow work about Holt, &c. is to turn a furrow on lay or *ollond*; the plough then returns and throws it back with the untouched land that is under it, into the former open furrow, and overlapping that, rests on the baulk left beside it." It is also observed that "Mr. Money Hill, in breaking up the strongest land he has, ploughs deeper than on the lighter, that is, four inches, and on light three and a half, and on that depth drills on flag; if twitch in the land, ploughs only three and a half: if beyond the usual depth, would hurt the crop and give weeds. Waterden, a thin and flinty soil." It is remarked that "Mr. Hill's father lived for many years at Gateson, and was succeeded in the farm by Mr. Parker. Mr. Hill's last crop yielded 400 lasts of corn, above 520 of which were barley. He generally ploughed four inches deep, and never more than four and a half. Mr. Parker in the first year ploughed the second barley earth seven inches deep, sowing about eight score acres (the common quantity twelve score). He sold that year but twenty lasts: the seeds also were worse than usual: the wheat that followed, good; but in general, he had indifferent crops for fourteen or fifteen years." And "in March he applies what he calls *one-furrow* work to a foul stubble, if he has such by chance; the land side horse (that on the left hand) always, after the first furrow, returns in it; it is left open; harrowed down with a heavy harrow; then the weeds gathered and burnt, and the next ploughing given across."

Mr. Young says, that "in June 1776 being at Wallington, adjoining Marshland, he found the high broad ridges begin, which thence spread over a great tract of country, nearly perhaps across the island; and many of the furrows were then twelve inches deep in water: but at present he was informed that much more attention is paid to taking water off."

It is stated by the same writer, in the Agricultural Report of Hertfordshire, that "the common depth of ploughing about Westmill, is four or five inches; but Mr. Greg ploughs as deep as the staple will admit; which account of his bailiff implies, that five inches are not the depth of the staple. The crops in that vicinity are so great, that he should suppose there cannot be any material error in the basis of their practice."

It is observed that "Mr. Whittington remarks, that winter tillage is but of little use; he avoids it as much as possible; and has found that the application of a break, or a large four-horse harrow, is a good substitute for some ploughing."

In respect to the strength of team which is necessary, it is stated by the author of the Norfolk Report, that "Mr. Thurtell, through the summer, ploughs with three horses two acres a day, one always resting: this, from finishing sowing spring corn to the end of the turnip tillage. There is no doubt of their ploughing with ease an acre in four hours and an half. And in the clays of Marshland all are foot or swing ploughs; never more than two horses used: they do an acre a day, and in summer one and an half at two journeys. And at Remsby each pair of horses two acres a day at two journeys."

It is stated that "thirty years ago the common price of ploughing was 2s. 6d. an acre in every part of the district except Marshland: it is now 4s.; in some places 3s. 6d." Mr. Young adds, that "the farmers in every part of it get more land ploughed in a day by their men and horses, than on any similar soil in any other part of the kingdom; which, he thinks, is not altogether to be attributed to the merits of the plough, though it is certainly a good one; nor to any superior activity in the horses: the cause is more, he thinks, in the men, who have been accustomed to keep their horses and themselves to a quick step, instead of the slow one common in almost every other district of the island."

The Suffolk Report states that in "every part of the county this sort of work is done with a pair of horses conducted with reins by the ploughman; and the quantity of land usually turned in a day, is an acre upon stiff soils, and from one and a quarter to one and a half on sands. And it is added that the ploughmen are remarkable for straight furrows; and also for drawing them by the eye to any object, usually a stick whitened by peeling, either for water cuts, or for new laying out broad ridges, called there *steatches*; and a favourite amusement is ploughing such furrows, as candidates for a hat, or pair of breeches, given by alehouse-keepers, or subscribed among themselves, as a prize for the straightest furrow. The skill of many of them in this work is remarkable." This mode should be practised in other districts.

It is stated in the Hertfordshire Report on Agriculture that "the price of ploughing about Hatfield, amounts to 11s. and 12s. an acre; twenty years ago, 7s. were paid; all is done with four horses and a driver; 20s. per acre have been paid in the new enclosure at Cheshunt."

It is remarked that "in the 17 acres of experiment ground of the Marchioness of Salisbury, the cultivation was began by a powerful trench ploughing, 18 inches deep. Mr. Stephenson, the manager, who, having been head gardener, had the farmer's best education, knew that her ladyship intended to

cultivate parsnips, carrots, cabbages, and other plants demanding deep tillage, and very wisely began on garden principles. He remarks, Mr Young says, that in general, in Hertfordshire, there is a deficiency in not ploughing to a greater depth; they have a prejudice against it, and think land ruined that is stirred deeper than common: it is admitted that the first crop will sometimes suffer in spots, but the succeeding ones make ample amends. Barley has been sown on trench ploughing, and with success; in a dry season it grew well, while that for which the land had been indifferently prepared stood still."

The writer states that "Mr Pratchet, of Hatfield, having asserted that he would readily give for ploughing his land once over, 12s. per acre, and that he was sure it cost him more, he requested the particulars on which he founded his opinion; and his calculations are as below:

	£.	s.	d.
Four horses, seven bushels oats, at 4s.	1	8	0
Eight trusses of hay, at 5l.	1	2	2
Ploughman,	0	15	0
Driver,	0	12	0
Wear and tear, plough and harness,	0	6	0
	£ 4	3	2

He adds that "they plough five roods per day, when they break up their land, and one acre and a half when they give it a second, or any subsequent ploughing." And that "at seven acres and a half per week, the expense amounts to 11s. and 1d. per acre, besides the wear of the horses. At nine acres, it amounts to 9s. 2½d.; but the above estimate of Mr. Pratchet is, he says, drawn from the consideration, that this includes none of the time when the horses are unemployed, which is a very material point, and adds largely to the expense when they work; on a wet-land farm particularly, the time thus lost is considerable," in many cases.

It is observed that "Mr. Cook, from near Colchester, in Essex, bailiff to the Duke of Bridgewater, is of opinion (however prejudiced in favour of two-horse ploughs), that they could not break up for a fallow the flinty clayey loams of this county, but that after one ploughing, they are fully equal to the following tillage." It is added that "about Hitchin, they break up with the common Hertfordshire plough; but in stirring, use the swing-plough with three horses, and sometimes with two. And that at Mortgrave, near Hitchin, Mr. Green is settled, who came from near Clare, in Suffolk, about four years ago. He never uses more than two horses in a plough, and does his work just as well as the natives with four: he succeeds, and is supposed to be a very thriving man. Some of his Suffolk ideas, however, are, Mr. Young observes, said not to have answered so well, particularly the making composts with ditch earth: this he has given up, and now goes to London for manure, like others. And Mr. Sedgewick recommends a practice in ploughing broad lands with the common plough, to leave two or four furrows for the small narrow plough, to finish the lands, by which means there are channels on the slopes of the open thorough to catch seeds; whereas, with the great plough, the seed rolls into those thoroughs. But Mr. Parker of Munden, uses the foot-plough of Middlesex as preferable to the great Hertfordshire wheel-plough, and can break up flinty strong land with it as well as the other performs it: cases very rarely happen, in which the county plough has the advantage. He has a great opinion of deep ploughing; never has the least objection to any depth, nor ever yet checked his men for going too deep. His common depth is nine inches. This he has practised 23 years on good loamy land in Huntingdonshire, and here on the gravels and flints of Hertfordshire. He has never lost a crop by it, but met with an unvarying success; and is clearly of opinion, that at this time of day it ought not to be made a question, but received as an admitted fact. He does not limit his ploughs to nine inches, for he would like twelve better, if easily attainable. It is added that he has no idea of burying dung, but ploughs it in nine inches deep, and would plough it in deeper; for he is well assured from experience, that nothing is lost; and a great advantage of depth is, that one ploughing given deeply and clean, is of more effect and better than two, or even than ten, such scratchings as are called ploughings often in this county; but the harrows in *cleaning* should on loamy soil, be as deep as the ploughing. Mr. King of Barkway, it is remarked, who has Suffolk connections, ploughs with a pair of horses and no driver, and does as much and as well as his neighbours with four."

"On their moist retentive clays at Albury they are extremely attentive never to go on in wet weather: the soil is stiff and ticklish, and if touched when too moist, is greatly injured." This is a fact which is very general in most parts of the kingdom, on such lands.

It is further stated that "in every part of Hertfordshire they have a method of ploughing, of which they are very fond, called *combing*, or *hacking:* a field that lies on flat or broad lands, is half ploughed across, by beginning with a furrow and returning; the plough doubles the breadth of it by a second furrow, the contrary way from the former, leaving a very small baulk, just sufficient to give steadiness to the plough, by a purchase against the unstirred land, which is equally well effected by leaving no baulk, but by going two inches deeper on the land side. Then the plough returning for the third time, throws back the last turned furrow, taking up earth enough under it to clean plough the whole land, if wanted, or to do it at such spaces as to whole plough, or half plough the field; but if combed close, the surface is left in regular narrow ridges, called combs. This operation, with a little difference in the execution, is called ribbling in Suffolk. It prepares a good hold for the harrows. He saw it well executed at Sir John Sebright's at Beechwood, who understands the Hertfordshire tillage well." And bouting, as it is

called, is the lapping of two furrows together, by forming narrow ridges, a bout in each; then they are reversed in the same manner by splitting; after that, they plough down by one furrow in the centre of each ridge, and so leave it for harrowing: some time elapses between each operation. In breaking up, they do an acre a day, sometimes more."

PLOUGHING *in green Crops*, the process of turning down various sorts of vegetable crops in their green or most succulent condition.

It is a method of practice that has been employed in husbandry for a great length of time on the continent, though little practised here by the farmers. The reason of which is probably that the soils are in most districts too wet and heavy for its being had recourse to with advantage; the light and more friable kinds of land are most adapted for improvement in this way, as in such the green materials undergo decomposition much more readily, and become more quickly in the proper state for affording the support of crops. In some clayey soils, the putrefaction of such materials is retarded in such a way, that little or no benefit can be derived from their use. But in suitable soils crops of the green kind, such as buck-wheat, tares, clover, rape, and where sown for the purpose, pease or beans, &c. may be used with advantage, being turned in as a preparation for wheat crops without the expense of a fallow. Where employed in this way the crops, as observed above, should always be turned down when in their most luxuriant state of growth, and the soil rather dry, in order that a speedy decomposition and decay may be undergone. It has been suggested that "advantages may be gained in this view by the application of small proportions of calcareous substances in their caustic or more active state over them before they are turned down." And that the economy of the practice must chiefly depend upon the savings in cartage and the labour of preparation, which in other sorts of manure is often very heavy. Mr. Young in his Survey of Lincolnshire says that this practice, after having been attempted, appears to have been given up from its not fully answering the purposes for which it was intended, probably for the reasons stated above.

It is a mode of husbandry that, Mr. Donaldson says, has been had recourse to with success in Warwickshire, and which he considers as, beyond all others, the most economical. The expense of the seeds is almost the whole of what attends the practice.

PLOUGH-*Wright*, a term applied to a person whose business it is to make ploughs, and other implements of husbandry.

PLOUGH-*Jogger*, a term provincially applied to a ploughman.

PLOWS, a provincial term signifying ploughed ground, either in closes or pieces in open fields.

POA, a genus of grasses which principally forms the green covering of the fields: the meadow grass.

There are several species, some of which are highly useful as field grasses.

POA *annua*, the dwarf or white meadow, or Suffolk grass, which, according to Mr. Sole, is the quickest in growth of all the grasses, coming up, blooming, and ripening its seeds in the course of one month. It ought therefore, he thinks, to be called *mensual*; but as it will keep time with no other grass, it is not worth sowing. It is always leaving the ground bare in patches, except there happens to be an *agrostis* to fill its place. It is however a very sweet grass, and very generally liked by animals.

POA *angustifolia*, the narrow leaved meadow grass, which the same writer says is a very sweet grass, especially for hay, but like the *trivialis* is liable to go off, after mowing. It is dispersed sparingly in the meadows about Hinton abbey.

POA *aquatica*, the reed meadow grass, which, Mr. Sole says, is an excellent grass in its native soil, the fens of the Isle of Ely, growing to the height of six feet. It is usually cut when about four feet in height, and when dry is bound into sheaves; and it mostly undergoes a heat in the stack that improves its quality. It is found an excellent fodder for milch cows, but horses are not fond of it. In that place it is called *fodder* by way of eminence, other sorts of coarse hay being denominated *stover*, which signifies *coarse stuff*, and it is called *white leed* from its drying of a white colour.

POA *bulbosa*, the bulbous meadow grass, which the same writer finds to have all the good qualities of the *pratensis*, in so far as its size will admit, and it is proper for hilly dry grounds and poor soils, where it delights to grow. It is found in the hilly dry pastures about Newton St. Loe.

POA *compressa*, the compressed or flat stalked meadow grass, which Mr. Sole thinks an excellent grass for parks and sheep walks, as both deer and sheep are fond of it; and as it is a dwarf grass, the blades seldom exceeding two inches in height, it forms a fine turf, and causes the flesh of the animal to cut short and be fine flavoured. It is found in blossom in some places about Claverston Down, and probably on the Down itself, but the sheep there never suffer a bent of it to blow.

POA *distans*, the fen meadow grass, which the same author finds an exceedingly sweet grass, affording very rich milk, but it is difficult to cultivate, as it delights in miry situations. It grows in most sea marshes, and abundantly about Cottenham and the fens of Cambridgeshire.

POA *loliacea*, the hard or darnel meadow grass, which Mr. Sole thinks the most insignificant of all the poas, but which has one good property, that of growing where no other grass is capable of living, as in the driest parching sea sands.

POA *maritima*, the sea meadow grass, which the same botanist considers as a fine nourishing grass, being the principal one of our best salt marshes; but from its delighting in salt is difficult of cultivation.

POA *palustris*, the marsh meadow grass, which Mr. Sole thinks, a fine exuberant grass, and probably the best dairy grass. It grows in the rich marshes in all parts of the island, particularly those that are frequently refreshed by the occasional overflowings of rivers. It is valuable for laying down spon-

gy lands. It has often the height of four or five feet; and the panicle, when full blown, is extremely fine and flowing.

Poa *pratensis*, the great or smooth stalked meadow grass, which for the purposes of agriculture is considered by Mr. Sole as the most noble of all the grasses. Its foliage begins to shoot and put on a fine verdure early in the spring, but not so soon as some other grasses. Every animal that eats grass is fond of it; while it makes the best hay, and affords the richest pasture. It abounds in the best meadows about Laycock and Chippenham, and it has the valuable property of abiding in the same land, while most other grasses are continually changing. According to some it delights in rather a dry than a moist soil and situation, on which account it keeps its verdure better than most others in dry seasons; but it thrives most luxuriantly in rich meadows. It has been objected to by some from its creeping roots, which are difficult to extirpate, of course it is probably the most suited to permanent grass lands. According to Curtis it is distinguished from the rough stalked meadow grass by the stem being smooth when drawn between the finger and thumb, and while in that the membrane at the base of the leaf is long pointed, in this it is short and blunt. And besides, it only throws up flowering stems once in the season, and is of course well suited for lawns, &c.

Poa *setacea*, the fine meadow grass, which Mr. Sole considers as a fine rich grass for upland pastures, as it delights in a dry soil. It is found in the hilly pastures about Newton in Somersetshire. It is likewise an abiding grass.

Poa *trivialis*, the common or rough stalked meadow grass, which Mr. Sole thinks a fine grass for hay as well as pastures, but inferior to the *pratensis*. It delights in moisture and sheltered situations, on which account it is tender though productive. In rich land it grows tall, its height is however about two feet. It is said by some to be well suited to good sound moist loams. It is much esteemed on the continent, for dry pastures and watered meadows, as it multiplies by seed as well as the root. It is of course proper to let the seeds fall. Its fattening property is considerable for cattle. It is however apt to go off after mowing, being overpowered by those grasses of the bent kind. Its radical leaves as well as those on the stem grow much larger than in the *pratensis*. In sowing it the seeds should be carefully separated.

POCKET, a large sort of bag in which hops are packed up, in order to be sold.

POD, a term used to express the pericarpium, or seed vessel of plants, consisting of two valves, which open from the base to the point, and are separated by a membranaceous partition, from which the seeds hang by a kind of minute stalk.

POINTS *of Cattle*, the parts which show the excellencies or defects in their forms. See *Cattle*.

POKE, a small sack or bag.

POLE, a small thick piece of wood, such as a straight bough or young tree. It is useful for various purposes of husbandry, as the making of stakes, hurdles, and various other purposes.

Hop-Pole, a sort of pole much used in the cultivation of hops for supporting the bine. The poles of ash, oak, willow, poplar, chesnut, and various other sorts of wood are employed in this way. The ash, oak, and chesnut, are probably the most valuable. In this intention they are usually prepared by having the bark removed, and being sharpened at the thick end. Great care should be taken of them after they are separated from the bind, by having them properly stacked up in some dry situation. The prices of poles of this sort have lately increased in a high degree.

POLE-EVIL, in *Farriery*, a disease of the abscess kind formed near the heads of horses, as about the junction of the first vertebra of the neck. It commonly proceeds either from a blow or hurt received on the head, as by accidentally striking it against the ceiling of a low stable. It is advised by Mr. Denny, that whenever this is perceived, by a tumour forming about the part, the earliest and most active means should be employed to remove it.

"The most effectual remedy for which is, he supposes, that of anointing the inflamed parts with blistering liniment; for, by this simple treatment alone, an abscess may generally be prevented. Whenever the inflammation, however, has proceeded to suppuration, as soon as the matter can be distinctly felt, an opening must be made as near as possible to the inferior part of the abscess, to allow of a free discharge of its contents, and a seton be introduced through the whole extent of the cavity, which should be frequently moved, and washed with spirits of turpentine. The healing process may, he thinks, be assisted by daily injecting the following lotion into the cavity of the abscess:"

Take of Muriated quicksilver,
Vitriolated copper, of each, in powder, two drachms;
Boiling water, one pint: when cold add
Tincture of myrrh, two ounces.
Mix them.

Where sinuses are already formed, and the seton is not sufficient to heal the parts, the only mode, in his opinion, will be that of laying the parts open, by an incision through their whole extent, after which the following may be used to dress the wound with:

Take of Red precipitate, in powder, half an ounce;
Ointment of yellow rosin, two ounces;
Oil of turpentine, half an ounce.
Mix them.

And over this a large pledget of tow, spread with any simple ointment, may be laid. Nothing more will probably be required than keeping the wound clean, and having recourse to the practice usually pursued in common wounds.

POLLARD, a term applied to a tree that has been frequently polled or lopped, and its top taken off, or headed down to the stem for the purpose of fire wood or small poles for hurdle wood and other similar uses, as well as for hop poles, &c. It is a term most commonly in use in the southern and eastern districts of the kingdom.

Though much wood of this small sort may be pro-

vided in this way, the practice has been highly reprobated, not only as being destructive of good timber, but as a barbarous system which disfigures and renders the appearance of the country disagreeable.

Mr. Middleton in his valuable Survey of Middlesex, after remarking that the hedge rows in that "county are sometimes disfigured by pollard trees; but in no degree equal to what they are in some other counties; observes that he never saw hedge rows in any district so barbarously used by the tenants, or that reflect so much want of attention on the part of the landlords, as those in Norfolk and Suffolk. Numerous are the fields in those counties, says he, whose hedges are filled with pollards of every age, under perhaps two hundred years, of no value to the tenant, and worth to the landlord, only a twentieth, or thirtieth, part of what those identical trees would have been worth, had they been protected from the spoliation of the farmer's axe. Including interest on the value of such trees, the amount would have been at least an hundred times more than it is," he supposes.

And he adds that "instances are not wanting in every county, of pollard oaks abounding in hedge-rows; which if they had been protected till grown into trees, and sold in their prime, including interest on their produce, would now have brought three times more money than the freehold would sell for which produced them. But, for want of such protection, they at present disfigure the estates on which they stand; and are only of a comparatively trifling value. Consequently the owners of such estates have, he says, lost the greater part of their property by the knavery of their tenants; the want of skill and diligence in their agents; and of attention or discernment in themselves." He suggests that "the best remedy for this evil would be, for landlords to cut down all the pollards over the whole extent of their properties; and to sell them for what they would fetch. They would produce, he supposes, on some estates, a considerable sum; which, at compound interest, would double itself every fifteen years. But the longer the pollards stand, the less valuable they will be. In the next place, a covenant should, he contends, be entered into by the tenant, not to *top* any tree (nor to *lop* it to any greater height than ten or fifteen feet from the ground) under a penalty of five pounds for each offence; which sum the landlord would be entitled to receive of the tenant for every pollard discoverable at any time upon his estate. Any tree recently pollarded, would, he says, be positive evidence against the tenant; who should be invariably required to pay the penalty: and, when that is done, the landlord should cut the pollard down. If this method were adopted, and the young trees thus carefully protected, the estates would, he thinks, increase in beauty and value every year."

It is contended likewise that "in a *national* point of view, this matter is of still greater importance, as it is not conceivable without the help of calculation, what an immense loss of timber is sustained in this way."

When pollard trees abound in the hedge rows, they are in general cropped or cut over once in from about nine to fifteen years, the advantages of which mostly belong to the tenants. It is a work that should be carefully performed, the branches being taken off by a clean cut, and be constantly finished by the latter part of February, if possible.

Pollard, a term applied to the fine bran or inner husk of wheat. It is a substance much used in the southern districts in feeding hogs and different sorts of domestic animals.

POLLEN, a provincial word applied to the hen-roost. It is sometimes written pollen and hen-pollen.

POND, a reservoir, or receptacle for collecting and preserving water, for the use of cattle or other purposes.

The importance and necessity of water, in all pastures, is self-evident; as cattle cannot live without it, and the driving of them far for it, is known to be prejudicial to their health, in hot weather, besides being attended with great trouble and a considerable loss of time. This is so sensibly felt in many parts that people are obliged to dig wells, even to such a depth as frequently to require the assistance of a horse to draw up the water. The means of rendering it easily come at, must therefore enhance the value of the land where it can be procured, and are of very essential consequence to the husbandman.

Where the surface of the ground is sand or gravel, there seldom is occasion to dig deep for water; because such soils generally lie upon marle or some other rich earth through which the water cannot descend. Beds of clay are most commonly thicker than those of sand or gravel; and chalk is, often, the thickest of all. But wherever water is wanting the farmer should bore through the incumbent earth, if he intends to fit his land for pasture; and if he finds the expense of obtaining it too great, his best way will be to convert the ground so circumstanced into arable, or to plant it with timber-trees suited to the nature of the soil.

Various indications of the presence of water below the surface of lands have been suggested by the ancient writers on husbandry; such as the spontaneous growth of different aquatic plants, vapours near the surface, &c. but the best mode of ascertaining it is by boring: and about the latter end of August, when the ground begins to be a little moist, is probably the most proper season for the purpose.

But in whatever method water is found, the means of coming easily at it are the next consideration. If it be on a plain, there is no other way than digging a well. In doing this, the substance under the sand or light soil must be dug into, to form a reservoir of water for occasional wants; and this reservoir should be made deep and large in proportion to the quantity wanted. If there were no such reservoir, the water, after having risen a little above the impervious body underneath, would glide along its surface, as usual, and very little of it could then be obtained, either by pumps, buckets or any other way employed to raise it. If the well is made in a

sloping ground, and the declivity is sufficient to give it an horizontal vent, it will be worth the husbandman's while to dig such a passage, and by means of pipes, or any other conveyance, to carry the water across the light soil, through which it would otherwise sink: the greatest quantity of water will be obtained in this manner, because there will then be a continual stream.

If the soil is very deep, and its surface has inequalities in which rain water runs in any quantity; this may be collected in ponds made in the lowest parts of such grounds.

If a body of clay is found near the surface, it is worth the farmer's while to bore, that he may know at what depth a bed of sand or gravel may be met with; for he will be sure to find plenty of water in this last. If this be in a declivity, he need only cut an horizontal passage, and the water will flow so freely, as even to double the value of his land.

Here again the farmer needs not ever to be at a loss, because it cannot be very difficult to make a pond in a clayey soil, which is, of itself, retentive of water. But it may perhaps be advisable, even in this, to cover the bottom of the pond with a coat of gravel, in order to prevent its being poached by cattle, whose feet would otherwise be apt to sink deep into the clay. Some farmers judiciously pave the declivity by which the cattle enter into the pond, and this renders it much more lasting than it would otherwise be, and preserves the water clean.

When ponds are made in a loose soil, much more care is necessary. The bottom and sides must be covered with a thick coat of the toughest clay, from a foot to two feet thick, well rammed down. Some have added hair and loam to the outer part of this covering, with a view of rendering it less liable to chap: but a thick coat of gravel is more necessary here, that the feet of the cattle may not pierce through the clay. Perhaps the expense of paving the whole inside of a pond might, in the end, be money well laid out.

The greatest difficulty in finding water is in chalky soils, because these are not, in themselves, very retentive of it, and generally lie in such thick beds, that it is expensive to dig through them. However, it should be tried; and if sand or gravel be found underneath, water may be depended on. Even here, ponds are easily made, by digging into the chalk, and lining them with a coat of clay, as before directed. If there is a supply of proper manure, such as clay, or marle, this situation is well adapted to grain, which loves to stand dry; and as this kind of ground produces more forward crops than clayey or strong soils, it may be sowed early with corn, which will not, in that case, be so apt to be parched up as grass is, by the summer's drought. If a good soil can be made here a foot deep, it will yield plenty of various sorts of pasture, either roots or grasses, as the farmer shall judge most proper: or it may be planted with different kinds of timber-trees.

The following method of constructing ponds has been proposed in the sixth volume of the Annals of Agriculture, for the Yorkshire wold land, which is a dry tract of country, in order at all times, and in all situations, to supply water sufficient for the numerous flocks of sheep, and other cattle, kept upon it, and sufficiently good in quality for domestic purposes.

"It is observed that, about twelve or fifteen years ago, a man, by profession a well-sinker, first discovered the method of making these ponds; within this period the number of them has been so increased, that scarce a sheep-walk, or even field, is now without one; and the use of them is creeping into the neighbouring country, in situations where otherwise water could not be had; so sudden and general an adoption is sufficient proof of their utility; before this period many sheep-walks were entirely destitute of water; it is, however, worthy of remark, that most of those sheep which have now a constant supply of water, are by many intelligent persons, thought, from that circumstance only, to be considerably improved; whether, however, this opinion is well-founded, he cannot, from his own experience assert, not having had opportunity to make the necessary observations; but it does not admit of a doubt, that in very dry weather, much fewer sheep die than formerly: this, in several instances, was fully proved during the uncommon drought of a late summer, where the loss among sheep which had not this resource, was very great, while that among others of the same kind, and in similar situations, which did not labour under that want, was very trifling; perhaps not greater than would have taken place in any other equal space of time."

The plan "is shewn at fig. 1, in plate XIX, in which the line A marks a circular hole dug in the ground of the size required, upon which a layer of clay B, sufficiently moistened, is to be carefully beaten and trod down into a compact and solid body of about the thickness of a foot.

"Upon this C is a layer of quick lime finely and uniformly spread over the whole, of one inch or upwards in thickness.

"D is another layer of clay of about one foot in thickness, which is to be trodden and rammed down as the former; upon this are spread stones or coarse gravel E of such thickness as may prevent the pond receiving any injury from the treading of cattle, who would otherwise break through the body of the clay and lime, and by so doing let out the water; after this, according to the section, the pond will remain five feet deep and 45 feet diameter; the size they are usually made, F being the line of the water and of the ground.

"Brick-clay is by no means required for the ponds; any earth sufficiently tenacious to bear beating into a solid compact body, though not approaching to a pure clay, will answer the purpose very well.

"It is usual, where there is an opportunity, to make the pond in a little valley, or at the bottom of a declivity, or near a high road, in which situation a stream of water may be brought into it after sudden showers or thaws, the object being to get it filled

as soon as possible after it is made, that the sun and winds may not crack the clay; if it is not likely to be filled soon, some straw or litter must be spread over it; but in general, after it is once filled, the rains that fall in the course of the year will keep it full, no water being lost otherwise than by evaporation and the consumption of cattle.

"A pond of this size is usually made for from 4l. to 6l. exclusive of the time, and expense of the carriage of the clay, when that is necessary; the first varies in price in different counties, the last will depend upon the distance.

"It is to be remembered that the whole excellence of the pond depends upon the lime; care must be taken to spread it regularly and uniformly over the surface of the lower bed of clay; it is well known that ponds made with clay alone, however good its quality, and whatever care may be exerted in the execution, will frequently not hold water; these with the above precautions rarely fail. Never having seen a pond dug up after it had been made some time, he cannot say by what means the lime prevents the loss of water; one of these two is probably the cause; either the lime sets like terrace into a body impervious to water; or what he should rather think, the causticity of the lime prevents the worms in dry weather from penetrating through the clay in search of the water; certain, however, it is, that with lime, thus applied, ponds may be made in sand, however porous, or on rocks however open, in neither of which situations are they to be depended upon when made with clay alone."

On this mode of making ponds for the use of live stock, there are several circumstances of the process more fully detailed in the Rural Economy of Yorkshire, under the heads of, 1. the run, or collecting surface; 2. the reservoir; 3. the liming; 4. the claying; 5. the covering; 6. the time of making; and 7. the cost.

In regard to the 1, or the run, the author remarks that "a bare firm surface, as a road, collects the greatest quantity of water." But that "a grassy surface retains the rain water which falls upon it, and which, in level situations, is conducted into the soil, by worm-holes and other inlets, with which grass land generally abound; especially in summer, when a collection is of the greatest value. However, if the subsoil be retentive, ditches, especially of arable inclosures, will frequently afford a supply, even in summer; but, in an upland situation, where the subsoil is generally absorbent, a road, or an artificial run, becomes necessary. But that in upland districts, as the wolds of Yorkshire, and the downs of Surrey and Kent, the surface is generally broken into hill and dale, and diversified by smaller vallies and inequalities. In situations of this kind, he says, artificial runs are most wanted, and may be most easily made. He has seen some faint attempts at making them, on the wolds of this district, by cutting a few grips, with a spade, above the reservoir; but they were too few, too short, and too seldom scoured, to answer, in any considerable degree, the intended purpose. They nevertheless, he observes, shewed plainly enough, the utility of channels for catching hasty showers, falling on grassy slopes, off which a considerable quantity of water will escape, provided there be channels at proper distances, to receive it." But in order "to reap the greatest benefit from an artificial run, and to make it with the greatest ease,—he advises to "form the bason at some considerable distance from the head of a valley; from which, down to the reservoir, to open a main channel by two furrows of a plough, turned outward. From this main stem to plough lateral branches, with an easy descent towards it, along the sides of the slopes, by single furrows, turned down hill; by which means the ploughing will be rendered easy, the channels made free on the upper sides for the admission of water, and high on the lower sides for retaining it." And he thinks "the plough would not be less expeditious in scouring than in making the channels: or perhaps a more sledge-like implement would be still more effectual than the plough, in closing the fissures and worm-holes, which presently are formed in watercourses laid dry; and which, if left open, absorb an inconceivable quantity of water before they be saturated; especially if the current of water be retarded, by grass or other obstructions that may be formed in them."

In respect to the 2d, or the reservoir, he says, "the situation in them should depend principally on the run. Near the side of a road is, in general, he supposes, the most desirable situation, provided a sufficient descent can be had from the road to the reservoir. Roads leading along the sides of slopes can only afford a supply to the grounds on their lower sides. But, in this country, when a road leads down the descent, it is generally, he says, furnished on both sides with ponds, some of them, perhaps, not having more than an hundred yards of run off a narrow roadway; yet, from that small quantity of surface, are sufficiently supplied with water." He adds that, "in the situation of a pond, there is one thing requisite, which does not seem to be attended to, even by the most skilful in the art. The requisite he speaks of is that of admitting a waste water place, on the upper side of the reservoir, to prevent the water, when the pond is full, from running through it, by which means it becomes filled up unnecessarily. For the nature of foul water is such, that, whenever it changes from a current to a stagnant state, it deposits a considerable part of its foulness; so that the water which leaves a full reservoir, is finer than that which enters it, the sediment, of course, being left behind in the reservoir. Whereas, if the current into the pond were to cease when the pond is sufficiently filled, the sediment of the overplus water would, he imagines, be got rid of. The pond would receive, in this case, no other foulness than that which was given by the quantity of water requisite to fill it. He thinks that a small catch pool, between the run and the reservoir, would arrest much of the foulness of water collected from a road; and, in a situation which could admit of it, would be worth the trouble of forming. In many situations, the mud it might collect, would, he supposes, amply repay the expense of forming it."

He states that "the form of the reservoir is, universally, that of a shallow bason, or more strictly speaking, that of a flat cone inverted; the sides shelving straight from the brim to an angle or point in the center. If the excavation be made sixty feet diameter, its greatest depth is about seven feet: if forty feet diameter, the depth is about five,—before the coats of clay, &c. be laid on." And that, "a reservoir set out twenty-two yards diameter, by seven feet deep, will, when finished, measure about sixty feet by six, and will hold about two hundred and ten cubical yards, or near seven hundred hogsheads of water. Forty feet diameter by four feet deep, when finished, contains sixty-two cubical yards, or two hundred hogsheads (of sixty-three gallons, wine measure)."

In undertaking the work, "the first business in setting out a reservoir, is to take the level of the site, and drive piles, as a guide in forming the banks, and in making the conducting channel and waste-water place. If the situation be on a slope, the excavated mould is, he says, used in forming the bank on the lower side: if nearly level, the mould requires to be removed, or, (if laid round the edge) the conducting channel to be raised. But if the clay or stone be excavated, it is laid separately aside to save carriage. And, if the lower side be raised with the excavated materials, they ought to be firmly worked together, or should lie a sufficient time to settle; otherwise, he says, the side thus formed, is liable to settle after the reservoir is finished; by which means cracks are formed and a miscarriage ensues. When the excavation has received the intended form, its sides are made firm and smooth, for the reception of the lime, or first coat."

With regard to the 3d or liming, its use is, he says, "merely that of preventing earth-worms from perforating the coat of clay; the proper quantity depends, in some measure, on the nature of the soil. A fat rich earth, among which worms always abound, requires more, he says, than a dead hungry mould, or a dry stony bottom; on which retentive pools are said to have been made, without lime. However, as no soil, perhaps, is entirely free from those enemies to ponds, it would be folly to risque a miscarriage in any situation; as the expense of liming makes but a small portion of the whole expense; and the only preparation of the lime is that of slaking it and picking out the cores; no sifting or skreening being, in general, used; though obviously useful where it is usually laid on with a spade or shovel; but a sieve would, perhaps, be found, by the inexperienced, a better tool; and the extra labour no object." And, "the thickness of the coat laid on is, he adds, about half an inch. Half a chaldron of lime is sufficient to complete a pond of forty feet diameter. The principal part of it is laid on beneath the clay; a few bushels only being reserved for scattering round the edges, to prevent the worms from getting into the clay." He here states that, "a still more secure, and on the whole, a more eligible method of liming has lately been thought of, and is now (June 1787) in practice, at Lockton (in that neighbourhood) by the commissioners of inclosure, in making public drinking pools, for the use of the township. Instead of scattering the lime in powder, it is formed with sand, into mortar; a regular coat of which is spread about an inch thick, not only beneath, and at the edges of the clay, but over the entire surface. This is, he thinks, an obvious improvement, which appears, to human foresight, to bring this method of forming pools near to perfection. The clay becomes cased on either side, with a regular coat of cement, and is thereby secured, in perhaps the completest manner possible, from the attack of worms. The labour and expense, however, is by this method increased. A pond, nineteen feet diameter, he says, took two chaldrons and a half of lime, and five small cart loads of sand. Both the materials were sifted, and worked up in the usual way, into mortar. Great caution is necessary in laying on the clay, in this case. And, he adds that, "if the mortar does not lie some time to stiffen, the clay displaces it: if it get too dry before it be covered, it is liable to crack."

In respect to the 4th, or claying, it is, he says, in this operation, the manual art, and the labour, principally center. And that, upon the wolds, clay is sometimes fetched six or seven miles; and is seldom found at hand, in situations where artificial pools are most wanted: the carriage of the clay, therefore, generally becomes a heavy article of expence. But, "the choice of clay is, he observes, thought to be less essential, than the working of it. Good ponds are said, he adds, to have been made with common loamy mould; but it is wrong, he thinks, to depend on any thing, but a strong ductile clay, if it can be had within a moderate distance. And, "the thickness of the coat, now pretty generally laid on, is, he says, about five or six inches, in the rough; beating it down to about three inches. In the infancy of the art, two coats of clay, of about that thickness, were laid on; but one coat has been found effectual, and much less expensive. However, it is probable, it will not prove so durable." But, "the method of beating will, he says, be difficult to describe; yet it most especially requires description." And, "the drier the clay is worked, the less liable it will be to crack with drought, when finished. In a dry season, however, it is necessary to moisten it: for which purpose the center of the pit is sometimes finished first, to collect the water of showers; the carriage of water being, in some cases, expensive." In executing the work of laying on the clay, "the workmen, he says, begin at the bottom of the pit, and work upward; laying patch after patch, or circle after circle, until the brim be reached; taking great care not to carry on sticks, straws, dirt, or any kind of foulness, among the clay, or with their feet; and being careful not to displace the lime, in throwing it on; to prevent which, the lime is not spread over the whole at once; but is scattered on, as it is wanted to be covered with the clay." And as soon as "a plot of clay is laid

on, and adjusted, it is beaten flat, with a wooden 'mell,' or beetle, made, at present, of these dimensions, the head fourteen inches long, and three inches diameter; the handle four feet long, and suited in thickness to the hand of the workman. Beetles of different sizes have been in use, in different stages of the art; but none of them have been found to be so well adapted to the operation, as that in use at present. The first operation is performed with the side of the beetle, to level the protuberances, and smooth the roughnesses, so as to make the whole into a regular sheet of an even thickness." And when "this is effected, it is struck forcibly, with the end of the beetle, which is driven down nearly, but not quite, to the lime; leaving the surface full of somewhat honey-comb-like cells or dints. If the beetle be struck unguardedly, quite through to the lime, a piece of clay, and a little lime, if required, is carefully placed in the breach, to prevent a defect in the part thus injured." And "the whole being gone over, in this manner, with the end, the surface is again levelled down, with the side, of the tool; the workman passing backward," as the business proceeds.

In regard to "the next beating, it is with the end, but not quite so deep as before; and the roughnesses being again levelled with the side, it is again worked over with the end; but still shallower than in the middle beating." He observes that, "the first strokes with the end of the beetle ought to close the bottom of the clay, firmly, with the lime and the bed on which it is spread;—the second ought to unite the middle of the clay with the bottom;—and the last to close, without a pore, the upper part with the middle;—and the last strokes, with the side of the beetle, ought to be sufficiently forcible to close, entirely, the dimples formed by the last-given strokes with the end." When "these several operations are thought insufficient, it is continued to be worked with the end and side of the beetle, alternately, until not a flaw can be found; the entire coat of clay being manufactured into a lead-like sheet, firm enough to bear a man without an impression, and a horse without injury; and, when two coats of clay were in use, the upper one was, he says, laid upon the rough surface of the last end-beating; by which means the two coats became, by the subsequent beatings, incorporated in one thick sheet. A substantial method, this, of which, he says, the present appears to be rather a refinement, than an improvement" of the practice.

In the 5th operation, or covering, he remarks that, "the first coat is of common earth, to assist in keeping out the drought, and to make a bed for the stones; to prevent their asperities from piercing, and thereby injuring the sheet of clay. This coat may be three or four inches thick, according to the nature of the stones with which it is to be covered. If these be large and irregular, more earth is requisite, than when the stones are small, smooth, or flat. The leanest, most infertile soil is fittest for this purpose. Worms and weeds are equally to be feared; and a rich soil is genial to both. In this point of view, two coats of clay are, in his opinion, much preferable to a coat of clay and a coat of rich mould." He thinks that the persons employed in this sort of business, are not "sufficiently aware of the mischievousness of weeds: indeed, some ponds will remain, for several years, in a manner free from them. But he has seen others, in which weeds, even docks (near the edge) have grown luxuriantly. It is probable that the tap-rooted weeds strike through the several coats; and, whenever the roots decay, a perforation must be left." And he supposes that "mould taken from a dry sound highland situation is, in all human probability, less liable to propagate aquatic weeds, than the earth of a low situation or a bog." He thinks the following an ingenious and simple method of keeping the weeds under; especially at the edges, where they are generally most abundant. Though all the sides of a drinking pool be open, cattle will go to particular places to drink; and in these places, the weeds are trampled upon and killed. Therefore, to check the rankest, the parts which are most free are covered with thorns, while those which are weedy are left open for the cattle to drink at."

He adds that "the mould being rendered level and smooth, the stones are laid on: first covering the mould with the largest, laid with a flat side downward, to prevent their sinking down to the clay; and upon these laying smaller, until the coat be made five or six inches thick." He also states that "straw has been used between the clay and the stones; and, that in the instance in which an improved method of liming was practised, a layer of thick sods was laid, grass-side downward, upon the lime; and, upon the sods, about six inches thick of loose stones," so as to form a secure coat.

Mr. Marshall suggests that "a pavement would be a more regular covering; and, if the stones were set in lime and sand, would not only prevent worms from getting into the mould, and upper side of the clay, when the pond happened to be dry; but would, in all probability, prevent weeds; and, when the pond required to be cleaned from mud, would be a regular floor to work upon." And the "only objection he has heard made to paving the bottoms of ponds, is, that it would be a temptation to cattle to go into the water, in hot weather; and, by standing there, would not only foul the water, but in time tread up the pavement, and injure the clay; whereas sharp loose stones prevent their going farther than the edge. If the stones made use of in a pavement were sufficiently large, the latter part of the objection would fall; and whether cattle standing in a pool, in summer, be detrimental or beneficial may, he thinks, be a disputable point." But that "whether or not the inside of the bason ought to be paved, the rim should certainly be a broad smooth causeway, with a gentle grassy slope from it; especially on the lower side; that the cattle may approach the water, without wading in dirt, to the injury of the bank; and without having sharp loose stones to walk and stand on, while drink-

ing." He thinks that "a drinking pool, formed by a skilful artist, full to the brim, free from weeds, and smooth round the edge, is, in a green pasture ground, as agreeable an object, as the eye can be entertained with," in such situations.

With respect to the "6, or the season of making them, the autumn is esteemed the best time, as has been seen above. Drought and frost are both enemies to new made ponds. In autumn, drought has generally abated, and a sufficiency of rain water may be expected in this season, to fill them before frosts set in. A covering of straw over the stones is the usual guard against the extremities of seasons." And where "a reservoir is formed in a slope, where the lower side requires to be raised with loose earth, it ought to remain a considerable time to settle, before the coatings be put on: otherwise, it is liable to settle afterwards, and crack the clay. He has seen an instance of miscarriage through this neglect. If there be much made earth requisite to be raised, the excavation ought to be formed twelve months before the claying be done," and if longer it is the better.

In speaking of the 7, or expense, Mr. Marshall remarks that though "it is now twenty years since the discovery was made, the art is still partially hid under the veil of mystery; and is not yet become familiar to common farm labourers. In this neighbourhood, ponds still continue to be made, by men from the wolds; all of them, in reality or pretence, pupils of the first inventors." And "these men generally work by the gross; the price being in proportion to the diameter: but they seem, he says, to have no regular method of calculation" on the subject.

It is added that "ten pounds were formerly given, and may now be considered as a medium price, for twenty yards diameter; forming, claying, covering, and, generally, digging the clay, included; all carriage and extra labour being done by the employer. But in the early days of the art, and when two coats of clay were used, twenty pounds were, he says, given for ponds of this dimension." He states that "a circle twenty yards in diameter contains in its area 314 square yards. Therefore, each square yard of surface costs, at this price, seven-pence-halfpenny. And that the solid contents of a cone, whose base is 60 feet diameter, and whose height is six feet, is 209,4 cubical yards; each of which costs, in the above instance, eleven-pence-halfpenny." It is further stated that "five pounds have been given for a pond, twelve yards in diameter: which is ten-pence-halfpenny, each square yard of surface; and supposing it four feet deep, two shillings each cubical yard of water." And three guineas were given for forty feet diameter, and four feet deep, the excavation having been previously formed. This may be called four pounds for the gross; which is about sevenpence a square yard of surface; or fifteen-pence-halfpenny, each cubical yard of water." He adds that "the men, in the last case, earned about three shillings and six pence a day, without extraordinary exertion. In the first-mentioned instance, the same workmen did (according to their own assertion) make more than two shillings and sixpence a day. But a large pond gives longer employment; and the business of pond-making being uncertain and inconstant, travelling workmen can, he says, afford to make a large pond at a cheaper rate, than a small one." And "the curve superficies or superficial contents of the sides, of a cone twenty yards in diameter at the base, and two yards high, is, he observes, about 320 square yards. This in making a pond of those dimensions, is the quantity of coating: for each yard of which near 7½d. was given in the first instance, and less than 7d. in the last. Sixpence each square yard of surface to be coated, may perhaps be taken as a fair medium price." At present however, work of this sort is performed at a much higher price as from ten pence to a shilling or more.

In order "to ascertain the quantity of coating, to be done, he advises to measure the exact circumference or rim of the pit, when finally formed and adjusted for claying; this dimension multiplied by half the length (or depth) of the side (measuring from the brink, down the slope, to the center) is the quantity of surface to be clayed and coated. The digging would (under this mode of calculation) fall proportionally heavier, on a large pond than on a small one; but this would be counterbalanced by the advantage above mentioned."

It is added that "the quantity of clay used, in the first instance, was about forty cart loads, fetched about three miles: in the last, about fifteen loads, fetched one mile. The quantity of lime, in the former case, one chaldron; in the latter, half a chaldron."

On these grounds, he says, "it is plain, that the larger the pond, the less in proportion is the expense. A reservoir, to contain two hundred cubical yards of water, requires little more than three hundred square yards of coating; whereas one, to contain only fifty yards of water, would require one hundred and twenty yards of coating; consequently a cubical yard, of the former, would only cost (at ninepence a yard for manual labour, materials and carriage) eighteen pence; while the same quantity of the latter, would cost near two shillings and sixpence." This is therefore a point that should be attended to in this sort of work.

In speaking of the benefits of these ponds, it is remarked that, "the superiority of those made in the manner above described, to those which have formerly been made, by some other art, or which have been formed by nature or accident, may be mentioned. During the dry seasons which have prevailed of late years, it has been observed, he says, that newly made ponds retain a supply of water, when the waters of other stagnant drinking places are dried up. This can only be accounted for, he thinks, perhaps, by their perfect retentiveness, and by their being free from weeds, which convert to their own nourishment, and throw off daily by perspiration, a great quantity of water. Upon the wolds their excellence was, he says, most conspicuous:—while one man was driving his stock, three or four miles to water, his neighbours, who had "*made ponds*,"

upon their farms, were free from this serious inconveniency. In many situations artificial ponds may, he thinks, repay the expense of making, the first dry season. Driving stock to distant water, in hot weather, and in a busy season, is an expense, and a detriment to the stock so driven, which it would be difficult to estimate in many instances."

This important subject is concluded by remarking that on "examining ponds, in this neighbourhood, which have been made some years, the evil effect of covering with loose stones is evident. As for one, two, three, or more yards round the edges, according to the time they have been made, the use they have been liable to, and to the steepness of their sides,—the stones are entirely displaced, or trodden into the clay; which is, by this means, exposed to the feet of cattle, and to the open attack of drought and worms. For a while, he says, the clay, even thus exposed, preserves its retentiveness; but, in time, it is destroyed, and the most valuable part of the pond entirely lost." He adds that "this effect is so probable, so evident to be foreseen, that, on the first reflection, it seems astonishing so unsuitable a covering should be universally adopted. A beast when it goes into a drinking pit, necessarily throws the chief part of its weight upon its fore-feet; which, in the act of drinking most especially, are placed, as for the intention of forcing, whatever they stand on, down the slope, toward the bottom of the pit. Upon loose stones, laid on a steep surface, cattle cannot make a step, or move a foot without producing this effect in a greater or less degree, and, by repetition and length of time, the entire coat (except some few stones which happen to be trodden into the clay) must, in the nature of things, be forced into the center." But this absurd practice "was first established upon the Wolds, whose stone is of a perishable nature; a species of chalk; which on being exposed to air and water, and to the treading of cattle, unites into a cement, which, forming a regular casing, preserves the clay from injury, for a considerable length of time. Loose chalk as a covering was, therefore, a good thought of the first inventors (indeed upon the wolds there was no alternative); and it is not to be wondered at, that their pupils, mostly day labourers, should imitate the practice, in this county, by making use of loose stones for the purpose." But "perishable or soft stones of any species, a strong rough gravel, or even sand, would, he believes, be better than loose hard unperishable stones." Though "in this neighbourhood, where stones of various kinds abound, or, in any country, where stones of a proper size can be procured, at a moderate expense, there appears to him to be no choice, with respect to covering. A regular firm pavement, strong enough to bear stock without an impression, would last through ages; and although the expense, in the first instance, would be something more than that of loose stones, its durability would, in the end, doubly repay it. Even the wold ponds, which have been made fifteen or twenty years, are many of them beginning to fail, and will, in a few years more, require to be fresh coated: whereas, a pond properly paved would, in all human probability, remain perfect, for at least a century. Where rough stones are used they should be placed with the smooth side downwards, upon the clay." And besides this the pavement of stones has, he thinks, much less tendency to be disturbed by the pressure of the feet of the animals, from its being a sort of inverted dome which acts as an arch against the materials underneath it. See *Rills* and *Drinking-ponds*.

The following hints have been suggested by Dr. Anderson in his Recreations in Agriculture, &c. for collecting water in different cases for farm uses, in situations where it is not easily procured.

For this purpose he would "beg leave to direct the attention to one never-failing source of water in this island, which if duly husbanded, will certainly, he says, preclude the danger of want at any season for almost any purpose, either for man or beast, that can ever occur. He here refers to the rain that falls upon the roofs of houses, which amounts to a much greater quantity than most persons are aware of. It has been ascertained by repeated experiments that in scarcely any part of this island does there fall less than twenty-eight inches deep in a year. At this rate there will fall upon every square foot of roof of any house above seventeen gallons and a half of water; or upwards of two hogsheads and a half on every square yard. At that rate, a house of thirty feet in length and twenty in width (which is not larger than an ordinary cottage), would collect one hundred and seventy-five hogsheads in a year, which would afford the expenditure of half a hogshead a day. There are few farms with their offices that have not roofs to ten times the extent of the above; so that were this water all preserved they could expend at the rate of five hogsheads a day throughout the whole year, which would be sufficient for a very extensive stock of cattle. But when we consider that in almost every situation cattle can be easily supplied with water from other sources for the greatest part of the year, it will appear very plain, that if all this water were carefully preserved, no farm could ever be in want of water for cattle or other purposes. All that is wanted then is, to discover an easy manner of collecting and preserving that water till it shall be wanted;" which he proceeds to show is not a difficult matter. "Few houses are now built, he says, without having spouts placed along the eaves to collect the rain-water and convey it into a reservoir, usually a wooden cask, for the purpose of washing. But this reservoir is usually so small as soon to be filled, when the surplus runs over and is lost. Instead of that, let the whole of the water thus collected, be led by pipes to one place, where it may be let into a well, dug in the ground to a proper depth for that purpose, and covered at top. It will there be screened from the sun, and prevented from evaporation, so as to be kept sweet and cool as long as necessary; and it is well known that no water is so pure and wholesome as rain water. But to those who are peculiarly delicate it may occur, that some impurities may be washed off by the rain from the roof,

which they would wish to get rid of. This may b easily and effectually done. By sinking another well at a moderate distance from the first, making a passage between the two near the bottom, to be filled up with small clean sand and gravel, through which the water must percolate before it reach the last well; in consequence of which it will be perfectly purified. The pump for supplying the family should be fixed in this last well, where it will of course find nothing but pure water."

But "for the sake of cattle, if it be necessary, he advises that another reservoir be formed, also under ground near to the pump well, with which it may communicate by means of an opening at one side near the top of the well, through which the superfluous water will run off when it rises above that level. This may be made in the form of a trough, covered as far as may be found convenient, and open towards one end for the cattle to drink, without allowing them to set their feet in it."

In cases "where the house is upon an eminence, it will be very easy to convey the water from this last reservoir, by means of a pipe under ground, to any convenient part of the fields, or the garden, where it may terminate in a box, to communicate with a trough for the cattle by means of a ball-cock, which always allows water to flow into the trough as it is drawn off, and closes of itself when it is full, so as to keep it always full without ever running over. In this way abundance may at all times be had without any waste; and the pure element procured for the cattle, without any extravagance of expenditure. If pools are made in the lower places of the fields, the cattle may in these occasionally cool themselves: but if they have ready access to the troughs they never will drink there. But for fields which are at a distance from the house, where the surface of the ground is not a dead level, wells of this sort may be formed by collecting the water that flows over the surface of the ground, during rainy weather, and leading it into these wells. But these reservoirs should be always covered, and only have an open trough at one place to allow cattle to drink. He supposes that by these very simple contrivances many parts of the country that are now much distressed at times for want of water, may be effectually relieved, so as never to suffer any future inconvenience; and much expense in carting water to many villages might be entirely saved."

Wherever ponds or reservoirs of water are sufficiently high, they may be converted to the purposes of irrigation in many seasons, with vast advantage to the farmer, without the use of machinery. Ponds are likewise beneficial for the purpose of breeding and preserving fish in many situations. See *Fish-ponds*.

Pond-*mud*, that sort of earthy vegetable material, which is collected from the depositions of stagnant waters, and becomes an useful manure when mellowed by exposure to the atmosphere, and blended with some sort of dung into a kind of compost. See *Mud*.

Mr. Young considers June as the proper season for emptying ponds and cleansing rivers, for the sake of the mud; for being early in the summer, there is afterwards an opportunity of turning the mud over, and thereby sweetening it, and laying it into the proper state for bringing on to the land. "There is a part of husbandry, he says, too much neglected by many farmers; but advantage should always be taken of it by a good husbandman, when he is lucky enough to succeed a great sloven; for then he will probably find all the ponds, &c. full of rich mud."

He thinks it is improbable that pond mud, especially if there is a stream into the water, should ever fail of proving a good manure, when judiciously used. The method of managing it which has been found the most beneficial, is, he says, the following: as soon as the mud is dry and hard enough to spit, turn it over, and, in about three weeks or a month after, mix it with an equal quantity of chalk or marle: either bring the chalk to the mud, or carry the mud to the chalk. If lime is cheap and plenty, it will be an excellent management to add about one-fourth the quantity of mud, in lime. Let the whole be mixed well together and remain until September, when it should be turned over again, and spread upon pasture or meadow land in October." This is husbandry that will pay well in most cases.

It has been observed by the author of the Middlesex Report, that "every pond that can be made by the damming of a stream, would collect large quantities of mud, always fit for immediate application on arable land, without any thing else being mixed with it, or on grass, after being mixed and turned up with dung. Of such great use, says he, are ponds, as collectors of mud, that some excellent farmers have a small one at the lowest corner of every close for the water to deposit the grosser parts of its rich sediment in.

Pond-*weeds*, such weeds as are collected in ponds, and which are often used as manure. See *Weeds*.

POOR LAWS, those laws which regulate the raising money for the support of the poor in the different parishes of the kingdom. The author of the Present State of Husbandry in Great Britain considers the poor laws and poor rates as "scarcely less oppressive to the farmer, or injurious to the interests of agriculture in England," than tythes.

In speaking of them, he says, "those most impolitic of all impolitic laws, were unquestionably established on principles and from motives, that do honour to the feelings of the legislative body of the time in which they were enacted. They were considered, not only by those who framed and supported them, but by all sensible and intelligent people, as the wisest and most philanthropic of human institutions. They had for their chief object the comfortable subsistence of those who, feeble through age or misfortune, were rendered incapable of exerting themselves in such a manner as to procure from their labour a sufficient supply of the necessaries of life; and that by means the most rational, namely, by compelling those who possessed none, or but a small share, of "the milk of human kindness" to contribute in an equal proportion with those who,

from liberal and beneficent dispositions, would have continued to do so without legal compulsion. It was, he says, expected, that the enacting of these laws would have had the effect of introducing a spirit of industry among the lower ranks; which, while it tended to render the operation of the poor's laws in a very small degree burdensome to the wealthy part of the community, would also have greatly promoted the prosperity of the nation. But how blind, says he, is human foresight, and how imperfect all human institutions! These laws, from the establishment of which so many happy effects were expected to result, have tended to consequences of the most alarming nature; consequences which, if effectual measures are not speedily taken to avert them, may and probably will soon end in universal ruin." That something is necessary to be done in respect to these laws, the late rapid increase of the rates sufficiently shews. It is further remarked by the above writer, that it is stated in Kaimes's Sketches of the History of Man, "that in Dr. Davenant's time the poor's rates were about £.700,000 annually. In 1764 they amounted to £.2,000,000. In 1773 they amounted to £. 3,000,000, equal to six shillings in the pound land-tax." So that if they have increased in an equal ratio since the year 1773, which will not be denied, they cannot, he says, in 1796 be less than £. 5,000,000, equal, by the above calculation, to ten shillings in the pound land-tax." That this is the case there can be little doubt, though the sum would seem to be a great deal more than would maintain all the poor of the kingdom under proper management.

But it is added that "notwithstanding the enormous assessments to which they give rise, they are by no means attended with the advantages which were expected. In place of tending to improve the morals or increase the industry of the poor, they have had, he says, quite a contrary effect. It was but a short time after the enactment of these laws that the public were, he observes, insulted with the famous song of

> Hang sorrow, cast away care,
> The parish is bound to maintain us.

And how much this sentiment seems to be impressed on the minds of the generality of that description of people for whose benefit these laws were framed, is well known to all who live under their influence. They require not to be reminded how necessary it is become to endeavour, by every possible means, to curb that spirit of licentiousness which so generally reigns within the walls of a parish work-house; whence shame, honesty and pride seem to be for ever banished." And Mr. Middleton in his able Survey of the County of Middlesex, after observing, that "agriculture occasions very few poor; on the contrary, it provides them almost constant labour, remarks, that it is only the blind, the extreme old, the very young children and idiots, which become chargeable in a parish purely agricultural." He thinks that "a labourer in agriculture, is more likely to support his family without assistance from the parish, at twelve shillings a week, than is a journeyman in any large manufactory, though his earnings should be a guinea, or a guinea and an half." But, says he, "large manufactories, like crowded work-houses, destroy every virtuous principle. Such situations are the very sinks of vice; the old and the young, the healthy, and those afflicted with loathsome diseases, the necessitous and the abandoned, are all mixed in one house, or perhaps in one room. Here the young, the unfortunate, and persons of weak yet honest minds every minute have their ears assailed with infamous oaths and descriptions of every species of vice, deception, and theft. The scene is in the highest degree horrid, and infinitely surpasses any powers of description." It is added, that "the idea of supporting a large family at a less expense per head than a small one, has led us into sad extremes. The supporters of such a system neglected to estimate the effect of that general contamination of morals which always takes place in situations crowded with paupers of every description; as well as the impossibility of preventing frauds and of effecting the most prudent management, in large work-houses, or houses of industry, such, in short, as in the end to have the effect of more than doubling the expense; and which is calculated to be perpetually increasing, in something like the proportion of compound interest." In support of this, he further remarks, that "the difference in favour of small or thinly inhabited parishes, when put in comparison with such as are large and populous, as to the expense and orderly behaviour of their poor, is astonishingly great. Hence the latter should divide and subdivide their poor, in order to put them on the advantageous terms of the former." And he justly thinks, that "all the really necessitous, and who only want a part of their support, should be assisted in their own houses, where five shillings will frequently go as far as twenty would do in the work-house." He adds, that "the Rev. John Howlett, speaking of the means used for lowering the poor-rates in his parish of Dunmow, attributes it to two causes: first, a determination in the parish officers to spare their money to the utmost; and, secondly, by admitting as few as possible into the work-house, where experience had taught them, that the maintenance of the poor is much more expensive than out of it. The consequence was a very large decrease in the rates." This is a strong fact which deserves the particular attention of the farmer and land proprietor of every district.

Mr. Middleton thinks, "that for distressed objects who of necessity must have the whole of their support from the parish, there should be a sufficient number of small cottages built, in lieu of a work-house, not all close together, but perhaps in pairs, or at least so much a-part, as to admit of each cottage having a piece of ground for the production of potatoes, turnips, &c. if widely dispersed over several parts of the same parish, so much the better; they should be made to hold two persons, and one or two children, or in lieu of the children, one or two of those paupers who should be found the most infirm. They should be obliged to assist each other, and to do something towards their own support. Alms-

houses are, he says, a case in point, where poor persons live on an average, for half the expense that supports others in a work-house, which incontrovertibly shews the more cheap and superior comforts which cottages afford over work houses, and likewise the wisdom of erecting them in lieu of work-houses for the reception of the poor." Many instances of this sort are to be found.

He contends, that "they who are able to work, but who are idle and incorrigible, should be let out to persons who are in the habits of employing and supporting such characters: or they might be committed to the house of correction. And in many cases paupers might, he thinks, be employed in scraping the turnpike roads and highways. The overseers should undertake the work by contract, which would be a benefit to the parish, and a convenience to the public."

And it is strongly stated, that "lodging and diet in the work-houses, in every instance, are superior to what the industrious labourer can provide for his family. It is obvious, he says, that this must have an influence over their minds, and become most injurious to the interests of society. It holds out encouragement to prefer the work-house to labour; and, by filling the poor-houses with improper inhabitants, it reduces the amount of industry." In this county, "in those parishes with which he is acquainted the annual expense of each pauper is about fifteen guineas; a stout healthy labourer in husbandry, with a wife and three children, earns only thirty for the support of five persons;" and that the earnings of the inhabitants of work-houses, on an average of the whole of the county, does not amount to eight shillings per head per annum; which taken from the former sum, leaves fifteen pounds seven shillings, or near six shillings a week, as the expense of supporting each pauper. This is, he says, a profuse expenditure of parish money, as two-thirds of the whole number of persons would support themselves out of the house, on being allowed only two shillings a week each. If it be true, he says, that two thirds of the number can be supported for two shillings a week in their own houses, the whole might in that case, be maintained for half the expense incurred under the present system. Nor ought they in any case to be allowed so much as one-fifth of the earnings of a labourer, otherwise their situation is made as good or better than his." This is a point that ought to be well considered by the managers of parishes, where the work-house system prevails.

He concludes by well observing, that "every institution which tends to make the poor depend on any other support than their own industry, does them great disservice, and is highly injurious to society, by diminishing the quantity of labour which annually produces consumable goods, the only wealth of a nation."

It is only necessary here to consider these laws as they affect agriculture. And it is contended by Mr. Donaldson that "from no alteration having been made in regard to the species of property assessable in virtue thereof, although they might have been considered equitable at the time they were enacted, have, in consequence of the alteration of circumstances that has gradually taken place, become almost intolerably oppressive on the landed interest; while the merchant, the manufacturer, and the monied man are either entirely exempted, or but in a very small degree affected. In short, poor's rates, according to the present establishment, are, he supposes, the most partial tax that ever was levied in this or in any other country." He well remarks, that "in the days of Queen Elizabeth, when poor's rates were first established, the commerce and manufactures of England were in their infancy, and three per cents. India bonds, exchequer bills, scrip, omnium, &c. were unknown. That being the case, permanent property only, as the rents of lands and houses, could fall under the view of the then legislators as subject to assessment. Hence the reason why these laws, which, as formerly observed, may be supposed to have been arranged on equitable principles, according to the state of matters at the time, have now become an engine of oppression against two descriptions of people, the proprietors and farmers. That this is the case, is obvious, he thinks, on the most cursory view of the subject. The poor's rates, for instance, in the parish of Kettering, in the county of Northampton, were last year (1795) at fifteen shillings in the pound of rack rent." And he "has been informed, that, in the city of Norwich, the poor's rates were the same year at twenty-four shillings in the pound; that is, while the tenant paid £. 20 to his landlord, he was obliged to pay £. 24 towards the maintenance of the poor. The cause of so high an assessment was, as may easily be supposed, owing to the failure of the manufactures in consequence of war."

Suppose, therefore, says he, that a proprietor in the former parish was entitled to receive £. 1000 of rent from his tenants, they would at the same time have to pay the overseers of the poor £. 750 0 0

Suppose further, that a merchant, manufacturer, or stock-holder, residing in the same parish, had a clear annual revenue of £. 1750, arising from the profits of trade, or the interest of money in the funds, he would probably possess houses at an established rent of £. 60 a-year. In which case his assessment for the maintenance of the poor would amount to 45 0 0

Difference, £. 705 0 0

From this, he thinks, it appears, that the land-owner possessing an estate of the value of £. 1750 a-year, pays upwards of £. 700 towards the support of the poor beyond what could be legally demanded from the merchant, the manufacturer, or the stock-holder, under similar circumstances, in regard to the extent of funds. Were the land-holders the only persons that suffer by this partial, and consequently oppressive tax, it would not be generally regretted; as it is well known, he says, that it is to their supineness in not apply-

ing to the legislature for an alteration of the existing poor's laws, that the evil has arrived at such a height, and that such heavy assessments are rendered necessary: but the farmers, unfortunately, are also sufferers, and, owing to the concurrence of several causes, frequently to a very considerable extent." In the instance mentioned, of "the parish of Kettering, the poor's rates, previous to the commencement of the war, did not, he says, exceed 5*s.* in the pound; so that from that period, and during its continuance, a tenant paying £. 100 a-year of rent to his landlord, has to pay £. 50 of additional poor's rates, and that, whether he possesses his farm under lease or at the will of his landlord. If the farm be held under lease for a term of years, the tenant can, he says, have no recourse on the landlord, who generally stipulates that he shall pay all parish-taxes. If, on the other hand, it be held from year to year, the tenant is, from that circumstance, so dependent on the proprietor that he dare not make the least objection against paying the additional assessment, from an apprehension of being turned out of his farm, and thereby deprived of the means of providing for his family. The proprietors therefore, pay only the ordinary poor's rates, the tenants being subjected in payment of such as are rendered necessary in consequence of the nation being at any time engaged in war, or that a stagnation of paper credit, or any other circumstance occurs whereby the manufacturers are interrupted. While, says he, the manufacturers can promote their own interest by employing the labouring class of people, they do so; but when they perceive they can no longer benefit themselves, they send them home to their different parishes, to be maintained at the farmer's expense till the return of peace, or other favourable circumstances occur, to create a new demand for manufacturing labourers." He further states, that Mr. Marshall, in the first volume of his Rural Economy of the West of England, mentions, as an evidence of the mischief which manufacturers are capable of entailing on agriculture, "that a woollen manufacture was some time ago set on foot at Modbury, and carried on with spirit and with success to the individuals who prosecuted it: but their end being answered, the manufacture ceased, and all the vice and debility which it had drawn together were left as a load upon the parish. The consequence of which is, the occupiers of land within the township of Modbury are now paying five shillings in the pound to the poor, while those of the surrounding parishes do not pay two shillings." Numerous instances of this sort might, he says, be mentioned to prove, that while the manufacturers pocket all the profit that can be derived from employing these people in prosperous times, they consign them to the farmer's charge the moment the wages which they choose to give are inadequate to their maintenance, or when they, the manufacturers, cannot profit by continuing them in their service."

On this subject it is further observed there is another circumstance that "requires to be mentioned as productive of many evil consequences, namely, that which regards the gaining a settlement in a parish. It is well known how much superior the situation of all ranks of people in this country is to that of those in some parts of the continent of Europe; particularly in Russia, where the peasantry may, he says, be considered as appendages of the soil, being doomed to cultivate a particular tract of land, whoever becomes the proprietor." It is, he says, with regret that he mentions "that a species of slavery exists in England nearly of the same nature with that." Can, says he, "that country be called free where the great body of the people are bound to reside in the particular spots where they were born? Yet this is certainly the case in England. The peasantry of the present day are bound by laws, enacted long before they were born, to confine themselves to their own parish; and if perchance they emigrate to a strange country, although perhaps only to the adjoining parish, they are not only prevented from exercising the rights of active citizens; but when there is the least prospect of their becoming burdensome to the inhabitants, they are hunted home like a parcel of strayed cattle or sheep that had overleaped the inclosures in which they were confined. Why not, he asks, permit the poor to seek a livelihood wherever work offers, or inclination leads them? In place of being subjected to be taken up as vagrants, if found out of their own parish, a parish perhaps in which they cannot find employment; would it not be for the interest of the community were they permitted to go where they could render essential service to the public, and where they have a certainty of supporting themselves and their families, without being reduced to the necessity of making a mortifying application to an unfeeling parish officer? Were such an alteration to take place, both the rich and the poor would, he thinks, experience the benefit. But while the laws of parish settlements remain on their present footing, let, says he, Englishmen, while they boast of the liberty they enjoy, reflect on these, and they will find that they accord not with genuine liberty: that wherever such laws are in force, rational liberty must be considered as in shackles."

It is strongly contended that "while this order of things remains, while the manufacturers shall continue in a great measure exempted from contributing towards the expense of maintaining those people who have become old and infirm in their service; while the farmers are subjected to such heavy exactions on every interruption to which the manufactures of the country are liable—agriculture must remain in a languid state, and the spirit of the farmer continue depressed."

The same writer then takes a view of the method of management in respect to the poor in Scotland, "in order to show, in how small a degree the expense of their maintenance affects the agriculture of that country." It is stated that, "the sum necessary to maintain the poor in any particular parish in Scotland, especially in the country, amounts only to a few pounds in the year; which may be accounted for by stating the simple manner in which they live;

oatmeal cooked in various ways, and potatoes, being their principal food. When reduced, by unforeseen accidents, or old age, to have recourse to the parish for relief, they are satisfied with a very small sum, two or three shillings in a month; asking in charity, what their neighbours in the same class in England, demand as a matter of right. Indeed, says he, few but such as are destitute of relations able to support them, make the application; it being considered disgraceful, both to themselves and their relations, to have their names entered on what is called the *poor's roll*." And, he adds, that, "the money necessary for the support of the poor is, for the most part, made up of voluntary contributions from the more wealthy inhabitants, which take place every Lord's day, before or after divine service."—But, that "there is also an old Scotch act of parliament still in force, by which the proprietors and tenants are liable to be assessed equally in such additional sum as may be judged necessary to support the poor of each parish: but this act is, he says, very seldom put in force, except in large towns, or in those parishes in the neighbourhood of the mountainous parts of the country, where the greatest number of poor people reside." He observes that "the slavish law of parish settlement is unknown in Scotland; the labouring poor, like the rich, are at liberty to settle where they can dispose of their time, or their talents, to the best advantage. Should a poor family, after having received supply from the funds of the parish in which they reside, remove to another, that parish in which they formerly resided, in some cases, supply their necessities for two or three years after their removal; at the expiration of which period, they become entitled to receive a share of the funds of that parish in which they are resident. But although this regulation has, it is believed, the sanction of law, there are, he says, very few instances where it becomes necessary to enforce it." It is therefore contended, that "the maintenance of the poor in Scotland cannot therefore be said to be oppressive to any class or description of the inhabitants." It is, however, remarked "that a disposition to encourage the introduction of poor's laws, appears to evince itself in many parts of that kingdom. A pound rate is, he says, already established in Berwickshire; 3d. or 4d. on the acre of improved land, is payable by the farmers; and in many country parishes in other districts, yearly assessments are made. Should the negligence of the proprietors to the situation of the poor, be the means of rendering the establishment of additional poor's laws necessary, their conduct must be considered, he says, by every thinking person, as reprehensible to the highest degree. The existing laws are fully sufficient for the purpose of securing the means of subsistence to the industrious poor, by their being at liberty to continue to reside in the place where they had spent the active part of life: after they are able no longer to procure themselves the necessaries of life by the labour of their hands, the manufacturers are compelled to contribute more liberally to their relief than if, under the authority of laws of settlement, the manufacturers, or mercantile, or moneyed people, residing in towns, had it in their power to order them, in the decline of life, when their period of labour is for ever past and gone, to the parishes in the country in which they were born." The writer strongly addresses "the proprietors of Scotland ever to consider the situation of England, in consequence of establishing impolitic poor's laws, as a warning to them against any innovation of that nature. And that, while they study that the poor in Scotland shall pass the remainder of their days without ever having to apprehend the fear of want;" that they "never make such an establishment as can tend, in any degree, to render morality and industry empty names."

The writer of the Scots Farmer has introduced some very strong remarks on the mischievous tendency of the present poor's laws. In speaking of the mode of levying taxes for the support of the poor, and the method in which they are maintained, he says he is "for doing good to the poor, but he differs in opinion about the means. He thinks the best way of doing good to the poor is, not making them easy in poverty, but leading or driving them out of it. In his youth he travelled much, and he observed in different countries, that the more public provisions were made for the poor, the less they provided for themselves, and of course became poorer; and on the contrary, the less was done for them, the more they did for themselves, and became richer. There is no country in the world, he says, where so many provisions are established for them; so many hospitals to receive them when they are sick and lame, founded and maintained by voluntary charities; so many alms-houses for the aged of both sexes, together with a solemn general law made by the rich to subject their estates to a heavy tax for the support of the poor, as in England. Under all these obligations, he asks, are our poor modest, humble, and thankful? and do they use their best endeavours to maintain themselves and lighten our shoulders of this burden? On the contrary, he affirms that there is no country in the world in which the poor are more idle, dissolute, drunken, and insolent." In addressing himself to the public, he says, "the day you passed that act, you took away from before their eyes the greatest of all inducements to industry, frugality, and sobriety, by giving them a dependence on somewhat else than a careful accumulation during youth and health, for support in age and sickness. In short, says he, you offered a premium for the encouragement of idleness, and you should not now wonder that it has had its effect in the increase of poverty. Repeal that law, and you will soon see a change in their manners. Saint Monday and Saint Tuesday will soon cease to be holidays. Six days shalt thou labour, though one of the old commandments, long treated as out of date, will again be looked upon as a respectable precept. Industry will increase, and with it plenty, among the lower people. Their circumstances will mend, and more will be done for their happiness, by inuring them to provide for themselves, than could be done by dividing all your estates among them."

These remarks deserve the fullest consideration of the landed proprietors and farmers of this country, and it is sufficiently obvious, from the rapid increase of such rates, that "material alterations must soon necessarily take place in regard to the objects of taxation, as well as in respect to the modes in which the money levied is expended. At present it is conceived that a system of peculation is established, in too many instances, among those whose province it is to expend the money so levied for the purposes to which the law directs it should be applied. The shameful expense of litigations between parishes, respecting the settlement of individual paupers, and the extravagant charge often incurred in transporting them from one parish to another, according to the present system, is often so great, as to add very considerably to the sum total necessary to be levied on the industrious and opulent inhabitants." There is likewise much other mismanagement both in the system of work-houses, as fully shown above, and in that of the regulations in respect to the expenditure of the money, which should be attended to in making such alterations as from the change of circumstances now become necessary in supporting the poor.

POPLAR, a well known sort of tree of the willow kind, of which there are several species, that are proper to introduce as ornamental trees, as may be seen below.

To marshy grounds no trees are better adapted than poplars, especially the first three or four sorts, noticed below, all of which thrive remarkably in moist situations. And as forest or timber trees, the white, black, tremulous, and Lombardy poplars, are proper to be employed. Marshy lands are capable of being improved to much advantage by coppices of these trees, to cut every four, five, or six years, for poles and other small purposes; being planted in rows a yard asunder, and in seven years they will be fit to cut for many small uses, and the stools shooting up again strong, afford a cutting every four or five years afterwards. And some of the sorts may also be planted occasionally to form hedges in moist or other situations, more particularly the Lombardy poplar, as this sort is peculiar in branching out numerously from the bottom upwards, and may be planted hedge fashion along the sides, or top of outward watery ditches, in large plants so as at once to form a hedge; they may be topped to five, six, or seven feet, in height.

Some think that when these trees are to be propagated by cuttings, it is best to do it in February, cutting off large truncheons of eight or ten feet long; which, being thrust down a foot deep in the ground, will take root very quickly, and, if the soil be moist, will grow to a considerable size in a few years.

The black poplar is not so easily raised from these large truncheons, but should be planted in cuttings, of about a foot and a half long, planting them a foot deep in the ground. This will grow on almost any soil, but does much better on a moist one than on any other. They are the fittest of all trees for raising a shade quickly, as they will grow fourteen feet in height sometimes in one season, and in four or five years will be large trees.

A considerable advantage may be obtained by planting these trees upon moist boggy soils, where few other trees will thrive; and many such places there are in England, which do not, at present, bring in much money to their owners; whereas if they were planted with these trees, they would, in a very few years, over-purchase the ground, clear of all expense: but there are many persons who think nothing, except corn, worth cultivating: or, if they plant timber, it must be oak, ash, or elm; and, if their land be not proper for either of these, it is deemed of little worth; whereas, if the nature of the soil was examined, and proper sorts of plants adapted to it, there might be a very great advantage made of several large tracts of lands, which at this time lie neglected.

The wood of these trees, especially of the white, is very good to lay for floors, where it will last many years; and, for its exceeding whiteness, is, by many persons, preferred to oak; but being of a soft contexture, is very subject to take the impression of nails, &c. which renders it less proper for this purpose: it is also very proper for wainscoting of rooms, being less subject to swell or shrink than most other sorts of wood; but for turnery ware, there is no wood equal to this for its exceeding whiteness, so that trays, bowls, and many other utensils, are made of it; and the bellows-makers prefer it for their use; as do also the shoe-makers, not only for heels, but also for the soles of shoes: it is also very good to make light carts; the poles are very proper to support vines, hops, &c. and the loppings will afford good fuel, which in many countries is much wanted. They also answer very well for hurdle-wood.

There are several species capable of being cultivated with advantage; as the white poplar, the trembling poplar or aspen, the black poplar; the Lombardy or Po poplar; the common tucam ahaca poplar, the heart leaved tucam ahaca poplar, the smooth poplar, the Canadian poplar; the Athenian poplar, the various-leaved poplar, and the Carolina poplar; but the three or four first are the sorts most commonly made use of for the purposes of agriculture.

The first is a tree that grows very tall, with a straight trunk, covered with a smooth whitish bark; the leaves are smooth, blackish green above, but having a thick white cotton underneath: they are about three inches long, on petioles, an inch in length, flatted and grooved on each side; in young trees the leaves are roundish, but in adult ones angular, divided into three, five, or seven lobes. It is a native of Europe from Sweden to Italy; also of Siberia and Barbary. There are two varieties, the common white poplar, and the great white poplar or abele. In the first the leaves are rounder, and not much above half the size of those of the latter, and the shoots of the latter are paler, the catkins larger, and the down of the seeds whiter and longer. In the latter the leaves are large, and divided into three, four, or five lobes, which are indented on their edges; they are of a very dark colour on their upper side, and

very white and downy on their under, standing upon footstalks, which are about an inch long: the young branches have a purple bark, and are covered with a white down, but the bark of the stem and older branches is grey. According to Mortimer, the best sorts come from Holland and Flanders. Hence in some places it is called the Dutch beech.

The second sort has a green smooth bark. The leaves at first breaking out are hairy above, and cottony underneath, but when full grown are smooth; they are slightly heart-shaped, smaller and more approaching to circular than in the preceding, with a few angular teeth on the edges. Dr. Stokes accounts for the trembling of the leaves from the plane of the long leaf stalks being at right angles to that of the leaves, which allows them a much freer motion than could have taken place had the leaves been parallel. This trembling of the leaves has been so generally noticed as to become proverbial. It is a tree of speedy growth, and will grow in any situation or soil, but worst in clay. It impoverishes the land: its leaves destroy the grass, and the numerous shoots of the roots spread so near the surface that they will not permit any thing else to grow. The wood is extremely light, white, smooth, woolly, soft, and durable in the air. Pannels or pack-saddles, cans, milk-pails, clogs, pattens, &c. are made of this wood. It is a native of Europe from Sweden to Italy.

The third kind has a naked lofty trunk, covered with an ash-coloured bark, and a regular handsome head: the leaves are slightly notched on their edges, smooth on both sides, and of a light green colour. It is a tree of quick growth, and on the banks of rivers and in moist situations it grows up to a great height, throwing out numberless suckers from the roots. It loves a moist black soil, and bears cropping well, the bark being light like cork, serves to support the nets of fishermen. The wood is not apt to splinter: it is light and soft, and sometimes used by turners. It is incomparable, according to Evelyn, for all sorts of white wooden vessels, as trays, bowls, and other turner's wares; and is of especial use for the bellows makers, because it is almost of the nature of cork, and for ship-pumps, though not very solid, yet very close and light. It affords useful rafters, poles, and rails, and in a proper soil makes a very quick return for such purposes. It is excellent for flooring boards, and is much used for the purposes of deal in some midland counties. It is a native of Europe from Sweden to Italy.

The fourth kind differs from the third chiefly in its close conical manner of growth, like the cypress. The leaves are greater in breadth than length, whereas in that the longitudinal diameter is the greatest. It has been esteemed by some as no more than a variety of that; and indeed it can scarcely be considered as a distinct species. It has been stated in Mr. Young's Annals, that the Italian poplar is fit to cut for building uses in twelve years, and that at eight years growth they are forty feet high. For rafters, small beams, sheds, boards, &c. it is very durable. The peculiar use of it in this country has hitherto been for ornamental plantations, and covering unsightly buildings. To the latter purpose its upright, close conical form of growing, with its feathering very readily down to the very ground, particularly adapts it. The conic form as a deciduous tree is peculiar to it; and one beauty the Italian poplar possesses which is almost peculiar to it, is that of the waving line it forms when agitated by wind. Most trees in this circumstance are partially agitated, one side is at rest while the other is in motion; but the Italian poplar waves in one simple sweep from the top to the bottom, like an ostrich feather in a lady's head. All the branches coincide in the motion; and the least blast makes an impression upon it when other trees are at rest.

The fifth is not of a very large size: the bark is smooth, like that of the third sort; the young branches have much the same appearance, but their annual shoots are seldom more than a foot in length. The leaves resemble those of the pear tree, are about four inches long, and an inch and a half broad in the middle, drawing towards a point at each end; their upper side is of a deep green, and their under side is hoary; they stand upon long foot-stalks, and are placed without order upon the branches. It is a native of Canada and some other parts of North America. It has varieties with much wider leaves: the Daurian, with a longer ovate leaf, more like this sort; and an Altaic variety with a lanceolate leaf. In Siberia the trunk is straightish, not tall, covered with an ash-coloured bark, the wood reddish, closer, and a little harder than in the common poplars. The branches in the Altaic tree are more slender and rod-like, in the Daurian thick, short, knobbed, and wrinkled, with a yellow skin sometimes of a very deep colour; the leaves in the rod-like variety ovate acuminate, in the Altaic commonly lanceolate; in the common Daurian ovate and thicker, so as to be in a manner coriaceous; in both very sharp, serrate, quite smooth, shining as if varnished, deep green above, and pale underneath.

The sixth sort also is resinous, like the preceding; but the leaves are different, being hollowed next the petiole, and drawn out at the point. It is a native of Canada. The seventh is a native of North America, and not much used at present. The eighth is a native of Canada, and but little planted. And the ninth resembles the tenth in growth and foliage, and is a native of the islands of the Archipelago. The tenth sort is a large tree, having numerous branches, veined and angular; the leaves broad and slightly serrate. It is a native of Virginia and New York. But the eleventh shoots very strong, and is generally covered with a light green bark like some sorts of willow. The leaves upon young trees, and also upon the lower shoots, are very large; but those upon older trees are smaller; as the trees advance in age their bark becomes of a lighter colour approaching to grey. It grows naturally in Carolina, where it becomes a very large tree.

All the sorts are capable of being readily increased by cutting layers and suckers. But the planting of the cuttings is the most expeditious mode, as they grow freely without any trouble; when made either

from the young year old shoots, a foot and a half in length, and planted a foot in depth, or large truncheons of two, three, or more years growth, from about a yard to five or six feet long planted in moist places: though these large cuttings or truncheons are not proper for general plantations only in some particular parts, as in a marshy or watery situation, where shade, shelter, &c. may be required as soon as possible, in which they may be planted finally to remain, putting them in to the depth of one or two feet. But in order to raise plants for regular plantations or for handsome standards, it is the best method to raise them principally from young cuttings of one years growth, or two at most. These young cuttings should be made about fifteen or eighteen inches long, and planted out in nursery rows two feet asunder, placing each cutting two parts or half way in the ground, and about a foot distant in the lines, they readily take root and make good shoots the following summer care being taken to trim off the straggling laterals in order to encourage the leading shoots to grow straight and rise more expeditiously in height: after having had from two to four or five years growth in this situation, they may be finally removed for the purposes for which they are wanted at the proper season. The layers may be laid down in autumn, choosing the lower young shoots that are conveniently situated, laying them by flat-laying. They will be well rooted, and fit to remove by the autumn following into nursery-rows to have two or three years growth. And suckers which some of the sorts send up in abundance from the roots as the fifth sort, may be taken off after the fall of the leaf, and be planted in nursery-rows, as directed for the cuttings, where they form good plants in two or three years.

And the plants raised in either of the above methods after having obtained from two or three to five or six years growth, are of a proper size for furnishing plantations, or other places.

These trees are also capable of being raised from seed, if care be taken to gather a quantity as soon as ripe; and sow it in autumn, in beds either broadcast or in drills, half an inch in depth.

POPPY, a plant of the weed kind common in the poorer sorts of corn land where the soil is of the calcarious kind. It has been observed that the common red poppy is one of the most mischievous weeds the farmers are plagued with among their corn, and the most difficult to thoroughly destroy. Its seed will lie a long time in land unploughed, without shooting; but they are sure to grow with every crop of corn. Mr. Tull in his Horse-hoeing Husbandry gives an instance of the seeds of this plant being buried four and twenty years in a field of saintfoin, and at the end of that time, the land being ploughed up for wheat, they all grew up among the corn, though they had laid dormant so long.

POPPLE, a term sometimes applied to the weed cockle. See *Cockle*.

POTATOE, the name of a well known plant of the knobby rooted kind much used as human food.

The discovery of this inestimable root has been of the greatest consequence to mankind, as it is now almost generally cultivated. It is stated by Mr. Donaldson, that it "may with the greatest propriety be denominated the *bread-root* of Great Britain and Ireland." It "was first brought, he says, from Virginia by the memorable, but ill-fated, Sir Walter Raleigh; who, on his return home-ward in the year 1623, stopping at Ireland distributed a number of potatoes in that kingdom. These having been planted, multiplied accordingly; and in a few years the cultivation of them became general." And they became soon, he says, of the greatest benefit to the people in the scarcities of grain that have since occurred in that country, especially in the last severe famine.

It is added that they "were brought from Ireland into Great Britain; and, owing to a ship loaded with potatoes being wrecked on the coast of Lancashire, the cultivation of that root, in the field, was first generally established there. And that within these last fifty years, the culture of potatoes has been introduced and extended in every part of the kingdom; but is now, he says, much more general in Scotland than in England, except in a very few counties."

It is further stated, that "during the great scarcity of grain which happened in the north of Scotland, in consequence of the failure of the crop of 1782, many thousands of the inhabitants must have been reduced to the greatest distress, but for the relief which potatoes afforded them." And that "although the crop of potatoes failed to a considerable degree in 1795, every one knows, he says, how much the miseries consequent on so great a failure of the crop of grain as then happened, have been alleviated in consequence of this root being so generally cultivated, and in such abundance. The culture of a root so highly valuable as the food of man should be of course particularly attended to by the farmer.

There are two general kinds of this plant which are distinguished into the *red-rooted*, which has purple flowers, and the *white-rooted* which has white flowers, but in raising the root from the seed or apple numerous varieties have been introduced and are daily introducing themselves to the planter.

And it is supposed by the above writer, that "great improvements may still be made, both in the quality and productiveness of this plant, by raising it from seed," as is fully shown below. It is obvious therefore from the mode of raising the plants by seed that the varieties in cultivation must be extremely numerous, and be liable to continual change. The following sorts have been distinguished by an extensive cultivator in Lancashire where this kind of culture is in general well performed.

Of the early Kinds.

The Smooth yellows,
—Red champions,
The Mather's seedlings,
—Kerkham marbles,

POT

The White ditto,
—Lady queens,
—Drunken landlord,
—Birchal's golden yellows,
—Smith's seedlings,
—Foxe's ditto,
—Boskow's kidneys,
—English champions,
—Brition's dwarfs,
—Bates's ditto,
The Donbobin's seedlings,
—Poor man's profit,
—Golden gulleons,
—Invincible,
—Broughton's dwarfs,
—Hatley's nonesuch,
—Early perrins,
—Forcing dwarfs,
—Early Manley's.

Of the Late Kinds.

The American white rangers,
—Ditto red ditto,
—Derbyshire reds,
—Late Champions,
—Ditto kidneys,
—Pink eyes,
—Pink nosed kidneys,
The ox noble,
—Lords,
—Seedling varieties,
—Balmer's seedlings,
—Budworth's dusters,
—Irish apples,
—Winter kidneys.

Of this kind there are also other varieties.

The white Scotch,
—Magpie,
—Rough red,
—Purple,
—English white,
—Silver skin,
The common wise
—Apple,
—Red sprout,
—Munster white,
—Crones,
—Spanish,

The last six were formerly much cultivated.

For use as human food the old winter red has been found highly useful as keeping well to a late period in the spring, when most other sorts are unfit for the table. But as cattle potatoes, the ox noble and cluster sorts have been most commonly employed. The first though formerly very productive, has lately been found to decline in some degree, it is however a good sort. The latter is also a very productive sort in this view. The *royal* or Cumberland early, is likewise an useful sort, being both large in size and productive.

It has been remarked by a late writer, that the "*pink eyes* and *copper plates* are of a hardy nature, and probably capable of being grown with less perfect culture than most of the other varieties."

The *white* and *apple* sorts are only proper to be made use of in the early part of the season.

A great variety of attempts have been made by different cultivators, to ascertain the difference of productiveness in the different sorts, but the matter has not been decided with any degree of accuracy.

In Mr. Young's trials in this way under the drill system, the results were as below:

Kinds.	*Produce.*
The Cluster	360 bushels per acre.
—Red nosed kidney	144
—Golden tags	207

And with Mr. Baker in Ireland the results as stated in the report on potatoes published by the Board of Agriculture were these:

Sorts.	*Produce.*
The Commonwise	21 lb. 6 oz.
—Apple	20 2
—Red French	15 12
—Munster white	16 0
—Crones	16 6
—Spanish	15 10

And on repeating the experiment, they stood thus:

Sorts.	*Produce.*
The Black	111 barrels per acre.
—Quakerwise	108
—Red French	88
—White ditto	85
—Commonwise	103
—Apple	76
—English white	83
—White Munster	79
—Spanish	70
—Crones	60

It is observed in regard to soil, that the potatoe will grow in almost any, even in that of the most indifferent quality; but that in which it thrives best, and where potatoes of the best quality are produced, is a light loam, neither too dry nor too moist, but if rich, it is so much the better. They may however, be grown well on many other sorts of lands, especially those of the mossy, moory, and other similar kinds, where they are free from stagnant moisture and have had their parts well broken down by culture.

The differences in the produce as depending on soil are in some measure shewn below, in the result of Mr. Townley's trials detailed in the Report on Potatoes by the Board of Agriculture; though the very stiff sorts of land do not seem to have been tried. The experiments were made by planting four eyes or buds of the cluster variety on four different descriptions of land.

Kinds of Soil.	*Produce.*
On strong rich loam	34lb.
— light rich loam	29
— good gravel	19
— sand	15

It is here evident that though this sort of crop succeeds in the most perfect manner in the light friable sorts of soil, it does not answer on those of the purely sandy descriptions, as they are apt to become too

dry in hot seasons, and to have too little of the earthy material in their composition. The wires of these roots have been found to shoot and extend and the roots to distend themselves and become of the largest sizes in such soils as abound the most in good rich mellow mould. In cultivating this root in the field, it is of course of much advantage to have the land well broken down and divided by repeated ploughings and harrowings in the autumn and early spring months, being careful never to stir the land when it is wet. It may likewise be of utility in this view to have recourse to the culture of this root after such sorts of crops as have a tendency to loosen and render the land mellow and friable.

But when the practice of putting this sort of crop in upon sward or lay ground, is employed, which by some is supposed advantageous, the best method of preparation, is that of paring and burning, or the use of the skim coulter plough, the dung, and ashes being ploughed in together, in the first case by a light furrow. In the Survey of the North Riding of Yorkshire, "the land intended for potatoes, if wheat, bean, or oat stubble, should, it is observed, be ploughed before Christmas, or as soon after it as possible, about the middle of April, if the land has got well dried, it should be harrowed well, repeating the operation and also using the roller till the land is become fine. In a few days afterwards it should be ploughed again, being harrowed and rolled, as in the former case, and where the land is in a bad condition, it may be necessary to give it one or two ploughings more, with suitable harrowings and rollings, working according to its particular state, letting it remain a few days between the ploughings; then it should be ridged up according to the state of the land in respect to fertility for being planted.

From the nature of this root and the circumstance of its produce being formed in the soil, it can probably never be cultivated to advantage without the use of manure. In some sorts of the more heavy kinds of land, such as is of the long or littery kind, may be made use of, as keeping such sorts of land more dry and open, but in those of the light, dry, friable kinds, the more reduced sort of manure may be better. Mr. Young considers farm-yard dung the best, and the more the better, unless the soil be very rich, and upon an average of soils, less should not, he thinks, be laid than twenty-five or thirty large loads to the acre, being spread equally that it may plough in well. But Mr. Billingsley in his Survey of Somersetshire, supposes rotten horse dung, as the best manure for this crop, after which he advises hogs' dung, and then all sorts of farm-yard dung; but he observes that lime, marle, sopers' ashes, and rags, make the potatoes scabby. In Lancashire the good littery stable dung, is mostly set apart for this crop. In an excellent report on the Culture of the Potatoes presented to the public by the Board of Agriculture, the comparative advantages of different sorts of manure have been in some measure shown in different experiments.

	Quantity of Manure per Acre.	*Crop:*	*Bushels.*
EXPERIMENT, No. I.	53 Loads (cubical yards) farm-yard dung		400
	160 Bushels, soot		360
	160 Ditto, wood-ashes		240
	32 Loads of dung		280
	42 Ditto		360
	No manure		180
EXPERIMENT, No. II.	32 Loads of dung, and 40 bushels of wood ashes		400
	No manure		280
	160 Bushels of slaked lime		380
	1½ Ton of barley straw		300
	340 Bushels of pot ash		380
	32 Loads of dung		400
	32 Ditto and 160lb. salt added at time of spreading		400
	32 Ditto, and 160 bushels lime		480
	32 Ditto, and 480 gallons urine		520

The same thing has likewise been attempted by Mr. A. Young, the results of which has been shown below:

Manures.	*First Year.*	*Second Year.*
No. 1. No manure	produced 120 bushels per acre,	140
2. Night-soil, 10 waggon loads	600	640
3. Ditto, 6 ditto	650	500
4. Ditto, 2 ditto	500	300
5. Bones, 10 ditto	650	640
6. Ditto, 6 ditto	640	560
7. Ditto, 2 ditto	560	240
8. Hog dung, 60 one-horse cart loads	480	300
9. Ditto, 30 ditto	480	160
10. Yard compost, 60 ditto	300	240

Manures.	*First Year.*	*Second Year.*
11. Yard compost, 120 one-horse cart loads,	480	300
12. Ditto, 30 ditto	140	140

And in the trials of the Rev. Mr. Cartwright made with a view of ascertaining the use of salt as a manure, with mixtures of twenty-five different substances, on a ferruginous sandy soil enriched by pond mud in single rows with the same number of sets in each, they were found productive in the following order:

Kinds of.	*Produce.*
1. Salt and soot	240
2. Chandler's graves	220
3. Salt and wood-ashes	217
4. Salt, gypsum-peat, lime	201
5. Salt, lime, dung	199
6. Salt	198
7. Salt, graves	195
8. Soot	192
9. Fresh dung	192
10. Salt, malt dust	189
11. Wood-ashes	187
12. Salt, decayed leaves	187
13. Salt, peat-ashes	185
14. Malt dust	184
15. Salt, lime, peat	183
16. Salt, saw dust	180
17. Salt, peat, bone dust	178
18. Decayed leaves	175
19. Salt, lime, sulphuric acid	175
20. Salt, peat	171
21. Salt, lime	117
22. Peat	159
23. No manure	157
24. Saw-dust	155
25. Lime	150

With Mr. Townley in Lancashire, the manure being placed in furrows of five feet ridges, the results stood in the following order:

	Sorts of Manures.	*Quantity of Produce.*
No. 1.	Coal ashes only,	produced 211lb., rather small.
2.	Stable dung and coal ashes mixed	344, very fine.
3.	Stable dung alone	315, ditto.
4.	No manure	134, very small.
5.	Compost dung-lime, and soil	204, middling.
6.	Stable dung covered with common yellow moss	438, remarkably fine.
7.	Soaper's waste	383, very fine.
8.	Stable dung and lime	268, tolerable.
9.	Lime alone	187, ditto.
10.	Coal ashes and lime	19, ditto.
11.	Stable dung and soaper's waste	298, very good.
12.	Soot, soil, and coal-ashes	271, ditto.
13.	Salt and soil	200, ditto.
14.	Saw dust and coal ashes	190, smaller.
15.	Stable dung and saw-dust	307, very fine.
16.	Dung of poultry and coal-ashes	236, pretty fine.
17.	Dung of poultry and sand	156, rather small.
18.	Saw-dust and lime	197, ditto.
19.	Decayed rushes and lime	208, very good.
20.	Tanners' bark and lime	76, very poor.
21.	Bark and stable dung	141, rather larger.
22.	Bark alone	35, very poor.
23.	Stable dung and lime spread over the land	230, pretty fine.
24.	Chopped whins, with a covering of lime over them	256 very fine.

In cultivating this sort of root on the heavier kinds of loamy lands, various sorts of littery materials have been made use of on the principle of preserving the soil in a more open and porous condition for the knobby sorts to extend themselves. With this view, wheat, straw, stubble, furse, broom, heath, seaweed and other similar materials have been made use of after being reduced by chopping, with good success being laid in the bottoms of the drills to be planted upon. Various kinds of luxuriant green vegetable crops have likewise been turned into the soil and planted upon as a manure with success in some instances where it could not be procured. And also substances of the peaty kind have been found advantageous in the same way as well as in keeping the drier sorts of land in a better state of moisture, and those of the heavy sort more light and open state, and of course more free from stagnant moisture. Good rich mould and decayed leaves may be of use in cases where they can be had in sufficient quantity.

All the trials that have been made with lime seem to show that it has a tendency to induce the *curl* and *canker* in whatever state it is employed.

The ashes of burnt land, are however, found highly beneficial in producing good crops of this root, which affords an opportunity of cultivating the coarse and waste sorts of grass land to much advantage, as by a crop or two of this sort they will mostly be in a condition to afford those of the grain kind.

But whatever sort of material may be made use of as a manure for this kind of crop, a sufficient proportion should always be employed to afford a due supply of nourishment to it while upon the ground. In the drill method of putting in crops of this kind, the manure is usually placed in the bottoms of them in an even regular manner, but in the other methods it is usually spread out evenly over the surface and then turned down. It has been supposed by some, that for the early crops of this root, it is better to apply the manure to the crop that precedes them, as by that means the danger of their over-luxuriance may be prevented and the crops be better in their quality. In general it is however the best practice to apply the manure to the crop.

The manner of placing the manure so as to afford the greatest advantage has been a disputed point by different cultivators. The following experiments made by a correct agricultor, however, show the propriety of placing it below the set and not upon it, as is often done:

The following exact experiments were made by Mr. Baker on potatoes planted in an understratum of poor yellow earth, April 27th and 29th, 1771, with the rows 20 inches asunder, and the sets 12 inches apart in the rows, and 30 sets in each row.

Sorts.	*Modes of planting.*		*Produce.*				Total.	
N°			N°	lb.	oz.		lb.	oz.
1 Spanish	Over dung, chiefly neat's dung.	Merchantable	91	12	4	Small 98	3	6	15	10
2 Red French		Ditto	63	13	8	Ditto 51	2	4	15	12
3 Common Wise		Ditto	103	16	2	Ditto 86	5	4	21	6
4 Crones		Ditto	53	12	4	Ditto 60	4	2	16	6
5 Munster White		Ditto	62	12	8	Ditto 59	3	8	16	0
6 Apple		Ditto	50	15	8	Ditto 53	4	10	20	2
	Total	Ditto		82	2	Ditto	23	2	105	4
7 Spanish	Under dung chiefly neats.	Merchantable	54	7	12	Small 60	3	8	11	4
8 Red French		Ditto	40	9	0	Ditto 60	1	12	10	12
9 Common Wise		Ditto	89	15	2	Ditto 84	4	8	19	10
10 Crones		Ditto	56	9	12	Ditto 44	2	1	11	13
11 Munster White		Ditto	54	9	14	Ditto 53	3	8	13	6
12 Apple		Ditto	58	14	14	Ditto 40	2	8	17	6
	Total	Ditto		66	6	Ditto	17	13	84	3
13 Spanish	Very small single eyes or sett under dung, chiefly neat's.	Merchantable	47	5	12	Small 40	2	8	8	4
14 Red French		Ditto	18	4	8	Ditto 45	2	1	6	9
15 Common Wise		Ditto	74	13	8	Ditto 49	2	12	16	4
16 Crones		Ditto	48	9	0	Ditto 50	2	8	11	8
17 Munster White		Ditto	40	6	8	Ditto 27	1	7	7	15
18 Apple		Ditto	40	11	0	Ditto 36	3	4	14	4
	Total	Ditto		50	4	Ditto	14	8	64	12
21 Spanish	Large seed, under dung, chiefly neat's.	Merchantable	74	8	12	Small 27	1	4	10	0
20 Red French		Ditto	40	9	4	Ditto 33	1	12	11	0
21 Common Wise		Ditto	131	18	2	Ditto 60	4	2	22	4
22 Crones,*		Ditto	42	7	0	Ditto 27	1	8	8	8
23 Munster White		Ditto	62	8	12	Ditto 31	2	0	10	12
24 Apple		Ditto	60	12	8	Ditto 32	2	4	14	12
	Total	Ditto		64	6	Ditto	12	14	77	4
25 English White	Under dung.	Merchantable	71	13	0	Small 2	3	4	16	4
26 White French		Ditto	45	13	4	Ditto 6	2	8	15	12

* Some error of the men, suspected in this sort.

It is observed, that "whoever casts an attentive eye over the preceding table, will see that several circumstances of information are immediately pointed at; there are very many others which are omitted; those before us appear to be so satisfactory, in the several variations which arise upon the face of the table, that he shall, at convenient time pursue all the changes which the subject will admit of. In the mean time he proceeds upon the present information.

"The first question is, he says, this, whether planting potatoes under or over the dung, is most advantageous to the crop? This question appears to be conclusively answered by every species of potatoe in the first and second set; and the totals of each clearly determine in favour of putting the seed over the dung.

	lb.	oz.
No. 1 to No. 6, over dung, gross produce	105	4
7 to 12, under dung, ditto	84	3
Over dung superior to under by	21	1

"This difference of 21 pounds, upon so small a quantity of ground, would, he says, be a very great object upon an acre. Happily in this kingdom, (Ireland) the potatoes are chiefly laid over the dung. In England, they practise the contrary in many places.

The second object, says he, in this enquiry was, to determine by fair experiment, whether the small seed is equally prolific (as thousands assert it to be) with that which is reasonably large. For this purpose, he cut single eyes with his own hands, and was careful not to cut them thin, but like pellets. This set was planted under dung; and therefore we must compare it with our second set of experiments.

	lb.	oz.
No. 7 to No. 12, under dung, gross produce	84	3
13 to 18, under dung, gross produce	64	12
Reasonably large seed, preferable to very small, by	19	7

"This upon an acre would, he says, be a prodigious difference: and, he thinks, seems decisive in favour of seed moderately large. Whereas Nos. 19 to 24, both inclusive, seem by no means to prove very large seed to be necessary: for if we compare those numbers, with No. 7 to 12, both inclusive, we see the greater produce from the larger seed is by no means regular, and therefore that point is not decisive in the present enquiry; and the remark upon No. 22 should not be forgotten.

"Our third object in this enquiry is a truly important one to the poor labourer of Ireland, viz. to ascertain with accuracy, which kind is most prolific upon poor broken ground. As No. 25 and 26, did not come to hand time enough to introduce them in the whole set of experiments, he must throw this part of his enquiry into two divisions, as there is so material a difference between planting over and under dung. To do this in the shortest manner, he shall only throw the several kinds into two little tables, according to their merit in quantity; the quality is a consideration chiefly at the gentleman's table.

N°			N°	lb.	oz.		lb.	oz.	lb.	oz.
3 Common Wise	Over Dung.	Merchantable	103	16	2	Small	5	4	21	6
6 Apple		Ditto	50	15	8	Ditto	4	10	20	2
2 Red French		Ditto	93	13	8	Ditto	2	4	15	12
5 Munster White		Ditto	62	12	8	Ditto	3	8	16	0
4 Crones		Ditto	53	12	4	Ditto	4	2	16	6
1 Spanish		Ditto	91	12	4	Ditto	3	6	15	10

N°			N°	lb.	oz.		lb.	oz.	Total. lb.	Total. oz.
9 Common Wise	Under Dung.	Merchantable	89	15	2	Small	4	8	19	10
12 Apple		Ditto	58	14	14	Ditto	2	8	17	6
26 White French		Ditto	45	13	4	Ditto	2	8	15	12
25 English White		Ditto	71	13	0	Ditto	3	4	16	4
11 Munster White		Ditto	54	9	14	Ditto	3	8	13	6
10 Crones		Ditto	48	9	12	Ditto	2	1	11	13
8 Red French		Ditto	40	9	0	Ditto	1	12	10	12
7 Spanish		Ditto	54	7	12	Ditto	3	8	11	4

It is added, that "here we always have the order of merit in point of quantity of the merchantable potatoes, from equal culture. The totals vary a little as in the preceding table. The wise and apple potatoes keep their places in both tables, as to produce; but the red French and Munster white, and crones, contend pretty closely as to produce; and in the second table vary in their places of merit. Hence we may conclude, that some of these kinds agree better by being put under the dung than others; but every examination of the latter point, clearly proves, that under dung lessens the crop. The Spanish potatoes which are certainly the best in the world for eating, uniformly keep their place, of being last in the point of produce. There is, he says, another very material point, worthy of the cultivator's attention in his choice of his potatoes in these tables. He will observe, doubtless, that he has given the num-

ber of the merchantable potatoes of each kind; he will therefore see that there is a prodigious difference in their sizes, a circumstance that comes strongly against the wise potatoes. A "table upon that point framed from the preceding ones, according to the order in point of size, is given below.

N°	N°		lb.	oz.		
6	Apple	50	Weight	15	8	Average Weight per Potatoe 5 Ounces.
26	French White	45	Ditto	13	4	Ditto $4\frac{3}{4}$
4	Crones	53	Ditto	12	4	Ditto $3\frac{3}{4}$
2	Red French	63	Ditto	13	8	Ditto $3\frac{3}{8}$
5	Munster White	62	Ditto	12	8	Ditto $3\frac{1}{4}$
25	English White	71	Ditto	13	0	Ditto $2\frac{7}{8}$
3	Common Wise	103	Ditto	16	2	Ditto $2\frac{1}{2}$
1	Spanish	94	Ditto	12	4	Ditto $3\frac{1}{8}$

The following table distinguishes the difference in the quantity of produce in the different sorts, and the quality, according to the foregoing experiments.

Quantity of produce.		*Quality.*	
First.	Common Wise.	First.	Spanish.
Second.	Apple.	Second.	English White.
Third.	Red French.	Third.	Munster White.
Fourth.	Crones.	Fourth.	White French.

Mr. Donaldson says that "it has been proved, from long and general experience, that the month of April is the best season for planting this root, so as to produce a farinaceous or mealy crop. Potatoes are frequently planted in the end of May, and sometimes even in June; but the crops, although often as abundant, are neither so mellow nor mature, as when the sets are planted in April, or in the first eight or ten days of May."

A late practical writer, however, contends, that this sort of work should constantly be performed "as soon as possible after the danger of frost is over, which, in the more southern districts, is generally from about the middle of March till the latter end of April; and, in the northern ones, from about the middle of April until towards the close of May, according to the differences in the state of the climate. The earlier the crop can be got into the ground, the better, he thinks, it becomes. Besides, he says, they have a better chance of being taken up and removed from the land, while the season is dry; and there is less risk of injury from moisture and frosts after they are fit for taking up. It may also be added, that the land will derive much advantage from being ploughed up while it is in a dry condition, after the potatoes have been removed, as in this way it is preserved in a less moist state during the winter, and the weeds are more effectually destroyed. But at whatever period the crop may be put into the ground, the business should be performed as much as possible when the weather is dry, and the land not too much soaked with moisture, as under such circumstances the early vegetation of the crop always proceeds in a more regular and expeditious manner, by which the produce is generally rendered better in quality and more abundant."

The author of the Present State of Husbandry in Great Britain, observes, that as "there are a number of what are called *eyes* in every root, each of which produces a separate plant. This points out the propriety of planting the large and middle-sized roots, properly cut, in place of the smallest, uncut; as when the larger potatoes are properly cut, one, or at most two eyes only, being left in each set, there is no danger of too many plants springing from the same root, which must often happen, when small potatoes, with a great number of eyes, are set whole." He asserts that "it is the common practice, and against which there appears no well-founded objection, to cut potatoes, intended for seed, into small pieces, about half an inch square; in the course of which operation, attention is paid to single out the eyes that appear strongest, and most vigorous. In this way, one root of ordinary size furnishes three or four sets, or pieces proper for planting. This for the reason above mentioned, is, he thinks, a better method than setting either large or small potatoes uncut."

There has however been much difference of opinion in respect to the best sort of sets for the raising of this crop, whole potatoes and large cuttings having been contended for by some cultivators, while others, on the ground of experience, are equally strenuous in support of small cuttings, sprouts, shoots or even only the eyes or buds. With all these different sorts of sets good crops are stated to have been raised; though tolerable sized cuttings of pretty large potatoes with two or three good eyes or buds in each are probably to be preferred. Independent of the increased expense of the seed it is never a good practice to make use of whole potatoes as sets. The experiments of the Rev. Mr. Campbell, of Argyleshire, as stated in the ninth volume of the Bath Papers, not only throw much light on this subject, but also on the most proper distances of planting in regard to the rows.

Rows.	In 1790.	Inches distant in the Rows.		Value per Acre of the produce after the seed is deducted. £.	s.	d.
1.	Small whole potatoes	6	——	16	6	$7\frac{7}{8}$
2.	Large pieces	3	——	15	16	6
3.	Large pieces	6	——	15	8	6
4.	Large pieces	12	——	13	4	$1\frac{7}{8}$
	In 1791.					
1.	Large whole	6	——	18	18	$1\frac{1}{9}$
2.	Small whole	3	——	18	1	$4\frac{1}{9}$
3.	Small whole	6	——	17	11	$9\frac{1}{4}$
4.	Small whole	12	——	17	3	6

POT

Rows.	In 1790.	Inches distant in the Rows.		Value per Acre of the produce after the seed is deducted.
5.	Small pieces	6	——	16 1 $5\frac{1}{4}$
	In 1792.			
1.	Small whole	6	——	19 7 $1\frac{7}{8}$
2.	Large whole	6	——	18 18 $1\frac{1}{2}$
3.	Large whole	12	——	18 9 $9\frac{1}{2}$
4.	Large pieces	6	——	18 3 0
5.	Small whole	12	——	18 1 $5\frac{1}{4}$
6.	Large pieces	12	——	16 19 6
	1794. Table 1.			
1.	Undunged potatoes, after dunged turnips			25 19 $8\frac{3}{12}$
2.	Undunged, after dunged fallow			27 10 $2\frac{6}{12}$
3.	Undunged, substituted for a summer fallow			14 10 $4\frac{8}{12}$
4.	Purple hearted, dibbled in the top of a well dunged row			48 10 $6\frac{4}{12}$
5.	White kidney, planted in the same manner			27 2 $5\frac{4}{12}$
6.	White kidney, upon much dung in the row			29 0 $9\frac{6}{12}$
7.	White kidney, upon little dung			24 16 $8\frac{10}{12}$
8.	White flat potatoes, upon little dung			30 19 0
	In 1794. Table 2.			
1.	Middle-sized whole	12	——	32 8 $0\frac{8}{12}$
4.	Small pieces	12	——	29 19 $2\frac{3}{12}$
6.	Small whole	12	——	29 2 $4\frac{1}{12}$
5.	Small pieces	6	——	28 17 $6\frac{11}{12}$

Rows.	In 1794.	Inches distant in the Rows.		Value per Acre of the produce after the seed is deducted.
				£. s. d.
7.	Small whole	6	——	26 19 $3\frac{7}{12}$
3.	Middle-sized whole	6	——	25 7 $5\frac{1}{12}$
2.	Middle-sized confined to one eye and stem	12	——	23 12 $1\frac{11}{12}$
	Without dung in 1795, after dunged potatoes.			
7.	Middle-sized whole	6	——	28 11 $7\frac{7}{12}$
2.	Large pieces	12	——	26 1 $10\frac{5}{12}$
4.	Small whole	12	——	24 2 $11\frac{8}{12}$
5.	Middle-sized whole	12	——	24 2 $11\frac{8}{12}$
6.	Middle-sized whole	9	——	23 19 $8\frac{1}{12}$
3.	Large whole	12	——	23 10 $8\frac{10}{12}$
1.	Shoots	12	——	15 11 $9\frac{6}{12}$

It is observed that "the real produce from 50 yards of row, planted with shoots, was only 2 pecks 5-19ths, but only 63 of 150 came up; if none had failed, the produce would have been no more than what is stated in the table. This calculation, then, it is supposed, goes on the supposition that the 150 shoots had borne in the proportion in which the 63 did.

It is remarked further that each of the experiment rows in 1790, was 75 yards in length; in 1791 and 1792, 200 yards; in 1794 and 1795, 50 yards." And that "the numbers prefixed to the rows in 1794, table 2, and in 1795, point out the order, or juxta position, in which they were planted."

The following is an Extract from Experiment on Potatoes in 1794.

Rows.		Inches distant in the row.		By Experiments per 50 yards of row.			By Calculation per English acre.			Value per acre at 6d. the Linlithgow peck.		
				Bls.	Pks	Lbs.	Bls.	Pks.	Lbs.	£.	s.	d.
1.	Middle-sized whole . .	12	Produce .		12	8	90	2	15	36	1	$4\frac{9}{12}$
			Seed . .		1	5	9	2	13	3	13	$4\frac{1}{12}$
			Clear produce		11	3	81	0	2	32	8	$0\frac{8}{12}$
2.	Middle sized, confined to eye and stem . . .	12	Produce .		10	0	72	0	11	28	0	$9\frac{6}{12}$
			Seed . .		1	10	11	1	5	4	8	$7\frac{7}{12}$
			Clear produce		8	9	61	8	6	23	12	$1\frac{11}{12}$

This affords "a specimen of the manner in which the experiment tables were originally constructed."

It is further added that "these potatoes were planted in rows upon dung, except where it is otherwise mentioned, and then covered up with a double earth-board. In 1790, 1791, and 1792, the rows were three feet, and in 1794 and 1795, two feet and a half asunder. This, with the difference of seasons, will account, it is supposed, for the greater produce in the last two years. The distances at which the potatoes were planted in the rows, were measured by a stick with notches, and taken from the center of the potatoe-sets. Care was taken to have the rows as equal in quality of soil as possible, and to have equal justice done them in manuring, where manure was applied, and in horse-hoeing them. The quantity planted and raised was carefully marked in the field by the author of the experiment, and no part of the process of management was intrusted to any other person." It is likewise noted that, "in the experiments, the acre is the English statute acre, of 4840 square yards; so that when the rows are three feet asunder, 4840 yards of row make an acre. When the rows are two feet and a half asunder, it will take 5808 yards of row to make an acre. The bolls and pecks are the Linlithgow measure, and the Amsterdam lb. is used as a measure of compound parts, being the 19th of this peck; the value affixed to potatoes is the price they produce, *comm. ann.* at the Edinburgh market."

It is supposed, from "the comparatively small produce of potatoes confined to one eye and stem, (see experiments in 1794, table ii, row 2.) that the method recommended by some writers on farming, to pull away the supernumerary stems, is evidently improper." It is further noted that, "the potatoes in row 2, were not only confined to one eye, but to one stem, by pulling up the supernumerary ones. This last precaution became the more necessary, as stems were found issuing in abundance from potatoes which had been deprived of all the eyes; and even from two out of twelve potatoes, which had been planted after all the outer surface was pared off. The result was, that row the 2d, though it had most weight of seed, had the least produce of all the experiment rows; it had more than four times the quantity of seed contained in row 4, the produce of which, however, exceeded it at the Edinburgh prices, by more than 6l. per acre. The productiveness of potatoes, then, it is observed, is probably not occasioned by the weight or quantity of the sets planted, but by their having that number of sound and perfect growths, which the soil they feed in can bring to perfection. The general result of the experiments is unfavourable to the opinion, that the weight of bulb has any effect in determining the quantity of produce; in most of the five years experiments, the produce from pieces of potatoes was inferior both to large and to small whole potatoes; yet, in general, the pieces exceeded the small potatoes in weight of seed."

The experimenter further states, that "though the large and small potatoes, mentioned in the experiments, were relatively so, compared with one another, yet some of those, called large ones, might perhaps, with more propriety, be denominated middle-sized potatoes. An acre of very large potatoes would require a quantity of seed so great as to deter any person from planting them; nor is it likely, that the productiveness of potatoes will continue to increase with their size. There is certainly, the writer thinks, a *maximum* and *minimum*, a *ne plus ultra* in the quantity of potatoe seed, as well as in every thing else. The middle-size of the human species, as well as of the different species of other animals, are the best calculated to undergo fatigue and labour; they are therefore more perfect in their kind, and consequently fitter to answer all the purposes of their creation. May we not argue from analogy, that potatoes of a moderate size are the most perfect in their kind, and consequently the best fitted to send forth those vigorous shoots, which insure a well-sized and healthy progeny?" And it is added that, "the greater the number of strong fibres and roots, the more do they search for food, and the more earth do they displace in the course of their growing; which divides the soil more minutely, and gives it the advantage of better pulverisation: and the greater abundance there is of leaf, the more nourishment is extracted from the air and dews, which are thus made to co-operate more with the vegetable pasture in the soil, in bringing the plants to perfection; and the thick foliage of the crop, by its umbrageous shade, has the same ameliorating qualities with a heavy crop of peas or beans, in destroying weeds, retaining the dews, and preventing the drought from penetrating and exhausting the soil." The writer says, however, that "it is to be observed, that too many, as well as too few, stems are unfavourable to the prevalence of fibres, and to the luxuriance of the leaves. Perhaps pieces about 2 oz. weight, are the most proper for being planted, and whole potatoes from that weight to one ounce; these may be called large pieces and small potatoes; and from them, it is probable, there will issue a sufficient number of stems to produce as many roots as the immediately surrounding earth can bring to perfection. To produce more, would, he thinks, make the roots small: to produce fewer, would give a less quantity of root from the acre." He further states that, "the roots procured from small whole potatoes, and from large pieces, both planted at 12 inches distance in the row, were better sized than those from large whole potatoes; and the roots from plants at 12 inches were larger than from plants at 6. And large potatoes planted whole at any distance, and whole potatoes or pieces at a nearer distance than 12 inches in the row, send forth so many stems, that, like cattle upon over-stocked pastures, they starve each other, and the produce is dwarfish." And he supposes that "shoots, small pieces, and potatoes confined to one stem, or a very few, resemble cattle upon pasture not nearly stocked; which, therefore, cannot make the proper returns to the owner. Large potatoes are more easily disengaged from the soil than small ones, and are more readily perceived at the time of taking them up; and therefore are in

less danger of being left ungathered. They take less time in gathering, which makes the expence of that operation smaller; and they sell better in the market. An objection to them, that they are not so easily boiled, is removed by splitting them, which will likewise make them drier, and better tasted. These advantages, attending the produce of small potatoes and large pieces, added to the œconomy in the article of seed, and the saving of time in planting them, seem to balance any little superiority, in point of quantity, gained by planting large whole potatoes at 12 inches, or any size of potatoes or pieces at a nearer distance in the row;" and "roots, so small as not to be distinguishable from the produce of curled potatoes, ought, he thinks, never to be planted where potatoes are subject to that disease. From eight potatoes, the produce of one curled one, planted in 1795, three came up curled, and that in a farm where it was a matter of difficulty to find a curled plant, upon which to make the experiment." This fact deserves the attention of cultivators.

It is stated that, "a disadvantage attendant upon planting shoots instead of potatoes is, that they do not ripen near so soon, and are therefore more exposed to injury from the equinoctial gales, and from early frost; neither do they admit of being planted so early as potatoes, as they are more delicate, and more apt to be hurt by the cold. But the chief disadvantage is, he says, that many of them fail entirely, or become such bad plants as to have very little produce." Other writers seem, however, to have been more successful with shoots.

The following observations are offered on the experiments stated above, in table 1, in 1749.

"Observation 1st. It is of great consequence to the farmer, the writer supposes, to pay attention to the kind of potatoe used for planting: see the amazing difference between No. 4 and No. 5. Though the most productive kind should not be the best tasted, it ought, however, to be planted for the use of horses, cows, hogs, and poultry. The potatoe in No. 8, is the best eating potatoe of those mentioned in the experiments; yet the produce from it, with little dung, exceeded that from No. 6 with much dung.

"Observation 2d. From the difference between No. 6 and No. 7, the former of which had three times the quantity of dung that was applied to the latter, the farmer will judge whether it is his interest to dung sparingly or plentifully; always paying a due regard to the condition of his soil, and the expense at which he can provide manure.

"Observation 3d. From the produce of No. 3, it appears, he says, that undunged potatoes are preferable to a summer-fallow without dung. And from comparing No. 1 with No. 2, it is clear that a dunged summer-fallow is not so profitable as a dunged crop of turnips, both followed by a crop of potatoes with dung. An acre of potatoes at 27l. 10s. 2½d. after a dunged fallow, will bear no comparison with an acre of potatoes at 25l. 19s. 8¼d. added to a crop of turnips the produce of the preceding year, of 30 tons.

"Observation 4th. From a comparison between rows 5 and 6, planting potatoes upon dung in the row seems to be a better method than dibbling them in the top of the row, after the dung is covered up. But where the farmer is so situated, as to be under a necessity of planting them in a wet soil, perhaps it may be his interest to place them in the top of the row, as this method will keep them from the cold and moisture at the bottom, which would be apt to destroy them."

It is supposed, however, by different writers, in the second volume of Transactions of the Dublin Society, that in scarce seasons, the shoots and the eyes or buds, scooped out by an implement for the purpose, are capable of being set with equal advantage as the cuttings; but they are obviously liable to many objections, and should never be had recourse to but from necessity. They want that proportion of matter about them which is essential to the health, generation, and establishment of the plants. The following interesting experiment on scooping potatoes, made by the Rev. Mr. Findlater, of Fundale, and inserted in the Farmer's Magazine, are highly deserving of the cultivator's attention.

"He chose, he says, a number of potatoes of the same species, similar in size as might be; he scooped out a parcel of the best looking eyes, with cutler Wight's hemispherical scoop; he cut also out a number of equally good looking eyes with a knife, taking as much as possible of the mother potatoe to the eye; he chose out nine of the best looking scoopings, and an equal number of best looking cuttings—these he planted in alternate drills upon a border, three in each drill. His whole sets sprouted, and no accident, he says, occurred; but the scoopings came up, and continued perfectly dwarfish in comparison of the cuttings. They were raised in two separate baskets in the beginning of November, and laid by in a closet to be weighed. The weighing was neglected to the middle of December; but the result was what might be expected from inspection at raising—the produce of the cut ones weighed a stone and a half tron; that of the other, three quarters of a stone, without reckoning very inconsiderable fractions. The experiment was merely made, to ascertain which throve best. Anxious to do the scoopings justice, he pressed the scoop deep in, with considerable violence; and, probably, the forcing of the scooped piece into the narrow contraction of the hemisphere, bruised and damaged its substance. Would not, says he, an open ring answer better?" And he adds that "Captain Mackay of Scotston, in this parish, cut one peck with the knife; he scooped also an equal quantity; (the scooped ones were not weighed before and after scooping, which would have ascertained the saving of potatoe substance in the seed). They were set in the same field; no difference was observable in their growth: at raising, the difference of the produce, by measure, was in favour of the cuttings, by one and a half a peck; the deficiency, in produce of the scoopings, being probably more than compensated by the saving of substance in the seed. He apprehends that the writer's error in the mode of scooping had been

avoided. It is, however, observed that the produce of the scoopings were the best-sized potatoes."

In speaking of the difference of opinion in respect of scooped cuttings, Mr. Young remarks that "from some experiments carefully made, the result of which he is well acquainted with, it appeared that these contradictory opinions might be equally just, when founded on variations in practice. When the soil is sandy, or in a very light pulverized, or highly manured state, and every other requisite for success beneficially secured, these scooped cuttings succeeded just as well as larger sets; but when the soil was more stiff, unfavourable, in worse tilth, or not equally manured, or the sets ploughed in, under circumstances not very favourable, then the larger cuttings had a considerable superiority. The propriety, therefore, on any future occasion, of having recourse to this expedient, will, he says, depend on the state of the lands, the soil, the manuring, &c. If the cutting be done by the bushel, 2*d.* is a fair price, where woman's labour is 8*d.* a day." This sort of work is, he says, however, seldom well performed when left to women.

It may on the whole be concluded, with respect to the proper seed or sets, for the raising of potatoe crops, that though the quantity of produce does not, as has been commonly supposed, bear any exact ratio to that of the weight of the set, yet that it in some measure depends upon that circumstance, and there being a suitable number of eyes as well as of pulpy material about them.

The proportion of ground that can be advantageously cultivated under this root, must depend wholly upon the circumstances of the farmer. Mr. Young strongly "cautions those farmers who are unacquainted with the culture of it against applying too much land to it. If they have a great plenty of dung at command, they may, he says, enter largely into the husbandry; but they should determine to plant no more land than can be manured at the rate of 25 or 30 large loads per acre; for one acre well cultivated, will, he thinks, pay better than five, or even ten, indifferently managed." But besides this, there are many other points to be considered before he fully decides, such, he says, as those of "the number of acres of carrots he has sown; for if his soil be suitable to that crop, they are greatly to be preferred to this root, being cheaper, not requiring dung, and being applicable to all the uses to which potatoes are applicable. They do not, he says, at all impoverish the land, whereas potatoes scourge it, if the expression be permitted, more than any other crop the farmer puts in. These are very material motives to influence a preference. But if the soil will not suit carrots, then it will be necessary to plant so much the more potatoes. The same observation may be applied to cabbages, which also, in a great measure, answer the purposes of potatoes. If he deals largely in that crop, it lessens the necessity of having this root; and ruta baga is as useful to hogs as the potatoe itself; but being far more uncertain, and the difficulty of securing a crop of it being greater, it cannot be depended on, like potatoes. The fly and drought, &c. are so fatal to it, that many farmers in Norfolk have, he asserts, sowed in vain for several years together." But whatever the extent of land may be that is appropriated to this sort of crop, such of it as is designed to be planted early, should, he says, in the latter end of April "all be hand-hoed over the whole surface, to cut up weeds clean, and loosen the earth. This management is, he observes, known only in the neighbourhood of London, but it should be extended over the whole kingdom, for the excellence of it is indisputable. The expense of hoeing, when there is a clear space to cut, is trifling, and the succeeding cleaning which the potatoes receive after they are up, is performed at a much less expense on account of this operation, and at the same time in a more effectual manner." But it is added that "the cheapest and most effective method of performing this necessary operation is by a large shim, which cuts three or four feet of surface. For this purpose, there should, he says, be a small broad wheel at each end of the beam, to regulate the depth. The work is confined to the surface, the intention of it being merely to cut up weeds and to loosen the earth, which rain and succeeding sun-shine may have encrusted. The operation is of great importance" and lessens the expense of the hoeings that may be afterwards given.

Where land is scarce, and of course dear, the borders near hedges, and other waste parts, may be converted to the raising of this crop with advantage in many instances.

In respect to the planting of this root, there are many different methods in use, in different districts; but the great object should constantly be, to preserve the plants, as much as possible, in a medium state of dryness. They are likewise grown after different sorts of crops and on different sorts of land. It is observed by the author of Modern Husbandry that "they are cultivated by farmers in general, after every sort of white-corn crop; but in Lancashire for the most part on lands broken-up from grass for the purpose. This practice was no doubt, he thinks, borrowed from Ireland, where it appears to have been generally established, soon after the introduction of potatoes into that country. And, he observes, that there are different methods of applying the dung, which however ought always to be done with a liberal hand. Sometimes the field is, he says, formed into one-furrow ridges, at the second ploughing. The dung is then laid in the furrows; and the potatoes being planted by hand on the dung at the distance of ten or twelve inches asunder in the furrows or drills, they are then covered up with the plough, which is done by splitting the one-furrow ridges. In Lancashire, where this sort of business is well performed, in planting, the practice is, after the land has been made fine and perfectly level on the surface, to make equidistant drills the whole length of the field, in doing which, the plough after making a furrow up the field, is drawn down again on the contrary side close by the same, throwing the soil

equal heights on each side. These drills are made as wide and deep as to render them capable of containing the dung, which is laid in the bottom of each. The distance of the drills is such, that when the horses stand in one, each wheel of the cart or tumbril may be in the middle of the next drill on each side. The next operation is to carry in the manure; and as the horses stand in one drill, and each wheel of the cart in a similar situation, the neatness and order of the land is little injured. The dung is then thrown out of the cart in small heaps sufficient to supply the three drills or furrows, which the horses and the wheels of the cart occupy, a moderate scattering of which is put into the bottom of each; the whole being completed in a very short time by persons with forks with two tines or prongs. The long strawy dung lately thrown out of the stables or cow-houses, or collected from the farm-yard, is always employed where it can be had. When the drills are thus prepared, the sets are put into them upon the dung about six or eight inches distant from each other. After this the plough is run on each side of each drill, to throw the earth which was raised out of it upon the potatoes, and cover them, which operation elevates it in the middle, and causes it to lie sloping on each side like the roof of a house, when the business is completed until the stems of the potatoes begin to make their appearance above the surface.

According to the author of the Report of the West Riding of Yorkshire, where the culture of this root is likewise well performed, after the land has been properly prepared, the best cultivators begin to ridge it up by ploughing a furrow round it down, and then taking a suitable distance according to the nature and qualities of the soils, as from about two feet eight inches to three feet, such as are rich and fertile requiring more space of ridge than such as are poor and exhausted. The manure, where necessary, is deposited with regularity in rows by means of a labourer with a fork, in the ridges, the potatoe sets being then placed at proper distances upon it, and covered with the plough.

Another method of ridging which has been found beneficial in some of the northern districts, is as soon as the land has undergone a full preparation, and is made perfectly fine and level, by repeated ploughings and harrowings in different directions, to draw straight parallel furrows by means of a double earth boarded plough, drawn by a single horse, at the distance of two feet and an half from each other. This operation is performed in the most correct manner, by passing the plough twice in the same place, which, when the land lies sloping or uneven, should be down hill the first time. The manure is then brought on in carts from the higher sides of the fields where they are hilly, the horses passing in one furrow, and each of the wheels in others on the different sides; they are then emptied by the drivers, who walk behind them with crooked three pronged forks constructed for the purpose, leaving it in small heaps in the furrows in which the horses go, in sufficient proportions for the three drills. It is then divided and spread out in the different rows in as equal a manner as possible by women and children, the sets being put in upon it at the distances of about twelve inches from each other, the whole being afterwards covered in by the plough, by splitting or dividing the ridges betwixt the rows, and passing twice in the same track as in the work of opening the furrows for the rows of the crop.

There is still another raised mode of planting this useful root. It is stated in the Report of the County of Cheshire, as "the custom there to form the land into narrow beds of about five feet in breadth by the plough, the manure, when necessary, being previously spread out evenly upon the ground, and turned down. The sets are then planted by means of a dibbling-stick to the depth of about three inches in rows ten inches apart, and alternately ten and twelve inches in them, so as that the root-shoots of the plants may occupy the ground as completely as possible without interfering with or injuring each other. When the shoots of the plants first appear upon the surface, each of the furrows or divisions between the beds is dug out to the depth of about one spit; the loose earth thus raised being cast as evenly as possible over the plants in the beds, by which they, as well as any weeds that may have sprung up, are covered, and the growth of the former greatly promoted, while the latter are in a great measure destroyed. And in cases where the staple of the land will admit of it, in about a week or ten days afterwards a second covering is dug out and thrown over the crop in the same manner, by which its growth is still farther promoted. In this mode of planting, as much fresh earth is from time to time applied to the plants, their vigorous vegetation is not only secured, but the extension of the roots rendered more full and complete. As a quantity of fresh earth is thus annually furnished for the growth and support of the potatoe, it is asserted in the first volume of the Agricultural Magazine, that repeated crops may be taken from the same land, even where manure is not made use of, without its being exhausted in any great degree. It is therefore supposed that it may be had recourse to with advantage where manure cannot be easily procured. And from such lands as are inclined too much to the retention of moisture" for the perfect growth of crops of this sort of vegetables.

The raising of the land into high ridges is not, however, adapted to every sort of soil. It is obvious that such sorts of land as are very dry and of a sandy nature should have the surface kept as level as possible in order that the proper degree of moisture may be more effectually retained and preserved for the support of the crops.

But in moist situations and where the soils are less subject to be injured by parting with their moisture, it may be the most suitable practice to raise them into ridges; as by such means the depth of the staple is augmented, the manure more concentrated for the support of the crop, a better bed provided for the fibrous roots and wires of the plants to establish and extend themselves in, the danger of stagnant moisture guarded

against, and the after-culture of the crops rendered more easy, beneficial and convenient, by which they may be kept more clean and free from weeds, and be earthed up at different times, so as to insure the most full and perfect extension of the roots in the fine mould that is thus constantly laid up to them. And as the whole of the process is capable of being performed by means of the common plough with a horse or two, it is probably the most advantageous where such crops are cultivated on land that has been some time in the state of tillage. In cases where the ridges are only required to be small, the operation is completed in one bout of the plough, or by going up with one furrow and laying another up to it in returning, so as to produce a ridge in the middle between them.

Where the method of horse-hoeing this sort of crop is in use, by which great crops are in many cases obtained, the practice in respect to distance is various; but whatever mode is adopted the land must be ploughed into proper ridges for them accordingly. Mr. Young says they have been tried in equidistant single rows at two, three, four, and five feet; in double rows at one foot, on four feet ridges; these, and also three rows on five feet ridges. But though attended with success, these wide distances between the single rows, he thinks, certainly lose too much ground. When equally distant rows are employed, he thinks three feet preferable. And double rows on four feet have been successful. Equally distant rows, at two feet with a neat horse-hoe which turns no furrow, only cutting the surface of the earth and earthing up afterwards with a double mould-board, have likewise answered very well.

In planting this kind of crop upon the plane surface there are likewise different modes made use of in different districts and under different circumstances. In districts where the soils are inclined to be dry it is in some cases the practice, after the land has been brought into a proper condition by ploughing over twice or oftener and well harrowed, to spread the manure regularly over the whole surface, the sets being planted in every third furrow, and the dung with the fine earth turned upon them by the next furrow of the plough. In this way the manure is however placed upon the sets, which has on experiment been fully shown to be injurious to the produce. Besides, from the whole of the surface of the ground being covered with dung, a considerably larger proportion must be requisite than when deposited only in the drills, and of course the crop be cultivated to disadvantage in that respect.

In other cases, as soon as the land has been properly ploughed and harrowed in a smooth even manner, the manure is spread equally over the whole surface as above, and then ploughed well in, when the planting is immediately begun, and executed in the following way: a man has a dibble with an iron point, and a place for him to set his foot upon to strike it into the ground, in order to make a hole for the set. He is followed by a woman or boy with the sets, who drops one into each hole; after which, the land is harrowed over once or twice or more, when the work is finished. In this way they are set promiscuously at from nine inches to a foot apart; and the business is effected with expedition and without much expense, from fifteen to twenty bushels of potatoes being sufficient for setting an acre of land.

In planting this sort of root on sward land, after it has been prepared by the use of a plough that just pares off the surface and deposits it in the furrow, it is advised by Mr. Somerville to place the sets upon the inverted sod, and cover them with the loose mould from below by means of a common plough. Or the trench plough may be used with perhaps more advantage. But the best method is that of paring and burning, as has been shown above.

In some cases the practice is however to turn down the turf with or without manure, and then to put in the sets by a dibble; though the former is probably the better practice, as the turfy material on which the sets are put, soon begins to decay, and the purpose of a manure is in some measure answered by it. It is a plan that may be adopted with advantage where manure is scarce, as in bringing waste and other coarse grass lands into the state of preparation for grain crops.

Mr. Donaldson states it as the custom in the neighbourhood of towns and villages in Scotland, for the farmer to let a field to the inhabitants at a certain rate by the rood or perch. The renters or hirers of the land pay a specified rent, and agree to furnish a sufficient quantity of dung. The farmer is at the expense of carrying the dung, and of ploughing and harrowing the field. The renters attend at the last ploughing, and plant the sets in the bottom of every furrow.

But, though these are the common modes of setting potatoes where that sort of husbandry is carried on upon an extensive scale in the field, there are others with the spade which are probably preferable on soils of proper depth where labour is cheap; the first of which is, he says, pretty commonly adopted in Lancashire, and in some districts in the north-east of Scotland; which is, to trench the land. The farmer having carried the dung, and laid it on the field in heaps, at proper distances, the operation is performed by the manufacturers and people who rent the field, and in the following manner: Across the end of the ridge, a trench is formed, about three feet wide, and from ten to fourteen inches deep, according to the depth and quality of the subsoil. That being done, a second trench of the same breadth is marked off, and the surface-soil, to the depth of six or eight inches, is thrown into the bottom of the former trench, over which a sufficient quantity of dung being laid, the potatoes are planted at the distance of eight or ten inches from each other, and then as much earth is taken from the bottom of the second trench, as is necessary for covering the potatoe-sets, and of making up the first trench to its former level. Thus the field being completely trenched, well manured, and kept tho-

roughly clean by repeated hand-hoeings must not only, he says, produce an abundant crop of potatoes, but also be in high condition for receiving whatever kind of seed may be afterwards sown.

Another mode of setting the root with the spade is that which is termed the lazy-bed method, which was, he says, formerly well known in many parts of England, as well as all over Scotland, although now confined to the very remote districts of the latter kingdom. "The term applied to this mode of culture, indicates, he thinks, that it was invented to save labour, and must have been adopted for any length of time by those only whom indolence and ignorance precluded from following other methods. These beds are formed of such a breadth as that any man used to the spade, can with ease throw earth almost from one side to the other. The manner of forming them is as follows: The size of the bed is first marked off with a line, and from two to four feet left on each side for trenches. The surface of the bed being then dug, or turned over with the spade, the dung is spread, and the sets planted, at about the distances last mentioned, after which earth from the trenches on each side of the bed is thrown over the dung and the plants, so as to cover them to the depth of three or four inches."

But Mr. Young advises a neater mode of executing this business, in which the land is "marked into beds five feet wide, with narrow slips between them, two feet wide. These are then dunged, about fifteen loads per acre: on the dung are laid the potatoe slices, after which the turf is dug thinly up in the two-feet intervals, and laid on the sets, which, with another spit, and the loose mould, completes the covering. This mode is not equal, he says, to digging all the ground, on account of its being left whole for the succeeding crop, but the crop of potatoes is generally good; for, besides the dung, they have the turf below to spread upon, and are partly covered with that from the trenches, so that they lie hollow, and in a rich bed of mould."

In planting the shoots as sets for this crop, the best practice may perhaps be that of putting them in slight shallow sorts of drills, made by a very small light plough for the purpose, at the distance of eight or ten inches from each other, and seven or eight in the rows, putting the root part downwards, which may be readily executed by women or children. After this has been performed, a small proportion of dung is to be laid thinly over them, and the earth from the sides of the drills lightly drawn over so as to protect them against any frosts that may happen. As soon as they have thrown out the leaves and are about four inches above the surface of the ground, a second covering is to be applied, so as to leave about two inches above the surface; and as they advance in growth continuing to cover them in the same way, until the earth between the ridges elevates the drill at least twelve or fourteen inches in height. It is observed that the shoots that are made use of in this way should be strong and vigorous, about five or six inches in length, and planted while perfectly fresh and in a state of full growth. In respect to keeping the shoot sets, they may be preserved for planting by taking them off from the potatoes either at once or occasionally as they are wanted, without bruising, and placing them across upon each other, spreading a light covering of earthy materials over them. By this means they may be kept a month, six weeks, or longer, until the land is in a proper state of preparation for their being planted out. Another method has likewise been proposed for raising this sort of root, which is that of transplanting such young plants as have come up by chance on grounds that have had this sort of crop, or been prepared for the purpose, in beds of rich earth or mould and dung, or by planting seed in dung hills a few weeks before they are set out. However, as much injury must be done to the shoots of the young plants in the taking them up, and as this sort of root seldom grows well after being transplanted, it is probably a method of planting that can seldom or ever be practised with benefit, unless it be in the filling up the rows, when broken and defective, or in procuring more early crops, whether in the field or garden practice of cultivating such sorts of crops. But whatever methods are employed in putting them into the earth, it has been stated that it is necessary that the greatest care be taken not to deposit the sets to too great a depth in the soil, as the potatoe root has a tendency always to rise towards the surface of the ground: three, four, or five inches at most is sufficient in all the light dry sorts of soil, and in those of a moist and heavy nature less may be fully adequate to the purpose, And another circumstance deserving of much attention in the planting of this useful root, is that of all the sorts of sets being set in and covered by such mould as is in a fine state of friability and mellowness, as when the earthy material by which they are covered is of a lumpy and unreduced quality, the crops are never found to be so fine or so productive. Many facts of this nature have been mentioned by writers on husbandry.

Some writers on agriculture likewise suppose that where this sort of crop is planted in the row method on a fine mouldy preparation of the land, without any manure being applied, or where it has been incorporated with the soil some time before, the drills should be made in a more light and shallow manner than where the common methods are pursued; otherwise mischief may be done by the sets being deposited to such a depth as to cause them to rot and be destroyed.

It is observed in the Lancashire Agricultural Report, in respect to the raising of seed potatoes, that "upon the same ground from which a crop has already been taken, the early seed potatoes are in some places afterwards planted; which, after being got up about November, are immediately cut up into sets, and preserved in oat shells, or saw-dust, where they remain till March, when they are planted, after having had one spit taken off, and planted with another, of a length sufficient to appear above ground in the space of a week.

"But the most approved method is, to cut the

sets, and put them on a room-floor, where a strong current of air can be introduced at pleasure, the sets laid thinner, as about 2 lays in depth, and covered with the like materials, (shells or saw-dust) about 2 inches thick: this screens them from the winter frosts, and keeps them moderately warm, causing them to vegetate; but at the same time admits air to strengthen them, and harden their shoots, which the cultivators improve by opening the doors and windows on every opportunity afforded by mild soft weather: they frequently examine them, and when the shoots are sprung an inch and a half, or 2 inches, they carefully remove one half of their covering, with a wooden rake, or with the hands, taking care not to disturb or break the shoots. Light is requisite as well as air, to strengthen and establish the shoots; on which account a green-house has the advantage of a room, but a room answers very well with a good window or two in it, and if to the sun still better.—In this manner they suffer them to remain till the planting season, giving them all the air possible by the doors and windows, when it can be done with safety from frost: by this method the shoots at the top become green, leaves are sprung, and are moderately hardy. They then plant them in rows, in the usual method, by a setting-stick, and carefully rake up the cavities made by the setting-stick; by this method they are enabled to bear a little frost without injury. The earliest potatoe is the superfine white kidney; from this sort, upon the same ground, have been raised four crops; having sets from the repository ready to put in as soon as the other were taken up; and a fifth crop is sometimes raised from the same lands, the same year, of transplanted winter lettuce. The first crop had the advantage of a covering in frosty nights." It is remarked that "this useful information was communicated by J. Blundell, Ormskirk, and has hitherto been known only amongst a very few farmers.

It is stated by Mr. Marshall in his Rural Economy of Yorkshire, that in raising potatoes from seed there, the following method is pursued:

"In autumn, when the apples are beginning to fall spontaneously, they are gathered by hand, and preserved in sand until spring, when they are mashed among the sand, or among fresh mould, separating the seeds, and mixing them evenly with the mould. As soon as spring-frosts are judged to be over, they are sown in fine garden mould, and as fast as the plants get into rough leaf, and are strong enough to be handled without injury, they are transplanted from the seed-bed into another bed of fresh, rich mould, in rows, which are kept clean during the summer. In autumn, bunches of small potatoes are found at the roots of these plants, varying in size the first year, from the hazel-nut to the crab. These being planted next spring produce potatoes of the middle size; but they do not arrive at their fullest bulk until the third or the fourth year.

"Where the use of the stove or the garden-frame can be had, this process may be shortened. The seeds being sown within either of these, early in spring, the plants will be fit to be planted out as soon as frosts are gone; by which means the size of the roots will be much increased the first year; and will, in the second, rise nearly to perfection."

It is added that "potatoes raised from seed are a miscellany of endless varieties. Sometimes these varieties are planted miscellaneously; sometimes particular varieties are selected.

"In selecting varieties from seedling potatoes, two things are, he says, to be attended to: the intrinsic quality of the potatoe, and its productiveness. If these two desirable properties can be found in one plant, the choice is determined. To this species of attention and industry we are, he thinks, indebted for the many valuable kinds which have been, and now are, distributed throughout the island.

"It is observable, however, that varieties of potatoes, like those of corn, are partial to particular soils and situations. Hence the propriety of husbandmen raising potatoes from seed; as by this means they obtain, he says, with a degree of moral certainty, a sort adapted to their own particular soils and situations."

These are the principal circumstances which seem requisite to be attended to by the farmer in the planting of his potatoe crops; but there are others that demand his care in the after-management of them.

There cannot be any doubt but that by proper attention to the keeping the crops of this kind in a suitable state of cleanness and culture, after they have been put into the soil, much advantage must result both in the goodness and abundance of the produce. The manner in which this is effected is different, according to the mode in which the crops have been planted and the nature of the land. It is, however, mostly applied, by hoeing with the common or horse-hoe, and by hand-weeding. The first is the method usually followed where the old modes of planting are practised, the second where the drill system is had recourse to, and the last occasionally in both cases. The horse-hoeing mode has been applied on the principle of saving a part of the expense of hand-weeding the crops, as well as with the view of promoting in a more effectual manner the growth of the roots. It is admitted by the advocates of this husbandry that there are more plants in the old practice; but they contend, that the tillage by the use of the plough, is so much more complete and effectual than that of the hand method, and the admission of air among the plants so much more free and extensive, that the loss in respect to number is much more than supplied by the augmentation in size.

But whatever may be the advantages of the drill culture in this sort of crop, there cannot be any dispute, but that the finer and more loose and mellow the mould is kept during the time in which the plants are forming their wires and knobby roots under the ground, by frequent stirring, the better and more abundant the crops must be, from their growth and distention being more perfect and complete.

With the intention of effecting these purposes in the best manner, it is the usual practice in those districts where this root is much cultivated to have recourse at different times to such means as are capable of cleaning, mellowing, reducing and bringing up to the roots of the plants the fine mould which has been in this way produced.

The implements commonly made use of in this intention, are the harrow and the hoes just noticed, by the first of which the particles of the soil are broken down and reduced into a fine state, and by the latter laid up to the roots of the plants.

According to the author of a paper in the ninth volume of the Bath Papers, "the potatoe land is harrowed, when the growths from the sets under the surface are about an inch long; this can be known only from inspection. It is impossible to say, in how many days it will happen after their being planted, as it will depend on a variety of circumstances: such as the season of planting, the quality of the soil, the state of the weather, the kind of potatoe, the nature and quantity of the manure, &c. Harrowing potatoe land, he says, destroys the first crop of weeds, and creates a fine pulverized soil for the plants to feed in, when they arrive at the surface." And "by delaying this operation till the above time, the vegetation of the weeds is, he says, more advanced, and consequently more effectually destroyed;" but by delaying it much longer there would be a danger of breaking off the potatoe shoots.—"The harrow used by the writer is a folding-harrow, invented by himself, drawn in the intervals by a single horse; it applies stuff to the opposite side of two contiguous rows, destroys the weeds and pulverizes the soil without levelling the row, which would tear up many of the potatoes, or break off their shoots, and deprive the land of the advantages it has, by lying dry when the shapes of the rows are preserved. A lighter harrow, on the same plan, is employed in smoothing the rows intended for turnips and other small seeds, immediately before they are sown. When the potatoe plants are all early seen, the earth and weeds are removed from them, going as near as possible to them with a shallow furrow, and turned into the middle of the intervals by a horse-hoe; which is the same with the writer's large plough, on a smaller scale, with a very narrow earth-board. If it be done sooner, there will, he thinks, be danger of tearing away those which are not seen, if the hoe be allowed to come near enough to the rest. If it be delayed longer, there will not be the same benefit derived from horse-hoeing. Any weeds and grass which shall have escaped the plough, both now and to the time of taking up the potatoes, are carefully to be pulled up by the hand." And "in a few days after the first hoeing, the same instrument is, he says, to go deeper in the former track. This stirring will make the earth in the intervals free, that has been trampled down by the weeders, and it will bury the weeds they have pulled up. When the weeds, buried in the intervals, are rotted or converted into vegetable food, the earth is returned to the plants with a double earth-board-plough, going twice in the same track with a shallow furrow; the first of these times down hill, if the land be hilly, a boy following the plough to uncover any plants that have been buried in the row; for, if left in that situation, their growth would be either entirely stopped, or very much retarded. If, by avoiding to bury the plants, they should be left in some places without any mould touching them, it is drawn towards them in those places with a hand-hoe." He adds that when "the plants are about six inches in length, the earth is raised higher towards them, by the double earth-board going twice in the track of the former earthings, but much deeper than before; which finishes the horse-hoeing of the crop."

It is advised by Mr. Young, that some time in May, the early planted potatoe crop should have a hand-hoeing, which should be done with good attention, that not a weed may be left, and the surface of the land be left well cut, and in fine order. And that the crops in rows should receive, besides this hand-hoeing, the first horse-hoeing, which should be given with a common swing-plough drawn by two horses, one before the other, and turn a furrow from the rows, throwing up a small ridge in the middle of each interval. These operations should be well and attentively performed; for the weeds grow at a great rate, and, without such an attention, will destroy, or at least greatly damage the crop. And another hand-hoeing should, he thinks, be given in June, and so effectually executed as to render any succeeding ones unnecessary, as the plants may be so grown as to be injured by it. The crops planted for horse-hoeing must also have that operation now again performed with the double mould-boarded plough, splitting the ridges before thrown up, and applying them to the rows in an equal manner. And in July in some cases the crops in rows should have a third horse-hoeing. But he says, that the common mode of ploughing backwards and forwards *every* time of performing the operation is not well suited to the crop; as cutting the roots when the plants are in full growth hurts the crop, and destroys the runners that would afford potatoes. The third horse-hoeing should therefore be executed with the shim which loosens and cuts the surface of the ground, without turning it over or forming any ridge. Some of these tools, he says, work with many little triangular shares, others with single flat ones, and still others hoe with coulters; however, any that cut up fresh mould at the bottom of the furrows, do very well. They should be followed in about a week, by the double mould-board plough, striking the furrows, and throwing up all the loose mould to the ridges, banking them up. This is useful by affording fresh mould for the roots to shoot into, which is better than the practice of taking it away from them, when they have began to advance in growth.

And in August the rows of this sort of crop should be hand-weeded when necessary, as it is probably too late to horse-hoe them. But when the intervals are very weedy or much bound, or the plants not sufficiently earthed up, he advises the shim to be carefully run through them to destroy the weeds and loosen the earth, so as that they may be stricken clean by the double mould-board-plough, and well earthed

up for the wirey roots to extend into and increase the produce.

This sort of crop is shown to have attained a sufficient degree of ripeness as well as full size by the decay of the leaves and their dropping off the stems. And they should be taken up as soon as possible after the appearance of frost in the autumn, as in the latter end of September or beginning of the following month.

In the taking up of the potatoe crops the modes that are followed, are, Mr. Donaldson says, different according to the nature of the culture under which they have been managed; when they have been planted in drills, and horse-hoed, the common method is, he says, "first to turn a furrow from each side of the drill, and then to turn over with the plough that part of the drill in which the potatoes are lodged, and which are afterwards gathered by women and children hired for the purpose. Sometimes the middle part of the drill, after the two side-furrows are taken from it, is turned over by men with three-pronged forks. In other places, the three-pronged fork entirely supplies the place of the plough, which is never introduced. Where a sufficient number of women and children can be procured for gathering the crop, using the plough is certainly the most expeditious and least expensive mode. In order to avoid the risk of cutting the potatoes with the coulter, it is commonly taken out, and the plough with only a share, or sock, is used for turning over the middle part of the drill, which, as it performs the operation as effectually, is no doubt an improvement, and may be considered the best implement that can be used in taking up a crop of horse-hoed potatoes. When potatoes are planted with the spade or the plough, and with an intention of hand-hoeing the crop only, the common method of taking up the potatoes is with the spade, one gatherer attending every person who is employed in turning over the ground. Crops of potatoes thus cultivated, are sometimes, however, taken up with the plough. When that happens, it is found necessary to plough the field two or three times over, otherwise it is scarcely possible to get the crop properly collected." Mr. Campbell remarks, that "in his district the roots are taken up with a fork with three prongs." And that "to make this operation easier where the land is stiff, the outside of the row, in which there are no potatoes, is pared away by going round every other row with the horse-hoe, and when these are dug, returning to the remaining ones; that is, the earth is removed from the 1st, 3d, 5th, 7th, &c. and when the potatoes are taken out of these, it is removed from the 2d, 4th, 6th, 8th, &c. The injury done to the roots by the plough and harrow, and the great number unavoidably left in the soil, is not, he supposes, compensated by the saving of time and labour in taking up with those instruments."

But Mr. Young thinks, that "there is not the same reason for digging up this crop as for carrots; the plough among the latter is apt to cut, break, and bury them; but not so with potatoes, for it turns them over, damaging scarcely any." In performing this work, first, says he, "let a number of women preceded by a cart, pull up the tops, and throw the potatoes that adhere to them into baskets, and the stalks into the cart, which should convey them to the hog-yards, where they will presently be trampled into dung: then each plough taking its ground, attended by six or eight women, or more, if the crop is very large, each with a basket, divide the furrow, by setting up white sticks into as many parts as there are women, that each may pick her own share; a range of bushel skeps, at a small distance, for the baskets being emptied, and three or four carts ready for men (who do nothing else), one to eight or ten women, to take the skeps to the carts. The furrow being picked, he used, he says, many years ago, to work it by men with three-pronged forks, each with a women, or boy, to pick up the roots; but finding this expensive, he contrived a diagonal harrow in a shim beam, with 2 or 3 teeth, drawn by one horse, which tears the furrow in pieces, and lays bare the mass of the crop: the women then pick again; and another common cross-harrowing, with a second ploughing and harrowing, all three attended with two women to each plough, will finish the business, and clean the roots all away; so that he has found the pigs, when let in, make but very poor gleanings. The use of the little harrow saved him, he says, from 14s. to 20s. per acre in labour, which would otherwise have been necessary.

This implement is shown in plate 2 and 3, *fig.* XIX.

As soon as the potatoes are gathered, if the weather be favourable, they should be allowed to remain some days to dry, before they are stored up, as it will give them a much better chance of keeping. There are several ways of storing up potatoes: the best is certainly that by which they can be kept most effectually dry, and at the same time free from the influence of frost. Putting them into close houses, and covering them well up, with dry straw, is the most effectual mode, and that which is generally adopted. In some parts of Scotland, it is a common practice to dig pits in the potatoe-field, when the soil is dry and light, and, putting in potatoes to the depth of three or four feet, to lay a little dry straw over them, and then cover them up with earth, so deep that no frosts can affect them. Another method, which is practised in England as well as Scotland, is to put them together, in heaps, and cover them up with straw, in the manner for preserving turnips, with this addition, that the heaps are afterwards well covered with earth, and so closely packed together as to exclude frost. The farmers in Lancashire sort and separate their potatoes in the course of taking them up, according to their sizes, and are particulaly careful to throw aside all those that are spoiled before raising or that are cut in the taking up. This is a very necessary and proper precaution, (although by no means generally attended to), as the crop must have a much better chance for keeping, than when diseased or cut potatoes are stored up with it." It is also of great advantage to have the work performed in a dry season, as the

potatoes seldom keep well when taken up wet, or when placed in a sort of repository for keeping while in that state.

But the best way of storing the roots is, Mr. Young says, in what are called potatoe-pies. "A trench, one foot deep and six feet wide, is dug, and the earth clean shovelled out, and laid on one side: this has a bedding of straw, and the one-horse carts shoot down the potatoes into the trench; women pile them up about three feet high, in the shape of a house-roof: straw is then carefully laid on six or eight inches thick, and covered with earth a foot thick, neatly smoothed by flat strokes of the spade. In this method he never lost any by the severest frosts; but, in case of its freezing with uncommon severity, another coat of straw over all, gives absolute security.

"These pies when opened, should each be quite cleared, or they are liable to depredation. To receive one at a time, besides also being at first filled for immediate use, he has a house that holds about 700 bushels, formed of posts from fir plantations, with wattled sides, then a layer of straw, and against that earth six feet thick at the bottom and eighteen inches at top; the roof flat, with a stack of beans upon it. This he has found frost tight. The beans keep out the weather, he says, and yet admit any steam which rises from the roots, which, if it did not escape, would rot them."

Besides these, there are several other modes of preserving potatoes in use in different places.

In Rutlandshire, Mr. Marshall says, the method of laying up potatoes, is universally, that of *camping* them: a method somewhat similar to the above, but which requires to be described. "Camps are shallow pits, filled and ridged up as a roof, with potatoes; which are covered up with the excavated mould of the pit. This is a happy mean, he thinks, between burying them in deep pits, and laying them upon the surface.

"Camps are of various sizes; being too frequently made in a long square form like a corn-rick, and of a size proportioned to the quantity to be laid up. It has, however, been found, by experience, that when the quantity is large, they are liable to heat and spoil: much damage having sometimes been sustained by this imprudence. Experienced campers hold that a camp should not be more than three feet wide: four feet is perhaps, as wide as it can be made with propriety; proportioning the length to the quantity; or, if this be very large, forming a range of short ones, by the side of each other.

"The usual depth is a foot. The bottom of the trench being bedded with dry straw, the potatoes are deposited; ridging them up as in measuring them with a bushel. On each side the roof, long wheat straw is laid, neatly and evenly, as thatch; and over this the mould, raised out of the trench, is evenly spread; making the surface firm and smooth with the back of the spade. A coat of coal ashes is sometimes spread over the mould; as a still better guard against frost.

"It is needless to observe that a camp should have a dry situation; and that the roots ought to be deposited in as dry a state as possible. These camps are tapped at the end; some battins, or a quantity of loose straw being thrust close in the opened end, as a bung or safeguard."

As it is a matter of the highest importance, to preserve this root without spoiling during the whole year, it has been suggested, that the best method yet discovered for keeping potatoes sound for the longest period, is to spread them on a dry floor early in the spring, and to rub off the eyes occasionally, as they appear to have a tendency to push out; by using these precautions, Mr. Donaldson has frequently seen potatoes kept in good condition till the month of June. And the following ingenious method, of procuring a supply from the new crop, merits attention: "It is to take up carefully with the hand the potatoes that lie nearest the surface; this in place of injuring the crop, will rather improve it. If this practice were generally adopted by the poor people, who are often obliged from necessity to have recourse to the new crop at a very early period, and to dig up a considerable part of it before it comes to maturity, that diminution of the crop would, the above writer says, be in a great measure prevented."

Potatoe crops are exposed to the attacks of disease, and that of the *curl* or *blight*, is the distemper to which this plant is most liable. It shows itself very early in the season, by a curling in the leaves, and sometimes to such a degree, that whole fields are rendered thereby in a great measure unproductive. The cause of this disease is not yet perfectly understood, but the remedies most likely to prevent the evil, are those of frequent changes of seed, using large sets, cultivating and manuring the land in a proper manner, and not repeating this species of crop too often on the same land. See *Curl*.

The expenses of cultivating and produce of this sort of crops have been differently stated, and they must obviously differ greatly according to the soil and the manner in which they are grown, as well as other circumstances.

They are stated in the following manner in the Report of the West Riding of Yorkshire, by Mr. Brown, in 1799.

Expenses upon an acre of Potatoes.

	£.		
Land rent	1	5	0
Working and ridging	1	5	0
6 Sacks of potatoes at 7s.	2	2	0
Cutting do. and setting	0	2	0
Manure and leading	2	2	0
Hoeing, weeding, and taking up	1	5	0
	£. 8	1	0

Produce of an acre of Potatoes.

	£.		
60 Sacks at 5s. 6d. per sack	16	10	0
	8	1	0
	£. 8	9	0

The small that dresses out, of what is shipped to London, will deliver them, or rather more.

And in the North Riding of the same district from 200 to 300 bushels per acre, is stated to be con-

sidered as a good crop of the sorts for the table, and that those kinds raised for the purpose of cattle, will generally afford more by 50 or 100 bushels on the same extent of land. And the same is considered as a good produce in the Lancashire mode of cultivating the root.

It is observed in Young's Norfolk, that Mr. Cubit at Cutfield had an acre two years ago, which produced forty-eight pounds, at 6s. a sack.

It is remarked by F. Kirchaffer, Esq. of Dublin, in a paper in the fourth volume of Communications to the Board of Agriculture, that "of the seed potatoes that were planted in a field, there were just thirty-two hundred weight, which he procured from the South of Scotland, at a very considerable expense. These were a clean white and good kind, a little flatted, and had been raised in a moist soil. They were planted in some of the drills. Some more were planted with white seed, raised in the Bog of Allen. Some were also planted with black, and a few with very fine apple potatoes, from the same quarter. The remaining drills were planted with white, black, and apple potatoes, all of which had been raised on land very similar to that in which they were now put; in fact, had grown in the very next field." He found that "in their growth the Scotch seed made the earliest and by much the most luxuriant shoots; the Bog's whites and blacks were the next best. The home blacks and Bog apples, were the next; and the home apples were the worst of all." It is added, that "as the Scotch whites were the earliest, so they were the first that were dug out; and here the produce was, he says, astonishing to the workmen, and to numbers of strangers who came to see the digging. They lay in the drills like hanks of onions, from the bottom, on which the seed had been laid, to the crown. There was very little difference in their sizes, none either remarkably large or small, and they turned out of the ground as clean and beautiful as possible. A great number of the roots produced from two to three and four pounds each, and several were more abundant. He had scales brought to the field, and before respectable witnesses six perches of each kind of potatoes were dug out of the drills, three of which were such as were supposed to be the best, and the other three the worst, but in fact they seemed to be pretty equal. The weights of the produce of the six perches of each kind were, he observes, as follows:

Sorts.	*Produce per perch of seven yards.*		
	lbs.		lbs.
The Scotch whites	312	which averaged	52 each perch.
— Bog whites	246	. .	41 ditto.
— Bog blacks	210	. .	35 ditto.
— Bog apples	138	. .	23 ditto.
— Home whites	192	. .	32 ditto.
— Home blacks	162	. .	27 ditto.
— Home apples	108	. .	18 ditto.

It is further stated, that "all the drills were thirty-eight perches long and five feet distant from centre to centre; of course they were eighteen times thirty-eight perches of drills in an Irish acre, or 684 perches of seven yards running measure. This number, multiplied by the average of each sort of seed produced in a perch, gives the acreable produce of every kind in pounds, which, reduced into barrels of two hundred and a half, is as follows, viz.

The Scotch whites gave 126 of these barrels per acre.

— Bog whites	—	100 barrels.
— Bog blacks	—	85 barrels.
— Bog apples	—	56 barrels.
— Home whites	—	78 barrels.
— Home blacks	—	66 barrels.
— Home apples	—	44 barrels.

It is stated by Mr. Donaldson that "the multiplicity of weights and measures by which potatoes are sold in the various market towns in the kingdom, renders it almost impossible to give an accurate account of the value of a crop by the acre. It varies, he supposes, in weight from five to eight, and sometimes ten tons; probably the general average may be nearly six tons the English acre. The medium price of potatoes shipped at Dundee, has, he says, been, for some years, about 35s. the ton, equal to 10l. 10s. the acre."

These roots may be readily sorted by having recourse to a sort of wide riddle made for the purpose.

It is stated by the author of Practical Agriculture, that this sort of "root joined with hay, straw, chaff, and other similar matters, has been found useful in many cases, especially in the later winter months, as a food for horses, cows, and other sorts of live stock; and with these substances, as well as in combination with other materials, as bean or barley-meal and pollard, in the fattening of neat cattle, sheep and hogs: but as there is considerable trouble and expense in preparing them, it being found that they are much more safe and nutritious for such animals when boiled, they do not appear to have paid greatly when employed in this way." It is added that "the results of numerous trials detailed by different writers in the Annals of Agriculture do not show them to have been in this mode of application worth more, in general, than from four-pence to five-pence the bushel. When given to horses, it may be something more, as there is more difficulty in ascertaining the savings in other articles of fodder that are thereby made, and the advantages that are gained by the animals. It has, he says, been stated to be about ten-pence the bushel."

It is stated by J.C. Curwen, Esq. M.P. in a paper in the fourth volume of Communications to the Board of Agriculture, that his former success "in feeding horses with steamed potatoes and cut straw, has encouraged him to attempt to remove the only inconvenience he found attending it,—the length of time and labour requisite to steam any considerable quantity. He consumed last year at his works upwards of 60,000 stone. The washing was an operation of great labour, and if not particularly attended to, was often ill done." But in a steaming house which he has contrived, there is a washing machine, which will, he says, most completely clean eleven stone in two minutes, and requires only a trifling exertion. See *Steaming House*.

The following is the statement of "the expense of feeding his work and carriage horses:—the work horses are employed from eight to ten hours, and from the nature of their work, are obliged to travel quickly;

these horses, he says, stood their work remarkably well the last year, and continue to do so at present." He adds, that "he begun to feed with potatoes the 5th of October: to each horse is given daily one stone and a half of potatoes, mixed with cut straw, in the proportion as one is to ten. The average cost of potatoes 3d. per stone, one stone and a half, ... 4½d.

Oats, at 2s. 4d. per Winchester bushel, weighing from 39lb. to 40lb. 8lb. of ditto		6
Hay, at 6d. per stone,	7lb.	3
Cut straw,	4lb.	1
Steaming the potatoes		0½
Per day		1s. 3d.

It is further stated, that "horses of great draught, and such as cannot be allowed to rest at noon will require 12lb. of oats, which will make the cost of feed, per day, 1s. 6d. These horses consume rather less hay, but have double the quantity of cut straw with their oats, (which are bruised,) which makes the expense nearly equal." And the steaming 120 stone of potatoes requires, he says, two and a quarter Winchester bushels of coals = 137lb. (the weigh t of the bushel, 61lb.) costs . . 0 6¼d.
The labour costs . . 1 8

	2	2¾
120 stone steaming, at 1¼ .	2	6
The difference .	0	3¼

He says, that "this 3¼d. per day may be ap plied towards the first cost, and the necessary repairs of the machinery, and will, in seven months, amount to £8 1s. 10½d."

He supposes that "one acre of potatoes is equal to four of hay, and under proper management, the ground will be in as good condition for wheat as if it had been under fallow. The potatoe crop will not in general, he says, pay the expense, but there will be a considerable saving in putting in the wheat, compared with a fallow equal to forty shillings per acre."

It is remarked in addition, that "no pains has been spared in having the estimate made as accurate as possible; he has taken the price of hay and potatoes on the average of common years. He has, he says, seldom, if ever, cut less than 300 acres of grass, and has found that quantity inadequate to his annual consumption, and has always been obliged to purchase hay, and has paid from eight-pence to one shilling per stone, besides the expense of carriage which would make the average cost ten-pence per stone." On the whole, "he is fully persuaded that work and farming horses may be fed with potatoes at a much easier rate than with hay." It is added that "the waste in the steaming of this root is about one eighth part. And that lately straw has been substituted instead of hay, and the horses have kept their condition, and done their work equally well."

The method of baking potatoes, for the purposes of feeding lean and fattening other sorts of stock, has been suggested by Mr. Pierrepont in a letter to the Society for the Encouragement of Arts, and inserted in the fourth volume of Communications to the Board of Agriculture, as another and preferable mode of preparing this root, to that of the above. "Not altogether satisfied, says he, with the system of curing or preparing potatoes by steam from heated water, which he had practised, and conceiving that some better method might be found out, he in 1801 made several experiments and bestowed much attention and trouble upon it, before he brought his plan to bear, which is that of having an oven, and a proper digester placed in it for containing the roots which is shown in the second plate, on the steaming, roasting, and preparing cattle food. It is observed that "potatoes cured in this way are not near so apt to turn sour or scour the cattle, are more dry, so that the animals fed with them drink a deal more, and they become more hard when cold, so as to be flung to the stock with more convenience than when steamed. In 1802 the writer fattened, he says, fifteen brace of bucks chiefly with them. He says, chiefly as after the potatoes were gone, they had a few beans. They were very fine and peculiarly fine flavoured. He also fattened the same year with them two oxen, three cows, and two pigs which were equally well flavoured particularly the first. The pigs had, towards the latter end, a few whole pease after each meal. The bucks had six pounds per day, each at an average. The lean deer in the parks do very well, he says, with a little more than a pound per day instead of hay. And this year (1803) he has fattened two very large oxen, and twenty Welch wethers. The wethers with which there were two South Down rams, and one ewe, had eighty pounds of the potatoes per day, with a little cut hay. The ewe was, he says, put with them, to teach the other sheep to eat them, she has since had twin lambs, and the bailiff acknowledges that the lambs do better than the other at turnips, though he, with some others, dissuaded the writer from trying more ewes, under the idea that the potatoes would dry up their milk. Four dairy cows never, he says, did so well with very good hay, as they did last winter, with about four pounds of potatoes, and about five pounds of rubbish hay and straw cut. One of the oxen weighed on the 22d of March, 343 stones alive, upon a weighing machine; he had about forty pounds three times a day." It is observed by the Earl of Egremont, that he knows nothing of the expense of preparing potatoes in this way; but they appear to him "to be more nutritious than in any other mode of dressing, and much better tasted for the table." He adds that "he did not think it possible to bring such large oxen to such a state of fatness upon potatoes." In the feeding of milch cows, they have been found useful in some cases, even when given without being prepared by being exposed to the heat of boiling or any other means.

They are stated by Mr. Young to be sometimes given to horned cattle in the cribs that hay is given in. Giving hay in the morning, about ten o'clock potatoes, at noon hay, about two o'clock potatoes, and

at night hay. An ox of one hundred and forty stones (eight pounds to the stone) will eat one bushel and an half per day; from eighty to one hundred stones, one bushel, with about ten pounds of hay; they will not eat much hay if they have that quantity of potatoes. They get very fat cattle with hay and potatoes.

Mr. Close also states, that "he has for several years kept his hogs entirely upon his refuse potatoes, and can always, without difficulty, or the expense and trouble of confining them, sell those of about seven or eight stone weight, to the butchers, for roasting meat, at 4s. 6d. per stone: pork fed in this method is remarkably sweet, the flesh delicate and moist. This food succeeds admirably, except for bacon-hogs, and he finds from experience that it is necessary to keep those intended for that purpose about a fortnight upon ground pease mixed with boiled potatoes. If the hogs are forwarded with potatoes before they are confined, two bushels of pea-meal, and four bushels of boiled potatoes, well incorporated, will fat a hog of twelve stone, fit for hams or bacon; this method greatly reduces the expense commonly attending the fattening of swine." The best way is, however, to give this sort of food to the store hogs.

It is observed in the Survey of Norfolk, that "Mr. Repton has raised potatoes for the consumption of his farm; but not when he has any prospect of buying them, which he has done at 1s. 6d. to 2s. 6d. a sack. He steams them for young cattle, &c. having a very complete apparatus for the purpose; boils five coppers, which steam 50 or 60 bushels a day, and answers well: also turnips, and pours their liquor on to cut chaff, giving the whole mixed together; it answers extremely well; the cattle licking it up with great avidity, and doing perfectly well on this food."

And "Mr. Newman of Bayford, Hertfordshire, has fed cattle on potatoes, but as they were too watery, they would not answer; he therefore left off the practice."

"Mr. Rooper, of Berkhamsted, has usually had four or five acres for fifteen years past; he thinks very differently from Mr. Newman, and uses them raw for fatting beasts, as he assures Mr. Young, with much success; for hogs also they answer very well. He plants them after oats in every third furrow; and ridges up the stubble soon after harvest; he harrows it down in the spring, and spreads eight loads of long fresh dung per acre: then plants near 20 bushels per acre; he horse-hoes and ploughs up the crop, which produces from 150 to 200 bushels per acre, on a flinty loam, on a chalk bottom. Wheat will not do after them; but the barley is good. They are, he is clear, a very exhausting crop.

"Mr Hill has a field of uniformly light sand loam, on the ridge or highest land in the parish of Kempton, containing about two acres and three-quarters; this field was cropped with potatoes in 1794, when he saw it, and the year before produced about 400 bushels per acre, worth on the average 1s. 9d. per bushel 35l. per acre: every attendant expense about 5l. 30l. clear. He fed his milch cows and store pigs with the potatoes in winter: the cows gave abundance of milk, but not cream in proportion."

But, according to the first of the above writers, by much "the most general as well as the most useful application of this sort of crop is in that of human food, for which purpose the roots are rendered mealy, nutritious, and fit for undergoing the different processes of digestion, by means of heat, either dry or in water or steam, their acrid juices being in this way converted into mucilage, and probably some portion of that into a fine farinaceous or starchy substance. Experience seems to prove, he says, that where the heat is properly applied through the medium of steam, the potatoes become more mealy and nourishing than where water is made use of for the same purpose. But the differences in the mealiness produced by the boiling of this root is supposed by some to depend more upon the nature of the soil on which it is grown than on any other circumstance." And it has been suggested by Doctor Darwin, as stated by the same writer, "that the mealiness of some potatoes that have undergone the operation of boiling, may be sometimes affected by the acidity of the water in which they have been boiled: but it is believed to depend more generally upon the mucilage in some of them being more coagulable than in others, a circumstance the cause of which has not yet been fully investigated."

The cleaning of this root, where it is made use of upon an extensive scale, is frequently considered as a troublesome operation; it may, however, the above writer says, "be performed with great ease and convenience, by having a vessel constructed in the form of a barrel, with small strong narrow laths on the sides nailed to the solid boards, forming the ends at such distances as may be sufficient for preventing the potatoes or other roots from falling through, and at the same time for admitting the water to pass freely. The potatoes are to be introduced and evacuated by means of a door fixed in one of the sides." It is added, that "the vessel being thus prepared is to be hung upon a frame of wood over a large square tub containing water, in such a manner as that about one-half of it may be immersed; a crooked handle projecting at one of the ends, by quickly turning which, when the potatoes are put in, a large quantity may be expeditiously washed. There should likewise, he says, be a contrivance in the frame higher up and nearer the side of the cistern for lifting the barrel, from the place in which it turns, into, in order that, by opening the door and turning it round, the washed roots may be easily delivered into a barrow or other vessel placed below," so as that it may receive them. But a much more expeditious mode of doing this may be seen in the steaming and washing apparatus, contrived by J. C. Curwen, Esq.

In regard to the effects which are produced on the soil by this sort of crop, it seems probable, the author of Practical Agriculture says, that "both from the nature of the root and the large portion of manure that is necessary to ensure a great crop, except under particular circumstances of the land, that

the potatoe is a sort of plant that has a tendency to draw a large quantity of nourishment from the soil on which it is grown, consequently to exhaust and impoverish it in a considerable degree, though these injurious effects are in some measure counteracted by the great abundance of stem and the closeness of the foliage, producing a stagnated state of the air and a considerable deposition of vegetable and other matter on the surface, as well as by the pulverisation and aeration that is afforded in the culture and removal of the crop from the ground. It is perhaps in this way only that the contradictory accounts of the effects of this sort of crop on the soil and the occasional successive production of full crops on the same land, can, he says, be well reconciled." He further thinks, that "the experience of potatoe cultivators in general appears to support the conclusion; as upon the more strong and heavy sorts of soil, where benefit can be produced in the above manner full crops may often be taken in succession without much injury being sustained; while on the lighter kinds where much less advantage is derived in this way they become too open and exhausted for the successful repetition of this sort of crop, and even for the growth of wheat." And that in Mr. Young's trials with the potatoe, introduced in a great many different courses of crops, it was found that the state of deterioration of the soil was in proportion to the frequency of the occurrence of such crops in the rotations. In the experience of the writer of the Agricultural Report of the North Riding of Yorkshire, this kind of crop does not, he thinks, impair the fertility of the soil on which it is produced: as he has always found that the crop of corn succeeding the potatoes, and the seeds after the corn have been equal to those succeeding a crop of turnips. And he adds that "it is well known and generally allowed, that a well-managed crop of potatoes, leaves the soil in a mellower and more fertile state than any summer fallow, or any present mode of cultivation of any other crop. This arises from the frequent stirrings in the fore part of summer with the plough and hoes for the destruction of weeds: the thick shade of the plants which keeps a perpetual moisture in the soil, and the decay of so large a quantity of leaves and stalks, before and after the crop is taken up, all tend to enrich the soil. A question also, he says, arises on the food and support of this plant; do not all succulent plants derive a greater proportion of their nourishment from the atmosphere by their tops than those of a drier texture? This, though not capable of proof, is probably the fact; and it is confirmed by the circumstance of all meliorating crops being of a more succulent nature—as beans, peas, vetches, turnips, and clover, than wheat, oats, or barley, which are exhausting crops."

The facts on this subject as stated in the Hertfordshire Report are these: "Mr. Penrose of Hatfield, has often sown wheat after potatoes, but very rarely gets a good crop; finding this culture, as the reporter was informed, a bad preparation for that grain.

"Mr. Cassmajor, at North Mims, has cultivated this root, and has had considerable crops, but he uniformly found it so exhausting, that he could never get such crops of corn after them as satisfied him; he therefore gave up the culture. And Mr. Marsh, near Hatfield, a very improving farmer, has cultivated this root, for some years: he manures with horse-dung; plants chiefly the champion sort, and gets 700 to 800 bushels per acre. He has had good wheat after these but little crops of barley."

"Mr. Hill, of Whittle, has generally four acres: that he has had 1100 bushels on two acres and a half. He finds that giving them to store hogs is the most profitable application. His men dig up the crop with four-pronged forks, at 1d. per bushel; which crop is easily measured by a fifteen-bushel cart." Mr. Roper finds them a very exhausting crop."

"Mr. King, of Barkway, has had wheat after potatoes, but not good crops: this year he will take barley, which he is well convinced is the most profitable management."

It is stated in the Norfolk Report, that "Mr. Everit has found that they exhaust the soil more than any thing."

"The dispute respecting their effects on the soil may, Mr. Marshall says, perhaps, be settled satisfactorily in this manner:

"The potatoe contains, indisputably, a great quantity of nourishment; and is therefore, perhaps, as indisputably a great exhauster of the soil.

"But the quantity of vegetable nourishment carried off in the potatoe crop is not the only cause of exhaustion: it is notorious to common observation, that this crop leaves the soil in a singularly friable fertile state, causing an abundant produce of the crop which succeeds it.

"If taking the advantage of this prodigality of the soil, the husbandman keeps cropping it year after year with corn; and, when it will no longer answer his unreasonable expectations, lays it down to grass, it is no wonder that it should be unproductive: for having lavished all its riches on an ungrateful occupier, it is of course reduced to extreme poverty.

"On the contrary, if after a crop of potatoes, well dunged for, only one or two crops of corn be taken, and the land be laid down to grass, while yet in a state of fertility, the potatoe crop is, to vulgar appearance, at least, friendly to the crop which succeeds it.

"Hence it follows, that land which has been cropped with potatoes should presently afterwards be laid down to grass, or should be timely replenished with a quantity of manure proportioned to the degree of exhaustion it has undergone.

"The value of potatoes as a fallow crop, and as an article of food for cattle, compared with turnips and cabbages for the same purposes, may, he says, be considered thus:

"Potatoes are more nutritious; and in the opinion of those who have used them, fat cattle much quicker than either turnips or cabbages. Potatoes, too, being secured from the severities of winter, are more certain article of fatting than turnips or cabbages;

both of which are liable to perish under an alternacy of frost and thaw; and the turnip, more particularly, is locked up, or rendered more difficult to be come at, during a continuance of snow or frost. Turnips and cabbages, if they out-weather the severities of winter, occupy the soil in the spring when it is wanted to be prepared for the succeeding crop; while potatoes, if properly laid up, are a food which may be continued without inconveniency until the cattle be finished, or the grass has acquired the requisite bite for finishing them in the field.

"On the other hand, potatoes are, he says, a disagreeable crop to cultivate: the planting is a tedious dirty business; and taking them up, may be called the filthiest work of husbandry; especially in a wet autumn."

POTATOE *Harrow*, an implement of the drag kind, made use of for harrowing out the potatoes after the plough. Mr. Young remarks that he used formerly to work the furrows after the plough by men with three pronged forks, but that finding the method expensive, he contrived a diagonal harrow in a shim beam, with two or three teeth, to be drawn by one horse, which tears the furrow to pieces, and lays the potatoes bare, and by repeating the operation clears the ground of the crop. It saved him, he says, from fourteen to twenty shillings per acre in labour. It is seen at *figs.* 2 and 3 in plate XIX.

POTATOE *Scoop*, a sort of scoop made use of for taking out the eyes or buds of the potatoe for the purpose of sets; they are made of different sizes, according to the intention of the cultivator. Scoops of this sort are represented at *figs.* 4 and 5 in plate XIX.

POTATOE *Sets*, the cutting of the potatoe which are made use of as sets, for planting. They should always have one or more eye, and be from a quarter to half an ounce in weight, being cut from good sound roots.

POT-ASH, an alkaline salt produced from fresh vegetable substances by burning them.

POST, a strong upright piece of timber, either in a building fence or any other situation. Thus we have gate-posts, fence-posts, &c. See *Gate-Post.*

POST *and Pan*, a term provincially applied to half timber buildings.

POST *and Pailing*, a kind of close wooden fence. See *Fence.*

POST *and Railing*, a sort of open wooden fence often used for protecting young quick hedges, &c. See *Fence.*

POTHERY, a provincial word signifying close muggy, or sultry in speaking of the weather.

POULTING LUG, a provincial term applied to a long slender rod used in beating fruit off the trees.

POULTICE, in *Farriery*, a soft pulpy substance, constituted of different materials, calculated either to sooth an inflamed or ulcerated part by the effects of its warmth and moisture, or to produce some effect by its stimulus.

There are various forms of poultices according to the effects intended to be produced by them.

The common poultice may be prepared in this way:

Take of Milk half a pint;
Sallad oil, three large spoonfuls;
Grated bread enough to make it of a due consistence.
Add the bread to the milk when boiling, afterwards beat in the oil thoroughly, when it should be immediately used.

A good common poultice may likewise be made in this way:

Take of Fine pollard, half a peck;
Linseed meal, two pounds and an half;
Boiling water, a sufficient quantity.
And lastly,
Hog's lard, two ounces. Mix.

The suppurative poultice may be made in the following manner:

Take of the leaves of mallows, either green or dry,
Marsh-mallows, together, about twenty handfuls;
White lily roots, washed and pounded, half a pound;
Linseeds;
Fenugreek seeds, bruised: of each four ounces.
Boil these very soft and pulpy, and add
Elder ointment, four ounces;
Lard, as much as is needful.
Mix the whole together, and keep it for use, as there may be occasion.

The digestive poultice may be formed in this way:

Take of Oatmeal, a moderate quantity;
Strong beer grounds, as much as will sufficiently moisten it;
Lard, a small quantity.
Turpentine, one or two ounces, according to the degree of stimulus required.

And another may be prepared as below:

Take of White lily roots,
Linseed;
Rye-flour; of each a sufficient quantity.
Add the other ingredients as above.

The resolvent poultice is thus prepared by Mr. Lawrence:

Take of Onions;
Camomile flowers boiled;
Lard or neat's foot oil, of each a suitable proportion.
Mix them well together.

This is, he supposes, highly efficacious in dispersing swellings.

Another poultice of this sort may be made as below:

Take of Oatmeal, half a pint;
Cummin seeds, powdered, two ounces;
Camphor, in powder, half an ounce;
or,
Sal ammonia dissolved in British spirit, the like quantity.

It has been found highly useful by Mr. Lawrence in bruises, and in dispersing coagulated blood.

The anodyne poultice may thus be composed:

Take of Camomile;
Elder leaves, or flowers;
Poppy-heads;
Bay leaves;
Rosemary: each three handfuls.
Boil them soft and add a sufficient quantity of oatmeal, some elder ointment, and a little camphorated spirit afterwards, or the tincture of opium may be used without the ointment.

The restringent poultice is thus prepared:
Dissolve alum in vinegar or verjuice.
Add half the quantity of oil, with some red wine lees, or stale beer grounds, and bean meal.

And another may be formed as below.
Take of old verjuice or distilled vinegar, one quart;
Alum, one ounce;
Currier's shavings, or oak bark a sufficient quantity.
Boil these into a poultice, with or without saturnine ointment, and apply it warm twice a-day.

The fermenting poultice is formed thus:
Boil a quantity of brewer's wort, and stir into it as much oatmeal as will properly thicken it. And lastly, a tea cupful of yeast.
This is well adapted for putrid ulcers; or mortified parts, being frequently renewed.

The saturine poultice is prepared in this manner:
Add to the common poultice,
Extract of lead, three drachms or half an ounce.
Mix them well together.

And another in this way.
Take of acetated ceruse (sugar of lead), one ounce;
Boiling water, three quarts. Add
Bran and linseed meal, enough to make the whole of a due consistence.

POULTRY, a term applied to all kinds of domestic fowls brought up in the farm-yard, as cocks and hens, ducks, geese, turkeys, &c. The farm-yard cannot be said to be complete till well stocked with these sorts of birds. The advantages of this sort of stock is however, probably doubtful, except in particular situations, and where there is much grain cultivated. The poor villager may however, reap in some cases benefit from products of this sort as they are able to shift for themselves in some measure the greatest part of the year, by their feeding on insects, corn, or any thing of that nature.

There are many different breeds of this sort of live stock but those best known are the *game* breed, the *white* or *English* breed; the *black* or *Poland* breed; the *Darking* breed; the large or *Shakebag* breed; and the *Malay* breed.

The two first are much smaller breeds than the others. This sort of stock affords profit in the eggs, as well as the chickens, therefore such as are the best layers and sitters should be chosen, which are in general the game and Poland breeds, but the other breeds have probably the advantage in respect to the size of the eggs: as food the game and white breeds, are said to be the most delicate. Some advise the choosing those that are the best breeders, and best layers; the oldest being always reckoned the best sitters, and the youngest the best layers; but no sort are good for either, if they are kept too fat; the best age to set a hen for chickens is from two years old to five, and the best month to set them in is February; though any month between that and October is good. A hen sits twenty-one days, whereas geese, ducks, and turkeys, sit thirty. While sitting they should have constantly meat and drink near them, that they may not straggle from their eggs and chill them. When fowls are fed with buck-wheat, or with hemp-seed, it is said they will lay more eggs than ordinary; and buck-wheat, either whole or ground, made into paste, which is the best way, is a grain that will fatten fowls very speedily; but the common food used is barley-meal, with milk or water, but wheat-flour moistened is by some thought the best. The hen should not differ from the nature of the cock; but both be working, vigilant, and laborious, for their chickens. It is better for the hen to have no hinder claws, because they often break the eggs. Crowing hens are seldom either good layers or good breeders. To have large eggs and in plenty some advise the giving the hens plenty of food, and sometimes oats, with fenugreek to heat them. And to prevent hens eating their nest eggs, plaister or chalk ones may be employed.

Hens may be kept in the proportion of eight or ten to a cock.

Mr. Young says, that "when in the common way the farmer keeps but a few of each sort, that take their chance at the barn-door, for the convenience of eggs, and not to go to market when a fowl is wanted, no particular attention is requisite; but as, in some situations, they may pay well for more food and closer attention;" other circumstances may be noticed. "The poultry-house should, he says, contain an apartment for the general stock to roost in, another for setting, a third for fattening, and a fourth for food. If the scale is large, there should be a fifth, for plucking and keeping feathers. If a woman is kept purposely to attend them, she should have her cottage contiguous, that the smoke of her chimney may play into the roosting and setting rooms; poultry never thriving so well as in warmth and smoke; an observation as old as Columella, and strongly confirmed by the quantity bred in the smoky cabbins of Ireland. For setting both turkies and hens, nests should be made in lockers, that have lids with hinges, to confine them, if necessary, or two or three will, he says, in sitting, crowd into the same nest. All must have access to a gravelled yard, and to grass for range, and the building should be near the farm yard, and have clear water near. Great attention should be paid to cleanliness and white-washing, not for appearance, but to destroy vermin." See *Poultry-house*.

Boiled potatoes are the cheapest food; and of corn, buck-wheat. Turkies while young demand incessant attention, and must be fed with alum curd and

onions, for which purpose, store of those roots should be kept where they will shoot out and produce much food. If there be not much success in broods, and a certain high price, they will not answer, he thinks, for the expences are heavy" in the management of this sort of stock.

In setting hens the eggs should constantly be such as are new layed and in a perfectly fresh state. The number may be ten or a dozen, but it is best not to have too many.

The broods of chickens should be so managed as to have them coming in as the season begins to get warm in the spring; but by proper attention, they may be had at almost any time of the year. When they are first brought out they should be attended to with care where any are weak, and some advise their being removed into warmth, but it is probably best to let them remain with the hen. When they are two days old, rice, split grits, or very small oatmeal, may be given them, some dry, and some steeped in milk, or else crumbs of fine white bread; and when they have gained strength, curds, cheese parings, white bread, crusts soaked in milk, barley-meal, or wheaten-bread scalded, or boiled, or roasted potatoes, or any such like soft meat, that is small and will be easily digested. And it is necessary to keep them in the house for some time, especially in bad weather and not to suffer them to go abroad with the hen. Green chives chopped among their meat is very good, and will preserve them from the *rye* or other diseases in the head, and they should never want clear water, as puddle water is said to be apt to give them the pip.

When the chickens are confined under coops they should not be placed too near each other, as the hens are apt to destroy each other's chickens.

The quantity of food which young chickens consume is mostly about one or two ounces in the day, while in their early growth, as from one to two pounds in weight. They should be prevented from picking up slugs, snails, &c. from the earth as much as possible.

In order to fatten chickens, various modes are used, but the best practice is probably that of confining them for a few days in dry well ventilated places covered so as to prevent the entrance of too much light, the fowls being taken in, in good condition from the poultry yards. In these situations they should be regularly fed three or four times in the course of a day with well roasted or steamed potatoes, which are probably the cheapest sort of food; as near Liverpool, in Mr. Wakefield's practice, which is upon an extensive scale, it has been attended with the most complete success, the poultry thriving perfectly well. Buck wheat is likewise an useful and cheap food for this purpose, either given whole or ground into flour, barley meal ground, malt and also coarse wheat flour, when mixed up with milk, or what is better, water, as milk runs quickly into a state of acidity, have been much recommended in this intention. From some experiments it has been stated that pea meal employed in the same way possesses a still more fattening property, and is at the same time more economical as going much further. A confinement of eight or ten days in this way, will, in general, be sufficient for effecting the business of fattening. When kept up long, fowls are extremely apt to be affected with disease. Whatever sort of food is made use of full air and a perfect state of cleanliness is essential in all the utensils employed for the purpose in order to prevent the food becoming sour, and the fowls affected with diseases of the kinds mentioned below. It is stated by a writer in the sixth volume of the Agricultural Magazine, that he has ascertained that three pounds of meal flour, or grain of such a sort as does not cost more than a penny a pound, or to the farmer and cottager not even so much with water, and what other fare the little creature can find for itself, will feed and fatten a chicken sufficiently from the time of its bursting the shell, till that of its being of a growth and in a condition suitable for its being carried to market. And that the allowance of another penny is sufficient for the attention and labour which its rearing requires. The prime cost of the egg may be one halfpenny. Thus, he supposes, that even in the neighbourhood of any great town "a chicken that shall bring nine pence, or rather one shilling in the market, and is in comparison with other things worth as much for the use of your own table, whether you be a rich or a poor man, may be produced and reared at the expense of four-pence halfpenny. And further, that in proportion as fowls are kept for the consumption of the portion of farinaceous food that is daily in waste about farm-houses, the expense cannot be more than one penny; consequently by attention to this economical mode, abundance of poultry may be had at a reasonable rate." And, he adds, that old fowls "even though fed with food for which money proportionate to the just market value must be paid, will by their eggs pay annually at least three times the cost of their subsistance independently of the advantage of the manure which is afforded."

A system of management is stated by Mr. Young, as practised by Mrs. Boys of Kent, which appears to be extremely simple and beneficial. The labourers' wives and families who live on Mr. Boys's farm, he says, do the whole; he supplies them with what offal corn is necessary, and they return Mrs. Boys the grown fowls ready for market at three pence each; sixpence for turkeys and geese, and threepence for ducks; and the account, well kept, states a profit of twenty pounds a year, after all the expenses are paid and the family well supplied. And she has likewise all the eggs without any payment. It is a system, he says, equally beneficial to the people who undertake it, and to the farmer.

These birds are subject to different diseases, as the *pip*, the *roup*, the *flux*, the *stoppage* and *blindness*. The first is said to be occasioned by eating foul meat, and drinking dirty water, or the want of water. It is known by a thin white scale on the tip of the tongue, which prevents the fowl from eating; and it is cured by taking off the scale with your nail and rubbing salt upon the tongue.

The second is supposed to be a sort of swelling

on the rump, which disorders the fowl prodigiously; and is observable by the feathers on the affected part standing out of their natural position, the quills being full of blood. Pulling out the feathers, opening the sore, forcing out the core, and washing the part with brine or with salt and water, will affect the cure, it is said, in most cases.

The flux is supposed to depend on eating too great a quantity of moist fermenting food, and which is cured by giving peas-meal scalded, rice with a little wax. The stoppage in fowls is a sort of costiveness which affects them to such a degree, that they are unable to walk, and is shown by their not eating as usual. Its cure is effected by anointing the vents, and then feeding them with corn, or small bits of bread soaked in urine, the obstructing substances may also be taken out of the crops. The blindness of fowls is best remedied by a change of food and letting them have a free air.

To distinguish whether poultry is good or not: after a chicken is killed it will be stiff, white, and firm in the vent, if new killed; but tender, and green in the vent if stale; and if you rub your finger on the breast of a chicken, if it be new killed it will feel rough; but if stale, slippery and slimy.

Guinea Fowls, these are a sort of bird of the fowl kind which lay very abundantly, but which from their retaining much of their wild nature, are apt to wander much from home, and of course cannot be kept so conveniently as the more domestic sort of fowls. They are likewise remarkably shy, and on that account liable to forsake their nests upon the least disturbance being given them. They are probably better for the table than the common fowl, as being larger and having more of what is termed the *game* flavour; they have likewise the property of breeding abundantly when properly managed.

Turkeys, these are a sort of farm stock that can only be kept with advantage in districts where grain is the predominant article of cultivation. There are two varieties of these birds in this country, the black and the speckled sorts, the former of which is in general the larger and more hardy. It is observed that they are birds that prosper very well in open countries, where there is not much shelter to harbour vermin to destroy them: for they are naturally inclined to ramble. The hens likewise are so negligent of their young, that whilst they have one to follow them, they never take any care of the rest; and therefore there must be a great deal of care taken of them whilst they are young, to watch them, and to keep them warm, as being birds that cannot bear the cold. But some, where they have the conveniency of a small cover near the house, let them take their liberty, and seek their own nests; but it is only in particular places that they do well with such management. It is observed that a gentleman that had a hen-turkey of the wild kind from Virginia, from which, and an English cock, he raised a very fine breed, that bred wild in the fields, and always became tame when grown up; they were a very hardy breed, and much larger than the common, and reared their young ones without any care or trouble, breeding much better than the English sorts. Where they are kept with corn, they are very great feeders, and devour a great deal; but if left to their liberty when grown up, they nearly get their own living, by feeding on herbs, seeds, &c.

This is a sort of bird which breeds without the male birds being kept constantly with the females during the laying season, as is the case with most other sorts of birds. Turkeys are very apt to straggle, often laying their eggs in secret places; and therefore must be watched, and made to lay at home. They begin to lay in March, and will sit in April. Eleven or thirteen eggs are the most they sit on. They hatch in between twenty-five and thirty days; and when they have hatched their brood they must be carefully kept warm, for the least cold kills them. They may be fed either with curds, or fresh cheese chopped in small pieces, with onions or leeks, and their drink may be new milk, or milk and water. Some give them oatmeal and milk boiled thick together into which they put onions or leeks chopped small, and sometimes eggs boiled hard, and cut in little pieces. They must be fed often, as the hen will not take much care of them, and when they have got some strength, be fed abroad in a close walled place where they cannot stray; not letting them out till the dew is off the grass, and taking care to have them in again before the night, because the dew is very prejudicial to them.

These birds when young may be fattened with great expedition by means of boiled potatoes and good barley meal mixed well together with chopped onions or leeks, if they be kept fed in a regular manner. The writer of Practical Agriculture says, that the practice of cramming them is a piece of stupid and unnecessary cruelty, as it is evident they can only fatten in proportion to the quantity of food which is digested whatever quantity may be forced upon them; besides, they will consume it fast enough if regularly fed, which is probably the fact, however custom may have sanctioned such a method of fattening them. The author of the original Report of Norfolk thinks that, the fineness of the flavour in the Norfolk turkeys depends on the dryness of the soil in that district, and the extensiveness of the range which they are suffered to possess while in their young growth. The difference between the living and dead weight of a turkey, is thus stated by Mr. Young: live weight 21lb. dead weight 14lb.

Ducks, these are a sort of water fowl that may be raised with benefit in particular situations where there is plenty of water for them to rest upon in the vicinity of the farm-stead, as they require little trouble or attention. There are different breeds, but the *English* or *white* and the *brown* or speckled wild breeds are probably to be preferred. The latter are however, apt to wander.

It is only in such situations as above, that this sort of stock can be kept with benefit, except it be a few just for the purpose of the table. Ducks mostly begin to lay early in the year, as the latter end of January, or beginning of the following month, es-

pecially when well fed, and they require great attention at this period, as they lay a great number of eggs, and are very apt to drop them in the water, or at random in other places. One drake is sufficient for four or five ducks. When set, from ten to a dozen or thirteen eggs are a sufficient number. They sit about thirty days, and during the time should be fed and have water near their nests, to prevent the eggs being injured by their leaving them too long. When hatched, the ducklings should remain with the duck in some enclosed, safe, warm, sunny place, and be well fed with crumbs of bread, grits, or barley meal, with well roasted or boiled potatoes, well mixed and used in a fresh state, sand and clean water being constantly kept beside them in shallow pans. It is observed that the duck breeders have in general a provision of worms, snails, and other similar animals in readiness for them when a little more advanced in their growth, as well as corn either in its ground or natural state, and that it is likewise a point of great importance to keep them perfectly clean, and to let them have plenty of dry clean straw as litter. They should never be left at full liberty till they are become quite strong, as a month or six weeks old, being constantly kept as distinct as possible from the other sorts of poultry.

In the fattening of these birds which are greedy, but not nice feeders, grain either in its whole or reduced mixed state, is probably the best sort of food. The use of boiled potatoes well mixed with oatmeal, is found to be an economical and expeditious method. Much, however, depends on their being fed in an exact and regular manner, and on a proper supply of water and sand being constantly given: while at the same time they are kept in a perfectly quiet detached situation, not too much exposed to the action of light, but well aired; when fattened on animal substances, which are very expeditious in accomplishing the business, they are said to have more resemblance both in the colour and flavour of their flesh to the wild duck, than in the common method. In the acorn season they are also capable of being readily fattened on that sort of food, and are allowed to be well flavoured in their flesh from the use of it.

Mr. Weston has advised the use of malt for this purpose, which, he says, answers in the proportion of something less than a gallon per duck. "It has, he adds, an amazing quality in fattening them when young, and causes the flesh to be very delicate; when old they readily fatten with almost any food; but for the flavour it gives the flesh, he would always prefer malt before any thing else; before they have been put up to fatten, he has likewise given them plenty of lettuces which they are exceedingly fond of; they are, he thinks, a very cheap food for them, as they need then have but little corn.

It has been long ago observed that these birds are useful in destroying slugs, caterpillars, &c. and the author of the Report of Middlesex, thinks that "it is clearly ascertained that ducks might be kept in such numbers on corn farms as to prevent any sensible loss or destruction in their crops by worms, slugs, or caterpillars; and yet we are always hearing of great losses occasioned by those vermin. The support of a hundred or two of ducks on a farm is a trifling expense, and might be considered in the light of ensuring the young crops against being cut off. It is thought that many farmers receive more damage to a crop in one season, than would support a sufficient number of ducks to give security for twenty years."

The establishing of decoys for the taking of wild-ducks, is a point that deserves the farmer's notice in particular situations, as where there is a great extent of water in a retired situation at a short distance from the sea. It is often done in the wilds of Lincolnshire and in Norfolk as well as some other districts. Mr. Marshall remarks, that "the lakes and large pools, which abound in the southern hundreds of East Norfolk, are the nurseries of innumerable flights of 'wild fowl,' of various species, but principally ducks; which are taken in great numbers in decoys, formed on the margins of these waters; and which, in eligible situations, may well be considered as objects of rural economy." But he observes that "much judgment is requisite in forming and managing a decoy. A gentleman in this neighbourhood had, says he, a person out of Lincolnshire to make one for him. But, after a great expense of cutting pipes, fixing skreens, nets, &c. it proved unsuccessful. The pipes were too straight, too close and confined, and too narrow at the mouth; without any banks for the wild fowl to bask upon. Upon the whole, it was too much like a trap to be taken in."

He says, that the leading principles of a decoy, are these: "as the wild duck is a very shy bird, and delights in retirement: the first step, therefore, is to endeavour to make the given water a peaceful asylum, by suffering the ducks to rest on it undisturbed. The same love of concealment leads them to be partial to waters whose margins abound with underwood and aquatic plants: hence, if the given water is not already furnished with these appendages, they must be provided; for it is not retirement alone, which leads them into these recesses, but a search after food also." And further, that "at certain times of the day, when wildfowl are off their feed, they are equally delighted with a smooth, grassy margin, to adjust and oil their plumage upon. On the close-pastured margins of large waters frequented by wild fowl, hundreds may be seen amusing themselves in this way: and, perhaps, nothing draws them sooner to a water than a conveniency of this kind:—hence it becomes essentially necessary to success, he says, to provide a grassy, shelving, smooth-shaven bank at the mouth of the pipe, in order to draw the fowl, not only to the water at large, but to the desired part of it." And after having "by these means, allured them to the mouth of the pipe, or canal, leading from the water to a tunnel net, fixed at the head of it; but hid from the sight among trees and aquatic plants; the difficulties that remain are, he says, those of getting them off the

bank into the water, without taking wing; and of leading them up the pipe to the snare which is set for them, in the most easy manner."

In order "to get them off the bank into the water, a dog is, he says, necessary, (the more like a fox the better) which should steal from behind a skreen of reeds, which is placed by the side of the pipe to hide the decoyman, as well as his dog, until the signal be given. On seeing the dog, the ducks, he says, rush into the water; where the wildfowl consider themselves as safe from the enemy which had assailed them, and of course do not take wing.

"Among the wildfowl, a parcel (perhaps, eight or ten) of decoy-ducks should be mixed, which will probably be instrumental in bringing them, with greater confidence, to the bank.—As soon as these are in the water, they make for the pipe; at the head of which they have been constantly fed; and in which they have always found an asylum from the dog. The wild-ducks follow; while the dog keeps driving behind; and, by that means, takes off their attention from the trap they are entering." When, as "soon as the decoyman, who is all the while observing the operation through peep-holes in the reed skreen, sees the entire shoal under a canopy net which covers and incloses the upper part of the pipe, he shews himself; when the wildfowl instantly take wing; but their wings meeting with an impervious net, instead of a natural canopy formed of reeds and bullrushes, they fall again into the water, and, being afraid to recede, the man being close behind them, push forward into the tail of the tunnel net which terminates the pipe." He has, he says, been "told by the proprietor of a decoy, who is himself fond of the diversion, and whose veracity he has no reason to doubt, that he has, in this way, caught 'nine dozen' at a push."

From this "use of the pipe, its form becomes obvious. It ought, he says, to resemble the outlet of a natural brook, or, a natural inlet or creek of the principal water. The mouth ought to be spacious, and free from confinement, that the wildfowl, on their first rushing into the water, and while they have yet the power of recollection, may be induced to begin to follow the tame ducks; and for the same purpose it ought to be crooked, that its inward narrowness, and nets, may not, in the first instance, be perceived. The lower part of a French horn is, he observes, considered as the best form of the pipe of a decoy that can be had."

It is added that "a material circumstance remains yet to be explained. It is the invariable nature of wildfowl to take wing with their heads toward the wind; and it is always imprudent to attempt to take them in a decoy, unless the wind blow down the pipe: for, while their enemy is to leeward of them, they have less scruple to go up the pipe, making sure of an escape by their wings. But, what is of still more consequence, if the wind set up the pipe, when they take wing under the canopy net, some of them would probably escape (a circumstance always to be dreaded), and those which fell again into the water would fall, of course, with their heads toward the wind, and would, with greater difficulty, be driven into the tunnel." It is further stated that "this point is so well known, by decoymen in general, that every decoy is, when circumstances will admit of it, furnished with three or four different pipes, pointing to distinct quarters of the horizon, that no opportunity may be lost on account of the wind, being in any particular point."

The fattening of ducks at any age is easy, and whether it be the duckling, or the grown ducks, the method to be used is exactly the same. See *Duck*.

Geese, these are a sort of bird that will live upon commons, or any sort of pastures, and need little care or attendance; only they should have plenty of water. The largest English geese are reckoned the best, but there is a sort of Spanish geese that are much better layers and breeders.

In procuring geese for keeping, the author of Practical Agriculture says, great care should always be taken to procure them as large in size as possible, and from places where they have been well kept. Geese like most other birds, begin to lay in the spring months; and the earlier this happens the better, as the price of early green geese is generally high, and in some cases it may be possible to have a second brood. Both these purposes, he says, may be promoted by letting them be well fed with oats, grains, or some such kinds of food at the period. The goose generally lays from eight to twelve eggs, it may be known when geese are about to lay, from straw being frequently picked up and carried about by them. The length of time of sitting, is about thirty days. When geese are inclined to sit, they generally show it by remaining on their nests after laying a considerable time. In this case a proper quantity of eggs as from ten to twelve should be placed in the nests, and something put before them so as to prevent the geese from being much seen. They should also have plenty of food, sand, and water, near them, in order that they may not remain long off the nests, and in that way let the eggs be too much cooled. The ganders should be left with them as guards. When the weather is warm, they generally hatch sooner than when it is cold. After the gozlings are hatched, the best method is to let them remain with the goose, especially where they are strong, in some warmsunny place, that is well secured against the entrance of rats, and all other sorts of vermin, and which is properly supplied with water; being well fed with the crumbs of bread, grits, wheat, and some chopped clivers. They should remain in this confinement until they are grown strong, and capable of following the goose with ease, they may then be put into a small field or paddock where the grass is short, till they are fit to be turned out with the geese. When they are weakly it is customary to feed them in the house with bread soaked in milk, or a little barley meal, and where this is done, they should, however, al-

ways be put under the goose again, immediately after such feeding, and handled as little as possible; warmth in this stage being the most essential article in rearing them. They should never be suffered while very young to go into the wet, dew, or water, as the cold soon destroys them, by giving them the cramp.

It is stated in the Lincolnshire Report as the practice of that district, where vast numbers of these birds are annually produced, "for their nests to be made for them of straw, and confined, so as that the eggs cannot roll out when the geese turn them which they do every day. When near hatching, the shell is broken a little against the beak or nib of the gosling, to give air, or to enable it to receive strength to throw off the shell at a proper time: this is, however, seldom necessary. It is added, that the time of plucking them is about the beginning of April, when the fine feathers of their breasts and backs should be gently and carefully plucked: care must be taken not to pull or interrupt their down or pen feathers, and the quills should be pulled, five out of each wing. And it is observed that they will bear pulling in thirteen or fourteen weeks again, or twice in a year: the feathers three times a year of the old geese and ganders, seven weeks from each pulling. The young geese may be pulled once at thirteen or fourteen weeks old, but not quilled, being hatched in March. But when late in hatching, the brood geese should not be plucked so soon as April, but the month after. When well fed with barley and oats, they thrive and do better, and their feathers grow faster, and are better in quality than where it is omitted. They must constantly have plenty of grass and water: it is further stated, that in many parts of that fenny district, great advantage is made by the frequent pluckings of the geese. At Pinchbeck, it is the practice to pluck them five times in the year, as at Lady-day, Midsummer, Lammas, Michaelmas, and Martinmas. The feathers of a dead goose are worth sixpence, those giving a pound, but plucking alive does not yield more than threepence a head per annum. Some wing them only every quarter, taking ten feathers from each goose, which sells at five shillings a thousand. Plucked geese pay in feathers one shilling a head in Wildmoor Fen," at present it is much more.

In fattening green geese, they may be shut up when they are about one or two months old, and they will be fat in about a month more. They should have a little grass with their dry food which may be any sort of grain, malt or carrots.

But in the fatting of older geese, it is commonly done when they are about six months old, in or after harvest, when they have been in the stubble-fields, from which food some kill them, which is a good way; but those who have a mind to have them very fat, shut them up for a fortnight or three weeks; and feed them with oats, split beans, barley-meal, or ground malt mixed with milk, the best thing to fatten them with being malt, according to Mr. Weston. Green geese will likewise feed on and fatten well with carrots, cut small, and given them. If you give store geese rye before or about Midsummer, it will strengthen them and keep them in health, that being commonly their sickly time.

Poultry *House*, that sort of building which is contrived for the purpose of containing poultry, for laying, hatching, &c. It is observed, in a paper in the First Volume of Communications to the Board of Agriculture, that this sort of stock when "rightly managed might be a source of great profit to the farmer; but where many are kept they ought not to be allowed to go at large, in which case little profit can be expected, for not only many of their eggs will be lost, and many of themselves perhaps destroyed by vermin, but at certain seasons they do a great deal of mischief, both in the barn yard and in the field. No doubt they pick up some grain at the barn doors that might otherwise be lost, but if the straw is properly thrashed and shook, there would be very little of this. In the common careless way of thrashing, a great deal of corn is undoubtedly thrown out among the straw; but when we consider the dung of the fowls, and their feathers that get among it, and the injury these may do to the cattle, this is no object. It is much better, the writer thinks, to allow the poultry a certain quantity of corn and other food, and to let the cattle have the benefit of what corn may be among the straw." He therefore concludes that poultry ought "always to be confined, but not in a close, dark, diminutive hovel, as is often the case; they should have a spacious airy place, properly constructed for them. Some people are of opinion, that each sort of poultry should be kept by itself. This, however, is not, he says, absolutely necessary, for all sorts may be kept promiscuously together, provided they have a place sufficiently large to accommodate them conveniently, and proper divisions and nests for each kind to retire to separately, which they will naturally do of themselves." And, he adds, that this mode is "practised with great success at Mr. Wakefield's near Liverpool, who keeps a large stock of turkeys, geese, hens, and ducks, all in the same place: and although young turkeys are in general considered so difficult to bring up, he rears great numbers of them, the writer observes, in this manner every season, with little or no trouble whatever." For which purpose he has, he says, "about three quarters, or near a whole acre, inclosed with a fence only six or seven feet high, formed of slabs set on end, or any thinnings of fir or other trees split and put close together. They are fastened by a rail near the top and another near the bottom, and are pointed sharp, which he supposes prevents the poultry flying over, for they never attempt it although so low. Within this fence are places, he says, done up slightly (but well secured from wet) for each sort of poultry; also a pond or stream of water running through it. These poultry are fed almost entirely with potatoes boiled in steam, and thrive astonishingly well. The quantity of dung that is made in this poultry place is also an object worth attention: and when it is cleaned out, a thin paring of the surface is at the same time taken off, which makes a valuable compost, for the purpose of manure." But for keeping poultry upon a

small scale, it is only necessary to have a small shed or slight building, formed in some warm sheltered sunny situation, if near the kitchen or other place where a constant fire is kept so much the better, with proper divisions, boxes, lockers, or other contrivances for the different sorts of birds, and for their laying in, fit up in it.

But it is stated in the paper before noticed, that "the most magnificent poultry place perhaps that ever has been built, is at Lord Penrhyn's at Winnington, in Cheshire: it consists of a handsome regular front, extending about 140 feet: at each extremity is a neat pavilion, with a large arched window. These pavilions are united to the centre of the design by a colonnade of small cast iron pillars painted white, which support a cornice and a slate roof, covering a paved walk and a variety of different conveniences for the poultry, for keeping eggs, corn, &c. The doors into these are all of lattice work, also painted white, and the framing green. In the middle of the front are four handsome stone columns, and four pilasters, supporting likewise a cornice and a slate roof, under which and between the columns is a beautiful mosaic iron gate; on one side of this gate is an elegant little parlour, beautifully papered and furnished; and at the other end of the colonnade a very neat kitchen, so excessively clean, and in such high order, that it is delightful to view it. This front is the diameter or chord of a large semicircular court behind, round which there is also a colonnade, and a great variety of conveniences for the poultry: this court is neatly paved, and a circular pond and pump in the middle of it. The whole fronts towards a rich little field or paddock, called the poultry paddock, in which the poultry have liberty to walk about between meals. It happened while the writer was there to be their dinner time, at one o'clock. At this hour a bell rings, and the beautiful gate in the centre is opened. The poultry being then mostly walking in the paddock, and knowing by the sound of the bell that their repast is ready for them, fly and run from all corners, and rush in at the gate, every one striving who can get the first share in the scramble. At that time there were about 600 poultry of different kinds, he says, in the place, and although so large a number, the semicircular court is kept so very neat and clean that not a speck of dung is to be seen. This poultry place is, he adds, built of brick, excepting the pillars and cornises, and, he believes, the lintels and jambs of the doors and windows, but the bricks are not seen, being all covered with a remarkably fine kind of slate from his lordship's estate in Wales. These slates are closely jointed and fastened with screw nails, on small spars fixed to the brick; they are afterwards painted, and fine white sand thrown on while the paint is wet, which gives the whole an appearance of the most beautiful freestone."

This sort of cleanliness with as free a circulation of air as possible, and a proper space for the poultry to run in, is essential to the rearing of this sort of stock with the greatest advantage and success, as in narrow confined situations, they are never found to answer well.

POUNCES, a term applied to the talons or claws of a bird of prey.

PREGNANT, the state of an animal in young.

PRESS *upon the Hand*, in *Horsemanship*, a term applied to the horse when he bears hard or presses upon the hand, either through the stiffness of his neck, or from an ardour to run too much a-head, he stretches his head against the hand and withstands the effects of the bridle.

PRICK, in *Horsemanship*, a gentle touch of the spur, without clapping it hard to him. It also signifies touching the horse with a nail in the quick in shoeing. See *Pricking*.

PRICKER, in *Hunting*, a term signifying a hunter on *horseback*. It also signifies a sort of hook to clean horses' feet.

Pricker, a term applied to a brad awl.

PRICKET, a term applied to a spitter or young male deer of two years old, that begins to put forth the head.

PRICKING, in *Hunting*, a term signifying the tracing of an hare, where her footing can be perceived.

Pricking, in *Farriery*, a term used to signify the driving a nail into the soft or quick part of a horse's foot.

It takes place either in consequence of the farrier's rashness, in entering the nail too close to the sensible parts, or of the accidental bending of the nail in an unfavourable direction afterwards. When this happens, the horse soon becomes lame; and it will be necessary, in the first instance, to draw the nail which has occasioned the mischief, and secondly, to apply such remedies as are likely to abate inflammation in the foot. Instead of this, however, it is too common to treat the part with stimulating oils and tinctures.

Where gravel is the cause, it for the most part follows the nail-holes, and if it gets to the quick, cannot return, unless it is scraped out; for the make of the hoof favours its ascent, so that the gravel continues working upwards towards the coronet, and forms what the farriers call a quittor-bone.

The nature of this disorder points out the method of cure, which is to be as expeditious and careful as possible in getting out the gravel: if it be found difficult to effect this, let the sole or hoof be pared thin: and if necessary, the wound enlargened to the bottom, and then dressed as usual. Should the coffin-bone be affected, remember, always to bathe the hoof with vinegar, in order to allay the heat and inflammation, which often happen on such occasions; and should the pain affect the legs, treat them in the same manner, or charge the leg and pastern with a mixture of wine lees and vinegar.

PRIZE-*Cattle*, such cattle or other animals as have obtained premiums at some of the cattle shows, either from their superiority of form or fatness.

PROD, a term signifying a short spike. It also signifies a goad for driving oxen, and likewise a sharpened piece of stick for keeping thatch upon stacks, buildings, &c.

PROLAPSUS *of the Rectum*, in *Farriery*, is a

disease in which the rectum is protruded; and is caused by the relaxation of the sphincter to such a degree that the internal villous or rugous coat of the intestine turns out, making an external swelling. The causes are, weakness in the part, which is aggravated by costiveness, diarrhœa, and particularly a tenesmus; any violent stimulus applied to the part, hard labour, a stone in the bladder, or whatever can occasion a paralysis of the levatores and sphincter ani. The signs are evident to the sight; the inside of the intestine is turned outward: the tumour is of a fleshy colour, sometimes it is wrinkled, at others it is smooth and shining, and is accompanied with an uneasiness, and an ineffectual desire to go to stool. The cure is, in common cases, usually attempted by, first, restoring the prolapsed parts to their natural situation; secondly, by retaining them by mechanical pressure, or the use of astringents: thirdly, by removing the cause, whatever it may be. It is an accident which frequently happens to weak animals both in horses, cattle, and pigs.

PROBANG, in *Farriery*, a long flexible piece of cane or whalebone, having sponge fixed to the end. The use of it is, to force down into the stomach any extraneous substance that may be fixed in the gullets of animals in feeding, such as potatoes, turnips, &c.

PROFUSE *staling*, a term in *Farriery*. See *Diabetes*.

PRONG, the blade or fork part of an implement of the fork kind that lays hold of the substance to which it is applied.

Prong-*Hoe*, a term used to express an implement to hoe or break the ground near, and among the roots of plants. It consists of two hooked points of six or seven inches long, which when struck into the ground, stir and remove it the same depth as the plough, and thus answer both the ends of cutting up the weeds and opening the land close to the rows of grain.

PROP, a shore or support, set up for the purpose of sustaining any thing in its proper situation, as a wall, building, tree, or plant. They should always be sufficiently strong for the purpose intended, whatever it may be, and be so placed, that they may stand securely and without giving way. When used for trees that have been transplanted, they should likewise be so secured at the top part, as to prevent their rubbing and injuring them. It has been remarked by Dr. Darwin, that "as the bark is the only living part of the tree it is liable to receive much injury from its contusion, by the pressure of the props against it, or by the strangulation of the bandage, which holds it to them." He hence concludes, that "as the internal wood of a tree is not alive, he many years ago fastened one prop, by a strong nail to each fruit tree of a small orchard which he then planted and found the tree supported with much less apparent injury than in the usual manner by three props and adopted cordage." But as most fruit trees are extremely apt to be affected with canker, by being injured in this way by nails or other means, it should probably be adopted with caution for them, especially as where proper care is taken in fixing the supports, the business may be effected without any danger of the trees being hurt in the usual mode. See *Staking of Trees*.

PROPAGATION, the continuation of successive generations. It is applied to the raising of trees or plants from buds, &c. as well as to animals.

PROPOLIS, the wax-like kind of glue, or substance, found in the entrance of bee-hives.

PROPORTIONS, in *Horsemanship*, a term signifying the relative magnitudes of the parts of an animal, by which his powers are supposed to be materially affected. It has been supposed impossible by some, to lay down any general rules of just proportion for the horse; and its practical utility, even if done with precision has been doubted.

There cannot, however, be any doubt, but that a knowledge of the just proportions of the parts of these animals, may be useful in directing the judgment. And Mr. Feron, in his System of Farriery has suggested the following to be the *exact* and *invariable* proportions of the best *race* horses. He remarks, that the head, of a horse, divided into twenty-two parts, has been the usual scale for measuring every other part of the body by: but, that if the animal's head should appear either too long or too short, as sometimes is the case, that measure must be abandoned, and instead of it, to "take the height of the body from the top of the withers to the ground." The third part of this measure he fixes upon, for ascertaining the just length of every other part of the body; and also for showing how much the head may be defective. "As a well made horse, should, he says, measure three heads and sixteen parts, from the top of the head to the ground, provided the head stands in its natural position, which, however, it is not always easy to ascertain. The neck, should measure one head and thirteen parts, from the withers to the top of the head. The same measure is given for the length of the neck, from the top of the head to its junction with the chest. The height of the body should measure three heads from the withers to the ground. The same measure holds good from the rump to the ground, which, he thinks, exposes the false idea of making horses appear higher before than behind, when they are to be viewed. The length of the body, which should measure three heads and four parts, from the point of the shoulder to the posterior part of the buttock of the animal. The line falling from the articulation of the shoulder with the arm, should measure two heads and seven parts and ought directly to touch the hoof, in front of the toe." "If," says he, "the foot should stand before this line, the leg will be in an oblique direction forward; which structure will confine the horse in all its actions, because the fore-legs are obliged to come upon the ground nearly the same way as those of a horse on the descent (or going down hill), that is to say, the heels will touch the ground first, instead of the toes; but if the legs stand obliquely backwards from above, which is the opposite defect before

mentioned, the case is a deal worse, because the animal is continually stumbling, and even falling, on account of the feet being drawn too much under the belly, which situation obliges him to support too great a weight on the body. When this defect originates from the knees only, it bends the legs more or less, in which case the horse is called 'Bow-legged.' In either case such an animal must be rejected, and considered as unfit for the turf," or for any use where speed is required. "A line falling from the top of the fore-leg to the point of the heel, should measure one head and twenty parts, which shows the importance of a perfect perpendicular position of the fore-leg."

The distance from the top of the withers to the stifle, ought to measure one head and twenty parts. By the same measure the distance from the rump to the elbow may be determined. In width, the neck should measure one head from the top of the withers to the point of the shoulder. The narrowest part of the neck, and the breadth of the head a little below the eyes, should measure twelve parts of a head each. In thickness, the body, from the middle of the back to that of the belly, is stated at one head and two parts, and the continuation of the same line to the ground shows the animal's centre of gravity. The distance from the root of the tail to the stifle, should measure one head and four parts.

The breadth of the fore-arm, if taken from the anterior parts to the elbow, should measure eleven parts of a head.

The breadth of the hock, taken from its anterior part to the top of the os calcis, should measure seven parts of a head and the same measure (sideway) gives the breadth of the head above the nostrils. The forehead in breadth, taken from one eye to the other, should measure seven parts of a head, the same gives the distance between the fore-legs. And in a well proportioned horse, the knees in thickness, should measure five parts of a head; and the same measure gives the breadth of the fore-legs, just above the knees.

The breadth of the hind fetlock joints, should be four parts of a head. The fore-pasterns, should measure two parts of a head and three-quarters. And the breadth of the coronet, should measure four and a half parts of a head. The breadth of the hinder legs or shank-bones, should be three parts of a head. And the fore-legs should measure two parts of a head and three-quarters, in breadth.

A perpendicular line, falling from the articulation of the stifle, "should, he says, touch the ground at the distance of half a head from the toes. Too far or too near this direction proves the hock defective. If the hind feet advance too much under the belly, the hocks must be proportionably bent, and, the weight of the body overcharging them, will of course increase the deformity. The feet being too much under the belly will render it impossible for them to cover much ground; therefore their steps will be very much confined. The extension of the hocks terminating almost in an upright direction, will rather serve to raise the body than to push it forward."

"But, if, on the contrary, the hind feet stand too far behind this line, the hocks will be too straight and their flexion too confined. The extension of the hinder parts taking place, only in a perpendicular direction backward, will produce a defect capable of retarding the speed. He is aware of the general opinion of those who are deemed good judges of horses, that the hind feet ought never to pass over the fore feet, but this he thinks erroneous." He however observes, that "it is an obvious fact, that the extension of the hind quarters, and the freedom in the action of the hind legs, in a well-bred horse, convey the hind feet very much beyond the fore-feet; and this he knows to be the case with every animal which nature has designed for speed. A bad organization in the structure of the hock, gives also a bad direction to the feet, by turning them inwards or outwards; in either case it is precisely ascertained that the legs lose more or less of their power, because they do not perform their actions upon the line of the body; therefore such mechanism must be considered as a fault in hunters or racers, &c." And he adds, "that a bad organization in the thigh bone, as in case of its inclining outwards, gives a bad direction to all the rest of the limb, by bringing the point of the hocks together, and tending to turn the feet outwards."

It is however, observed, that "whether the hock bends outwards or inwards, the fault is considerable in either case, for the above reason, that the legs cannot move upon the line of the body. The croup will waver to the right and left; of course, a horse of this kind will labour a great deal more than one whose proportion is good: besides, all these lateral motions are absolutely contrary to the actions of a good horse; for which reason, he recommends to every one to be very particular in a true and exact proportion in the hind legs, inasmuch as the slightest defect in this part must effectually retard the speed. It is not so bad with regard to the fore-leg, whose function is rather to support the body than push it forwards."

It is contended therefore, that these proportions must unavoidably exist in a thorough-bred horse, and that they constitute the most beautiful and important quality of his structure: and any one who gives to the subject the necessary degree of attention, will soon discover those proportions in a horse which indicate superior activity and speed. A plate on this subject may be seen in Boardman's Dictionary of Farriery.

PROPRIETORS *of Land*, such persons as hold landed property. It is observed by the author of the Present State of Husbandry in Great Britain, that "the lands in England and Wales were, at no very remote period, chiefly in the possession of the crown, the church, and great proprietors;" but that "owing to several causes, noticed below, landed property has become of late more widely diffused,

and new orders of proprietors have risen into consequence, which has proved greatly advantageous to the state, not only in regard to improvements in husbandry, but also to the advancement of all the other arts."

It is stated that "the extent of landed property formerly vested in the crown, was very considerable; but during several reigns many improvident grants were made by the sovereigns to particular favourites, whereby it became much diminished. From the report given in to parliament some years ago, by the commissioners appointed to inquire into the landed revenues of the crown, it appears that the old and improved rent then payable, amounted only to £.16,784 12 3¼. The real annual value, however, far exceeds this sum; for, in the same account, it is stated, that the lands and estates from which the above mentioned rent is payable, were, by the latest surveys, ascertained to be worth £.102,626 14 1⅛ per annum. The writer, however, disclaims any intention of "throwing out the most distant personal reflection to the prejudice of those in the management of the crown-lands. It is well known, that these estates are commonly let on leases of one, or two, or three lives, or for a great number of years, on every renewal of which, fines (in Scotland called *grassums*) are exacted. These fines paid at the commencement of the leases, and improved by compound interest during the currency of them, may perhaps in the end, exceed in some cases, any yearly additional rent that could be demanded."

The author thinks "it is impossible to form any correct idea of the lands now in possession of the church. They are commonly, he says, let on leases of twenty-one years, renewable every seven, on payment of a fine; and therefore the rent-roll must be rather nominal, than such as can convey any information in regard to the real annual value of the property. Suppose, says he, the clergy of England had a right to the tithes over the whole kingdom; that all the parishes were inclosed; and that an allotment of land was given in every case, in lieu of tithes, a judgment may be formed of the extent of land that would fall to be possessed by them, from the rule frequently adopted by those who act as commissioners under acts of parliament passed for inclosing certain parishes, namely, giving the clergymen one-sixth of the arable, and one-ninth of the pasture, or two thirteenths of the whole. Including the lands in the possession of the religious corporations, it is probable, he thinks, they might amount to nearly one-fifth of the whole kingdom."

He adds, that "it has been observed, that while the feudal system existed, the lords and great proprietors parcelled out considerable parts of their estates among their vassals and dependents. Since the abolition of that system, the possessors of these lands have been generally known by the name of Yeomen. A most useful and valuable class of men, who are at present proprietors of no inconsiderable share of the landed property of England." And he further states that "the recent very great increase in trade and manufactures, and the consequent influx of money, have tended still more to the division of property, by the creation of a great number of small freeholds. Proprietors of extensive manors, who find it necessary to dispose of their estates, (and this will happen in every country where the practice of entailing landed property does not prevail,) judged it for their interest, to parcel them out in small lots, rather than sell them in entire manors. This having been for years the general practice, especially when the estates were situated in the vicinity of great cities, or large manufacturing towns, merchants, and manufacturers, and the officers of our fleets and armies, have had opportunities of exercising that degree of genius and persevering industry in planning and executing agricultural improvements, which in the early part of life enabled them to lay the foundation for becoming proprietors. It is therefore concluded that, "the proprietors of England and Wales may be classed into two divisions. The crown, the religious corporations or clergy, and the great landholders, or those who possess from 5000*l.* to 50,000*l.* a year and upwards, form the first class; and probably possess nearly three-fifths of the whole. The second division, consisting of that great body of gentlemen, holding estates from 400*l.* or 600*l.* to 4000*l.* or 5000*l.* a year; and of the yeomanry, or those who possess from 30*l.* or 40*l.* to 500*l.* or 600*l.* of yearly rent, are in possession of the remainder." These divisions have been much extended in the course of the last half century.

But in Scotland, the above able writer remarks, "the crown can hardly be said to possess any landed property. But it is only a few years since that was the case; for in consequence of the rebellions which happened in the year 1715 and 1745, the estates of several noble and respectable families were forfeited and annexed to the crown, on account of the active concern which the then proprietors took in those rebellions, in opposition to the established government. Highly to the honour of the British Legislature, however, such of these estates as were unsold and annexed to the crown, were lately restored to the representatives of those families, by act of parliament; an act which experience has, he says, already proved was politically right; as almost all the proprietors of those estates are now evincing their gratitude to their king and country, by exerting their utmost endeavours in the defence of both."

It is however observed, that where "previous to the abolition of Popery in the year 1560, the clergy possessed landed property to a very great extent, but at that period the great proprietors who had (with a view to promote their own interests) encouraged and supported the promoters of the Reformation, when it was effected, seized on all the church-lands, and in lieu thereof, and of the tithes which were formerly payable, allotted a certain quantity of money, or grain, or both, with a house, and a few acres of land, for the support and ac-

commodation of each Protestant clergyman. As proprietors, therefore, this respectable, useful, well-informed and deserving body, amounting to upwards of 900, rank very low, in comparison of what their predecessors did; for, in consequence of their offices, they only possess about 6000 acres of arable land. In this part of the kingdom, the feudal system was not only carried to a greater extent, but continued much longer in force than it did in England; and as manufactures and commerce began to flourish here only since the union of the two kingdoms, or rather since the middle of the last century, a greater proportion of the landed property still remains in the hands of great proprietors, especially in the northern and more remote districts, where trade and manufactures are comparatively but little known. In Scotland, great proprietors alone, or those holding estates from 4000*l.* or 5000*l.* to 25,000*l.* a-year, and upwards, may be said, he says, to be invested with the one half of the whole kingdom. The other half is more generally divided. The greatest part of it being possessed by a numerous and respectable body of gentlemen in estates varying from 300*l.* or 400*l.* to 4000*l.* or 5000*l.* a-year, and the remainder by such as possess from 30*l.* or 40*l.* to 300*l.* or 400*l.* of yearly rent. There are not many of this last description, who like the English yeomen cultivate their own estates, being for the most part engaged in the naval, military, or civil departments of the state, few of them reside constantly in the country."

In speaking of the management of estates, Mr. Marshall has remarked in his able work on landed property, that "the principal objects to be regarded, are tenanted farms, and their inhabitants; whether occupiers, or labourers." And, that the others "are woodlands; which are now generally, and properly, kept distinct from tenanted farms; excepting such plots as are requisite to the due occupancy of the farm lands. Also the waters and quarries that are not let with the tenanted lands; and mines, whether in hand, or tenanted. Together with the abstract rights attached to an estate; as tithes, manorial rights, chief rents, &c. &c. And, lastly, demesne lands; whether they are kept in hand, for domestic purposes; or as a seminary of improvements, for the use of the estate." The importance of which, are, he thinks, obvious, for, says he, "it were folly to purchase an estate, and equally imprudent to improve one, unless to be afterward duly managed; so as to secure a profitable return for the money laid out." But, that beside the profits which issue from landed property, there are other considerations which the proprietor of a tenanted estate cannot, he thinks, overlook. He differs, he says, essentially from the possessor of ordinary property. He is not in possession of the lands only, but also of their inhabitants. For although, in England, tenantry are not bought and sold, as other live-stock; yet, when an estate is under lease, tenants may be said to be as firmly rooted in the soil as the oaks are which grow upon it. And even where tenants are at will, and labourers without certainty, such are, in general, their attachments to their native soil, and their natural connections, that to be driven from them is banishment:—a patriot prejudice, which is, he says, planted in human nature, and which ought at all times, and especially at present, to be kindly cherished." He adds that "in this country, the possessor of an extent of territory has infinitely more power over its inhabitants than government itself. He may not only banish the native inhabitants, but he may depopulate the country, or may increase its population,—as to his pleasure may seem meet. By changing the inhabitants, he may change the manners of a country,—as from vice to virtue, or the reverse; and has it thus in his power to render the little world around him,—as well as himself,—miserable or happy; according to the principles of management he pursues. What inducements these are, says he, to men of fortune, to bend their minds cheerfully to their territorial concerns," and improve them in the best and most advantageous manner." See *Tenants*, *Farm*, and *Setting Farms*.

But though the promotion of such improvements are obviously of the greatest consequence and advantage to such proprietors as well as the public, they are in many cases strangely neglected, and even in some discountenanced. It has indeed been observed in a paper in a useful periodical work, the writer of which, after stating that the situation is highly favourable, the tenantry eager to improve their farms, knowledge disseminated, and capital accumulated, that "strange as it may appear, many very considerable land owners rather betray a disposition to retard, than to expedite real improvements. The terms of the leases are often arbitrary, and the landlord is too often reluctant in contributing a reasonable proportion towards permanent improvements, which are in themselves absolutely necessary, and of which it is equally preposterous and unjust to exact or expect the execution totally at the tenant's expense, more especially as the usual duration of his lease is seldom adequate to indemnify him. Even some proprietors do not only contribute reluctantly, but nearly refuse every assistance upon any terms. They accept the highest offer for the naked farm, and provided the stipulated rent be regularly paid, they appear indifferent how the tenant accommodates himself. They indeed express wishes to see their lands improved, but the honour of their motives may be doubted. Straitened circumstances do not, by any means, seem, he says, to form an excuse for this backwardness. It perhaps ought to be attributed to jealousy against their inferiors, and a desire of immediate aggrandizement, by pocketing an additional income without deduction. Such reasons as these are, however, entitled to no merit." But he "does not intend to throw out reflections on all the land owners in his part of the country; for if some of them had not adopted a more liberal way of proceeding, agriculture would never, says he, have made the progress amongst us which it has already done; at present, it would, however, be

says, be easy to prove that the landlords are, upon the whole, more backward than the tenantry. Many do not choose to become converts to their real interests, or to the lasting good of their country, but prefer a continuance of the illiberal policy of laying hold of what they can at the time, and allowing futurity to shift for itself. Under such a system, the tenant must, he thinks, be a drudge: his mind, broke down by his situation, disqualifies him for exertion, even though the necessary means were to come into his possession. His family rudely educated, are only fit for labourers or low mechanics; and one great link of the chain which connects an enlightened society is thus rejected or destroyed."

Mr. Middleton advises that every proprietor of a large landed estate, should occupy one of his own farms, which by being cultivated on the most improved scientific principles, may teach the neighbouring tenantry the best practice, by the most powerful of all means, that of *example*. If this, which seems to be at present more attended to, was general, much advantage no doubt would be the consequence.

PROTUBERANCE, in *Farriery*, is an elongation, or extension of a part whether natural or not; as the apophysis of a bone, and other similar cases.

PUBBLE, a term provincially signifying plump or full bodied, when spoken of grain.

PRUNING. *See* ORCHARD *and* TIMBER.

PUBLIC PATH, a common path. *See* PATH.

PUBERTY, a term signifying the maturity or full growth of any thing.

PUBERTY *of Plants*, the period at which they arrive at their full growth and are capable of producing blossoms and fruit. It varies very much according to the nature and habits of growth of the particular plants, some arriving early at this state, while others are extremely slow in coming to it.

PUCKBALL, a species of mushroom, full of dust.

PUCKLE NEEDLE, a troublesome weed in hard tilled lands, among the wheat, injuring the sample in a high degree. It is difficultly separated from the grain. It is often known by the names of shepherd's needle, and beggar's needle.

PUDDLE, a small hollow full of water.

PUDDOCK, a term used to signify a small inclosure.

PULSE, a term applied to all leguminous plants, as pease, beans, tares, vetches, lupins, &c.

All the species of pulse afford great abundance of excellent manure when turned into the soil, in the state in which nature presents them. The custom of ploughing in green succulent plants of this kind is very ancient. All the Roman writers commend it highly. Columella, particularly, advises lupins as a manure, which, if cut down and turned in while green, will have as good effect as the best and strongest dunging whatever. They may be sown upon poor land about the middle of September, and be ploughed in before they attain their full growth. In gravelly soils they should be cut down after they have put forth their second flower; and in strong lands, where a little more advanced. In the former of these grounds they are turned in while young and tender, that they may quickly rot; and in the latter, are let stand till they grow stronger, that they may produce a better effect on the stiff clods of earth, and render them more mellow and friable.

Pease, beans, lupins, vetches, and other succulent plants, have also been strongly recommended by the older writers on husbandry, as excellent manures, especially for sandy ground. These plants enriching the earth greatly if ploughed in, either green, or when in bloom. In strong land they are advised not to be turned down till the pods begin to harden. See *Ploughing in Green Crops*.

PULSE *Crops*, any of those which have been just noticed. In improved husbandry they are now seldom cultivated with the view of being turned in as manure, but as a row or green crop, for the purpose of clearing and improving the land, being mostly interposed between those of the white corn kind, so as to prevent the necessity of having so frequent recourse to the more uneconomical practice of naked fallowing. In this way they are found highly beneficial.

And Lister has recommended for the improvement of sandy, light ground, or any clay well sanded, all plants of the pulse or pea kind, and particularly, "upon experience, the wood vetch, which, besides its being perennial, (at least with respect to its roots) and its thriving even in woods and among bushes in almost every country, has these further qualifications, that it shoots out a thousand roots far and wide, and spreads itself under ground, like quich-grass; whilst it is so rampant above ground, that it will climb a fathom and a half upon measure, and preserve itself in spite of weeds or drought. It may be set as well as sown, in furrows. For the former of these purposes the roots may be dug up in September, which is also the time for gathering the ripe seed. The growth of the plants will be greatly advanced by setting their roots; for the older they are, the stronger, more numerous, and fuller of buds their shoots will be. He sowed in the latter end of March the seed which he had gathered in September, and had that year a very great increase, the bed being thick covered over with grass above two feet high: but it did not flower that year. He reckoned that one pea had put forth above thirty shoots in August of the first year. In the second year, it flowered by the middle of June, and bore a wonderful crop, the roots being innumerable. He has observed this pea very common in all the mountains as well as plains of this country where bushes or hedges are. Both the pea and grass are, he says, very sweet, and very agreeable to cattle, as he has found on trial.

Buck wheat and vetches are the two plants however most commonly sown in this country for being turned in as manure. The best time for

ploughing them in is when they are coming into bloom; being then in their most succulent state. Some farmers turn down their second crop of clover to enrich the land for wheat in the autumn. This should be done early enough to give the plants sufficient time to putrify thoroughly before the grain is sowed; otherwise it might prove prejudicial.

Mr. Elliot, of America, however, prefers millet to every other plant for green dressing of land, on account of the cheapness of the seed, and the largeness of the stalks and leaves, which must afford a good coat to turn in when ploughed. An old farmer who had long been in the practice of green dressing, assured him th at he had increased the strength of his land to a great degree, in a few years, by the following method: After his oats were harvested, he added a little seed to the scattered grains, and then ploughed them in. Towards the end of September, he ploughed in the green oats, and sowed rye; and the next summer, when the rye was well grown and full of sap, he ploughed that in at the usual sowing season, then sowed wheat, and always had a large crop. See *Beans*, *Pease*, *&c.*

PULLS, the chaffy pods of rape or cole.

PULK, a provincial word signifying a puddle.

PULVERIZATION, the separation of the earthy particles of soils, in such a manner, as to render them of a fine mellow mouldy quality, or to partake of the nature of powder. This state of mould is obtained in different ways, as by frequent ploughing and harrowing in the less stiff sorts of land; and in those of the more heavy and retentive descriptions, by the same means and the frequent exposure of them to the influence and effects of the atmosphere with the growth of such sorts of crops as produce a close thick shade upon them. This state of the soil when produced in lands has various advantages, the roots of plants penetrate it with more readiness, and greater facility. It admits of the particles of moisture, more equally, and in a more extensive manner, by which the fibrous roots of the crops are more fully supplied with nourishment. It likewise produces a more equal and regular mixture of the different materials of which the soils are constituted or composed, so as to yield the nutrition of plants in a more extensive and abundant manner. The rains in the vernal months are also, by this means, more abundantly drank up and retained, in consequence of their sinking to a greater depth, as well as more equally diffused through the different parts from which much advantage is derived in the support of the crops. By this fineness, in the particles of the soils, the manures or other ameliorating substances, are also more extensively and more perfectly blended and incorporated with them, and of course a more equal and abundant supply of nutritious materials, provided for the growth and increase of the crops of whatever kind they may be. And the air of the atmosphere is more intimately and abundantly received and blended with them. These are a few of the various advantages that may be derived from the pulverization of land; but, there are many others noticed by writers on agriculture. See *Fallowing*.

From these beneficial effects, it is evidently a state of tillage, that ought as much as possible to be aimed at by the intelligent cultivator, by the judicious ploughing, harrowing, and laying up of his lands, at those seasons when they can be the most acted upon and influenced by the extensive operation of atmospherical and other agents. See *Ploughing* and *Tillage*.

PUNCH, a term applied to a well-set, well-knit horse, or other animal which has a short back and thick shoulder, with a broad neck well lined with flesh. Thus we have the Suffolk *punch* horse.

PUNCTURE, in *Farriery*, is a small wound made with a pointed instrument, whose sides do not cut but stretch the flesh as it enters. Hence it is a species of lacerated wound. An opening made with a lancet, is, however, sometimes called a puncture. See *Wound*.

PURCHASE, a term applied to any thing that is bought.

PURCHASING *of Estates*, the business of buying landed property. In order to perform this sort of bargain with propriety, and to the best advantage, attention is necessary to be had to a great variety of circumstances of different kinds, which respect the nature, quality, situation, condition, value, and conveniences of the property. See *Valuation of Land*.

It is probably best done when to any extent by a surveyor or other person who is perfectly conversant with the nature of the business, and fully acquainted with the real value of landed property in the district where the purchase may be situated.

PURGATIVES, in *Farriery*, such medicines as have the property of purging.

PURGING, in *Farriery*, the operation of evacuating an animal body by stool from the use of purging remedies.

Purging is necessary in a variety of cases, for different sorts of animals, particularly in diseases of the inflammatory kind, swellings in the extreme parts, and in gross full horses, in some disorders of the stomach, liver, &c. but should always be directed with caution.

It has been observed by Mr. Clark, in his work on the Prevention of Diseases, after noticing the absurd opinions that have prevailed in respect to *humours* in the horse, and the great length of the intestines, that this last "together with the horizontal or prone position of the body of a horse, is unfavourable to the operation of purging medicines, which, on that account, remain in the intestines a considerable time before they operate, being from 18 to 28 or 30 hours, according to the state of the bowels at the time, and, in some constitutions, even longer. In these cases, it is not advisable to give any medicines in order to quicken or hasten their operation; walking exercise, but not too long continued at a time, together with plenty of warm water, if the horse will drink, is the best and safest means to forward their operation. At the same time, it will be necessary to notice whether the horse stales more than usual, as purging medicines are found sometimes to operate

in that way, without any considerable evacuation by dung."

It is likewise added, as a proper caution in giving purging balls, that "the operator should push the ball over the roof of the tongue, and that he be certain of the ball's being swallowed entire, and not broken or thrown out of the mouth. Mistakes of this kind have frequently occurred: when the ball breaks, one-half, perhaps, is only swallowed, the other drops out of the mouth, or it may happen that the whole ball drops out unperceived. In these cases, it is concluded, from the purge not operating in due time, that it has been too weak, and therefore, the next dose is made considerably stronger, and hence a super-purgation ensues, attended with great sickness, loss of strength, and other bad consequences. Therefore, when purging balls are given to horses, the head should, he says, be kept up, and care taken that the ball passes down the gullet, which may easily be discovered sliding down from the outside: but if any doubt remains of its being swallowed, a little water may be given the horse to drink, and one gulp or two will put it out of all doubt."

On "the common practice of giving purging balls upon an empty stomach, he observes that in some constitutions it occasions great sickness, faintness, griping, &c. long before they begin to operate. To prevent this, he advises a mash of bran to be given about an hour or more before the ball, which contributes to the effects of the purge, and causes it to operate in the most gentle and easy manner. And another error which many people fall into is, he says, that although a purge operates very well, yet, if the horse is not very sick during its operation, they conclude that it will not be of any benefit to him; and they therefore give the next purge made a good deal stronger, in order to *stir up* the *humours;* for they conclude that the sicker a horse is under this operation, the humours are the more stirred up, and the easier carried off by the purge, without considering the danger to which they expose the animal. But, says he, when purging medicines are intended to be given to horses, it is necessary that they should be kept quiet and at rest for some time before, that is, from any very violent exercise; and the same rule should be observed for some days after their operation is over, walking exercise only excepted. It is owing to the want of these and such-like precautions, as mentioned above, that so many accidents happen daily in the purging of horses."

On the practice of purging horses, by way of preparing them for running, hunting, &c. "it must, he says, be acknowledged, that there is a difficulty in combating the practice which too generally prevails, although there are a number of facts which will serve to demonstrate, that the purging of horses *indiscriminately* is not necessary in order to prepare them for these active exercises. On the contrary, he thinks, it must, and indeed is, in many cases, exceedingly hurtful, on account of the too frequent repetition of them, together with the too short intervals generally allowed between each purgation. It is well known, that horses, by good feeding, regular exercise, &c. may be brought to perform the most active exercises; and that many instances daily occur of horses both running and hunting, without undergoing any previous preparation by purging medicines; and it is likewise well known, that, even when purging medicines are given, still regular exercise is found to be absolutely necessary, in order to habituate the horse to this kind of active labour. And post-horses, he thinks, furnish a further proof of what has been advanced. It is well known how they can be brought to travel very long stages, and with great speed, without any preparation, further than good feeding, and inuring them by degrees to this violent labour."

The writer next combats the vulgar opinion of humours falling down into this or that particular part of the body, if a horse be not properly purged, &c. before he undertakes any active exercises, such as racing, hunting, &c. But does not wish to be understood to mean, that purging medicines are never to be used on these occasions. On the contrary, he is fully sensible of their good effects, when *judiciously* administered, the horse being at the same time properly managed during their operation. "But he does not approve of repeating purge after purge, merely, because this or that horse is to run or hunt, without first considering whether the animal be fat or lean, or whether he has been kept at hard meat, with proper exercise, or whether he has run a considerable time, or late in the season, at grass: all these, and a number of other circumstances necessary to be attended to, ought to be duly weighed and maturely considered, before any purging medicines are administered; for example, if a horse has run long at grass, and is of a plethoric or full habit of body, evacuations by purging, and diuretic medicines to a certain degree, are necessary, together with length of time, good feeding, and regular exercise, to bring his body into that proper habit to enable him to perform, with freedom, such active exercises. But if a horse is of a lean, low, or dry habit of body, whether it may proceed from the want of proper food, from fatigue, or any other cause, are we, says he, to reduce him still lower by repeated evacuations of any kind? There is such an inconsistency in this practice, that it would not even deserve to be noticed, were it not too much practised every day; for, with some people, it is no matter of consideration what state of body a horse may be in, that is, whether he be of a fat, or full, or lean, dry habit of body; still he is said to be full of humours, and which must be purged off before he is fit for hunting, or running, &c. Horses, in the latter situation, require only good feeding, and regular exercise, to strengthen and improve their constitutions, which cannot fail of taking place, if the viscera are sound and the horse otherwise in a healthy state. And, even although a horse should be a little inclined to the full, or what is called the ple-

thoric habit, yet, from the use of diuretic medicines, which are commonly given on these occasions, together with regular airings and proper exercise, good feeding, dressing, &c. he may be brought into that proper habit of body which will enable him to perform the most violent labour with the greatest ease to himself and without any bad consequences."

"After shewing that repeated evacuations, of any kind, are not necessary for horses in training either for the turf or the field, he suggests, that "if those horses that are intended for hunting, were only allowed the spring-grass, and taken up about the middle, or towards the latter end of June, before the grass becomes too rank, although it may be rather inconvenient to have them in the house at that season, yet the owner would find his account in it. The allowance of oats, he observes, must be but small for some little time, but it might be increased, together with the horse's exercise, as the hunting season approaches. Running horses might be treated in the same manner, according to the season in which they are to run, allowing both a greater length of time in the habitual practice of these exercises, together with proper feeding, dressing, &c. This treatment, together with the use of those alterative and diuretic medicines, which are usually given on these occasions, would render horses much stronger and fitter for these active exercises, without wearing out their constitutions by the repeated use of purging medicines."

These remarks apply equally to the custom of purging working horses at particular periods. In speaking of the use of purging, as a remedy in diseases, he observes that the substances "that are used for emptying the alimentary canal, may be distinguished into two kinds, the lenient, which open the belly gently; and the drastic, which purge more briskly. The lenient ought, he says, always to be preferred when there appears any unusual commotion in the vascular system, which may easily be known by the quickness of the pulse, &c. for, although purging medicines increase the motion of the pulse during their operation, yet they afterwards abate or lessen the motion of the blood, by drawing off a considerable quantity of the animal fluids by stool; they likewise clear the intestines of sharp stimulating matters or worms, which occasion an unusual degree of irritation in the system; they likewise may be given with different intentions, as circumstances may require, in small doses, to keep the body open, and prevent an accumulation of faces or dung in the intestines, which happens in diseases. In cases of frequent returns of the gripes or cholic, but not during the fit, lest the guts should then be inflamed, they should be given in the intervals, in order to prevent the return of the complaint."

"But, in cases where it is thought necessary to clear the intestines thoroughly, in strong robust horses, the drastic purges may, he says, be given, provided there is no great commotion in the circulation of the blood at the time. Purging medicines are of great service in cases where the intestines appear to be loaded with viscid or thick slime, or when it appears, by long-continued costiveness, that the peristaltic motion of the intestines is in some degree suspended; in gross habits, especially where there is any tendency to swellings in the legs, attended with running sores, &c. in dropsical swellings in any part of the body; in diseases of the head, rheums, or defluctions about the eyes; in rheumatic lameness, when the pains seem to move from one limb to another; in the jaundice: in obstinate coughs, especially when the horse is of a full habit of body; in most cutaneous diseases, or when a number of small pimples or lumps arise on the skin, and suddenly disappear again, or when the lumps discharge a sharp fluid of an ichorous quality; in plethoric or full habits, when the horse is intended for violent or active exercises, as running, hunting, &c.: in cases where it is judged necessary to lessen the general mass of fluids, or to divert them from flowing to any particular place in too great a quantity, as in inflammations of the lungs; in this last case, liquid purges are most proper, as they operate more expeditiously. In very delicate constitutions, rhubarb should constitute the greatest part of their purging medicines; they are likewise most proper in cases of want of appetite; no doubt there may be other cases where purging medicines may be necessary; but these must depend on the discretion and judgment of the prescriber.

"On the other hand, it will be prudent to avoid giving purging medicines during extreme cold weather; likewise in all feverish complaints, when the pulse beats strong and quick, till such time as these symptoms are considerably abated; in all cases of extreme weakness, whether arising from fatigue or long-continued diseases; in all lean dry habits, unless there is reason to apprehend it proceeds from worms: in cases of very obstinate costiveness, till such time as that complaint is in some degree removed by clysters, soft feeding, &c.; in cases when a horse labours under any violent acute complaint; in diarrhœa or looseness. Aloetic purges, or those in which aloes enter into the composition, are to be avoided likewise in severe cholics or griping pains, although liquid purges, that are quicker in their operation, and less irritating, may be given with safety in the intervals, when it is observed that horses are subject to frequent attacks of this complaint.

"Previous to the giving of purging medicines to horses, especially to those that have been kept on hard meat, it will be prudent to keep them from all violent exercises for some days before the purge is given. If they are fat, and of a full habit, it will be necessary to draw some blood, to lower their feeding, and to give them that which is soft and relaxing, as boiled barley, mashes of bran, malt, &c. When horses are to be purged at grass, no preparation is necessary, further than in plethoric or full habits, to treat them as above, observing, at the same time, that they be not costive, as this frequently happens although feeding on grass; in that case, they are to be taken into the stable, and treated as if they had been on hard feeding.

"In giving purging medicines to horses, it will always, he says, be most prudent to begin at first by

giving mild lenient purges, in order to find out the strength of the constitution, &c. as very strong robust horses, to appearance, are sometimes easier purged than those of a more delicate make; and it frequently happens, that the same horse is easier purged at one time than at another, according to the state of the stomach and the intestines at the time the purge is given.

"Mild purges are therefore much safer at all times, and of more benefit to the constitution, than too strong ones; for the latter cause too great an irritation of the stomach and bowels; whence follow griping pains, great sickness, &c. and sometimes inflammation of the intestines; they likewise may occasion a super-purgation, by which the bowels are so much weakened that they never afterwards recover their former tone; and hence follow loss of appetite, general weakness, and, perhaps, an habitual diarrhœa or looseness."

In the opinion of Mr. Coleman there is no substance more appropriately used for purging horses than aloes, and its operation may be reduced to almost any degree of mildness by its administration in small and repeated doses: for instance one drachm continued at proper intervals, till its effects begin to take place, but not afterwards. Almost all the known cathartic remedies have been supposed capable of purging brutes, and it is only lately that some of the most violent have lost their reputation as purges for the horse. Neutral salts, and castor oil, are not however destitute of activity, and are convenient remedies in internal inflammations, and other cases where irritating purgatives would be dangerous. Among the most useful purgatives, is calomel.

It is observed by Mr. Clark that when it is intended to give this preparation with purging medicines (which is to be done in cases of worms, or as an alterative), it is proper to give it in the evening, and a purging-ball the next morning, great care being taken that the horse be not exposed to cold, nor suffered to drink very cold water, although he may be indulged with plenty of water, milk-warm, mixed with a little oatmeal, or bran.

Horses kept much in the stable, who have not the proper benefit of air and exercise, in proportion to their food, should in spring have a mild purge or two, after a previous preparation by bleeding, lowering their diet, and giving scalded mashes. And such horses as fall off their stomachs, should have a mild purge or two. Purging is always found very beneficial in stubborn dry coughs; but joined with mild mercurials they are more efficacious.

Horses that have those sorts of lamenesses, that are said to proceed from humours flying about, require frequent purging; and should also have, between whiles, medicines that attenuate and thin the fluids. And some think that such horses as are subject to swelled legs, that discharge a sharp briny ichor, cannot have the cause removed any ways so effectually as by purging.

The first purge that is given to a horse should, as has been seen, be mild, in order to know his constitution.

It is a mistaken notion, that if a proper prepared purge does not work to expectation, the horse will be injured by it; for though it does not pass by stool, its operation may be more efficacious, as an alterative to purify the blood, and it may pass by urine, or other secretions. Purging medicines are very successfully given in small quantities, mixed with others; and act then as alteratives.

If mercurial physic is given, care should be taken that it be well prepared; and warmer cloathing, and greater circumspection is then required. Purges should be given in the morning; and about three or four hours after the horse has taken them, he should have a feed of scalded bran; and a lock or two of hay may then be put in his rack. The same day two more mashes may be given, but should he refuse warm meat, he may be allowed raw bran.

All his water should be milk-warm, and have a handful of bran strewed in it; but if he refuses to drink white water, give it him without bran. And early the next morning let him have another mash; but if he refuses to eat it, let him have as much warm water as he will drink: let him be properly clothed, and rode gently about. This should be done two or three times a day, unless he purges violently, once or twice will then be sufficient: at night give him a feed of oats mixed with bran. During their working, a horse should, in general, drink plentifully.

The following are some general forms of purges:

Take of succotrine aloes ten drachms, jalap and salt of tartar each two drachms, grated ginger one drachm, oil of cloves thirty drops; make them into a ball with syrup of buckthorn.

Take of aloes and cream of tartar each one ounce; jalap two drachms, cloves, powdered, one drachm, syrup of buckthorn a sufficient quantity to make a ball.

The following has likewise been found useful:

Take of aloes, from ten drachms to an ounce and a half, myrrh and ginger powdered each half an ounce, saffron and oil of aniseed each half a drachm, make them into a ball.

The succotrine aloes should always be preferred to the Barbadoes, or plantation aloes, though the latter may be given to robust, strong horses, but even then should always be combined with the salt, or cream of tartar.

Half an ounce of Castile soap, to a horse of a gross constitution, may be added to any of the above; and the proportions may be increased for strong horses.

When mercurial physic is intended, a drachm and half or two drachms of calomel may be given over night, mixed up with half an ounce of diapente, and a little honey, and the purging ball the next morning.

The following, when it can be afforded, is a very gentle and effectual purge, particularly for fine delicate horses; and if prepared with the Indian rhubarb, will not be expensive.

Take of the finest succotrine aloes one ounce,
Rhubarb powdered half an ounce or six drachms,
Ginger grated one drachm;
Make into a ball, with syrup of roses.

The following purging drink may be given with the utmost safety, and may be quickened, or made stronger, by adding an ounce more of senna.

Take of Senna two ounces, infuse it in a pint of boiling water two hours, with three drachms of salt of tartar; pour off, and dissolve in it four ounces of Glauber salts, and two or three of cream of tartar.

It is cooling, easy, and quick in its operation; and proper in all inflammatory cases.

When horses lose their appetites after purging, it is necessary to give them a warm stomachic drink, made of an infusion of camomile flowers, aniseeds, and saffron: or the cordial ball may be given for that purpose.

Should the purging continue too long, an ounce of diascordium may be given in a pint of port wine, and be repeated once in twelve hours, if the purging continues. Plenty of gum arabic water should also be given, and in case of violent gripes, fat broth clysters, or tripe liquor, be often thrown up, with an hundred drops of laudanum in each.

The arabic solution may be thus prepared:

Take of Gum arabic and tragacanth of each four ounces,
Juniper berries and caraway seeds, of each an ounce,
Cloves bruised, half an ounce;
Simmer gently in a gallon of water, till the gums are dissolved, give a quart at a time in half a pail of water; but if he will not take it freely this way, it may be given often in a horn.

Several other *formulæ* may be seen under the head *Ball*.

PURL, the part of the spinning wheel on which the yarn is wound.

PURLIEU, a portion of ground near any forest, which being antiently made forest, is afterwards, by perambulation, separated from the same, and freed from that servitude which was formerly laid upon it.

Purlieu-*Man*, one that has land within the purlieu, and forty shillings a year freehold; upon which account he is allowed to hunt or course in his own purlieu, with certain limitations.

Purlieu-*Woods*, such as formerly constituted parts of the royal forests, but of which the owners have obtained grants from the crown, and permission to disforest them, and which not being now subject to any of the laws or regulations by which the different interests in forest woods are conducted, may, Mr. Donaldson says, be to all intents and purposes considered as private property. And, he adds, that the manner in which these woodlands are occupied is exactly the same as that of many of the royal forests, with the exception of the right of pasturage, and for that reason much more productive and beneficial. See *Woods*.

PURSE-NET, a net used for taking both hares and rabbits, at certain times; and three or four dozen of them are sufficient to lay over their holes: they are to be fastened, by tying strings to sticks thrust into the earth, otherwise when the rabbits bolt out, they will run away and get out of the nets; but when the nets are fixed, and all things are in order, there must be one or two persons to lie close, to see what game comes home; while, in the mean time you beat the bushes, to force them homewards. But another way to take rabbits with these nets, is at their coming out of their parraces: and they should be secreted in this manner. First hunt them up and down, to force them all in, then put in a ferret with a bell about her neck, which gives the rabbit notice of her coming, who endeavouring to avoid the ferret, runs into the net.

PURSINESS *in Horses*, in *Farriery*, is a shortness of breath, arising from various causes. The following has been advised as a remedy where the horse is cock-throppled; as from his thropple or windpipe being so long, he is not able to draw his breath with so much ease as other horses which are loose throppled, as the windpipe being so straight that conveys the breath to the lungs, and vents it again at the nose, makes him pant and fetch his breath short; and in like manner when his pipe is filled with too much mucus or phlegmatic stuff, which suffocates him and makes his lungs labour the more.

Take of pounded aniseeds, liquorice, and sugar-candy, each four spoonfuls; of white wine a pint, let them stand till well mixed, and then add half a pint of salad oil. A little may be given frequently.

Pursiness is sometimes caused by a horse's being hard ridden after a full stomach, or presently after drinking, which causes an affection of the lungs or windpipe, which is extremely oppressive and troublesome.

It also proceeds from heats and colds, &c. causes dulness and heaviness in travelling, makes him sweat much, and ready to fall down upon every strain, or quick motion.

PUTREFACTION, the process by which all sorts of living bodies, when deprived of that power, become resolved or decomposed, and reduced into a sort of soft mass, which is obtained both from animal and vegetable substances, and is useful for the purposes of agriculture. This decomposition, is called fermentation in vegetables, and putrefaction in animal substances. But the same causes, the same agents, and the same circumstances, determine and favour the decomposition of vegetables and animals, and the difference of the productions which are obtained, arises from the difference of the constituent parts of each. It is found that air is the principal agent of animal decomposition, but water and heat prodigiously facilitate its action; it is also found, that an animal substance may be preserved from putrefaction by depriving it of the contact of the air, and that this process may be accelerated or retarded by varying or modifying the purity of the same fluid, for in

those circumstances, wherein putrefaction takes place, without the contact of atmospherical air, the effect is produced by the water, which impregnates the animal substance, becoming decomposed and affording the element and the agent of putrefaction. Hence the putrefaction of animal substances when enclosed in a vacuum. Moisture is, likewise, an indispensable requisite to facilitate putrefaction; and any substance may be defended from this change by completely drying it. Meat thus prepared has been preserved for several years without having contracted any bad flavour. And sands and light porous earths preserve animal bodies only by virtue of the property of exhausting their juices, and drying the solids. But too much humidity is supposed to impede the process of putrefaction. In order, therefore, that a body may putrefy, it is necessary, that it should be impregnated with water, but not that it should be inundated with it. It is likewise necessary, that this water should remain in the texture of the animal body without being renewed. This condition is requisite, first to dissolve the lymph, and to present to the air the most putrescible substance with the greatest extent of surface; secondly, in order that the water may of itself become decomposed, and, by this means, afford the putrefactive principle. Putrefaction is retarded and suspended by baking, because the flesh is dried, and by that means deprived of its humidity, which is one of the most active principles of its decomposition. It is also found, that a moderate degree of heat is a condition favourable to animal decomposition. By this heat the affinity of aggregation between the parts is weakened, and consequently, they assume a stronger tendency to new combinations. Hence it arises, that flesh meat keeps longer during the winter than in the summer, and better in cold than hot countries. Such are the causes which are capable of determining and favouring putrefaction; and hence we may perceive the best means of preventing, increasing and modifying it at pleasure. A body will be preserved from putrefaction by depriving it of the contact of atmospherical air: for this purpose, nothing more is required, than to place the body in a covering, which may defend it from the immediate action of the air; or else to envelope it in an atmosphere of some gaseous substance, which does not contain vital air. Putrefaction may be favoured by keeping bodies at a suitable temperature. A degree of heat, from sixty-five to ninety degrees diminishes the adhesion of the parts, and favours the action of the air: but if the heat be greater it volatilizes the aqueous principle, dries the solids, and retards the putrefaction. It is necessary, therefore, for the decomposition of an animal, first, that it have the contact of atmospheric air; and the purer this air is, the more speedy will be the putrefaction; secondly, that it be exposed to a moderate degree of heat; thirdly, that its texture be impregnated with humidity. The experiments of Pringle, Marbride, and Gardane have, likewise, shown us, that putrefaction may be hastened by sprinkling the animal substances with water, containing a small quantity of salt; and it is to a like cause, that we ought to refer several processes used in kitchens to produce this effect in food, as well as in the preparations of cheese, the curing of tobacco, the making of bread, &c.

The most constant appearances which are exhibited in this process, are, that every animal substance exposed to the air, at a temperature above ten degrees of Reaumur, and moistened by its own serous humour, putrefies, and the progress of this alteration appears in the following order: the colour first becomes pale; its consistence diminishes; its texture becomes relaxed; the peculiar smell of fresh meat disappears, and is succeeded by a faint and disagreeable smell: the colour itself at this time inclines to blue, as is seen in many instances. After this first period, the animal parts become more and more softened, the smell becomes fœtid, and the colour of an obscure brown; the fibrous parts easily break, the texture becomes dry, if the putrefaction be carried on in the open air; but the surface becomes covered with small drops of fluid, if the decomposition be made in vessels, which oppose its evaporation. To this period, succeeds that which most minutely characterizes animal putrefaction. The putrid and nauseous smell which was manifested in the second degree, becomes mixed with a smell of a more penetrating kind, arising from the disengagement of ammoniacal gas: the mass becomes still less and less consistent; lastly, the smell becomes faint, nauseous, and exceedingly active; and when the putrefying substance is in its last stage, the fibrous texture is scarcely discernible, and has no longer any appearance but that of a soft disorganized and putrid mass. Bubbles are seen to escape from the surface of this matter; and the whole ends by its drying, and becoming reduced to an earthy matter, which is friable when taken between the fingers, and readily breaks down into small fine particles.

Jackquin in his Elements of Chemistry likewise remarks, that, "vegetables are liable to putrefy if the necessary conditions be present. Some undergo this change immediately, without any previous fermentation;" but that, "many plants, on the contrary, do not become putrid till they have gone through the acid fermentation; to this class belong also such vegetable juices as have passed through the spirituous fermentation. The conditions necessary for putrefaction are not so limited as those for spirituous and acid fermentation; the following are, however, he says, indispensably requisite: 1, A certain degree of moisture, for vegetables which are perfectly dry do not putrefy. 2, A temperature of five degrees, at least, above the freezing point. 3, The presence of atmospheric air. But this circumstance is here less necessary than in the above fermentations. And 4, a certain degree of mixture, for alcohol, acetous acid, resins, etherial and fat oils, do not putrefy when pure."

It is added that, "the phenomena which accompany putrefaction are an intestine motion, but which is not so evident as in the spirituous and acid fermentation. Liquid putrefiable matters also become turbid; but the degree of heat excited is not very

discernible in drier putrescent masses; on the contrary, it is frequently so great as to produce spontaneous inflammation. But the most remarkable phenomena, in putrid fermentation, are a change of smell, which, even in aromatic plants, becomes ungrateful and nauseous; also the production of hydrogen, nitrogen, and carbonic acid gas; and finally the formation of ammoniac, which gradually escapes from the mass. After the putrefaction is completed there remains a soft mass, in which scarcely any one of the constituents of the vegetables can be discovered, except some colouring matter. This putrified mass gradually dries into a black powder, which consists of earth and a little saline matter, known by the name of vegetable mould." And "the putrefied vegetable mass, as well as the mould, affords, by distillation, he says, a fetid water, ammoniac, a fetid empyreumatic oil, and charcoal, the ashes of which, when burnt, contain a little pot-ash." See *Fermentation* and *Manure*.

It is by these means that various substances and bodies are decomposed, reduced, and brought into the state proper for being applied to lands for the support of crops; but, which is more fully explained, in speaking of the nature of the different materials, that are capable of being made use of in ameliorating land. See *Manure*.

PUTRESCENT *Matters*, such substances as are in a state of putridity. Various materials of this kind are capable of being made use of by the farmer. It has been lately suggested by Dr. Hunter, of York, in a paper in the third volume of the Farmer's Magazine, that different materials of this nature may form a substitute for the folding of sheep.

"The trouble and expense of keeping a flock of sheep for the purpose of folding, may, says he, probably be avoided by forming large ponds, so constructed as to receive and hold water. Into these ponds let drains from the stables, cow-houses, ox-stalls, pidgeon and wash-houses be directed; and, in order to enrich the water, let all kinds of vegetable and animal substances be thrown in, particularly the contents of the necessaries and slaughter-house. It is presumed, that this putrid water, when put upon the land, by means of water-carts, will prove as beneficial as a flock of sheep kept for the express purpose of folding; and where no sheep are kept for that purpose, such will prove an excellent manure for meadow land. A pond of sixty feet diameter, by six feet deep, will, he says, contain upwards of 700 hogsheads of water. It is presumed, that a pond of this nature and size, when properly supplied with water and putrescent bodies, may be equal in its effects to a codsiderable fold of sheep. The putrescency of the water may be greatly increased, he thinks, by occasionally supplying the ponds with the refuse of fish, and sea-weed, where they can be conveniently procured; and in all places within a reasonable distance of sea-ports, where ships are employed in the Greenland fishery, the farmer will find a seasonable supply of putrescent matter by the purchase of the whale blubber, after the oil has been taken from it. Such, says he, is the strength of the last-named substance, that it is well worth the farmer's while to be at the expense of carrying it in casks to a considerable distance, for the purpose of giving vigour to his compost dunghills. The ancients were scrupulously nice in the formation of their dunghills; and it is a reproach to the present race of farmers, that so material a branch of their business should, at this day, be so imperfectly known or attended to." And in many large cities and especially Edinburgh, it would, he thinks, "be a great improvement, if a well-constructed reservoir was made to receive the excrementitious matter, the bason being occasionally replenished with earth and small rubbish. In this manner, many thousands of loads of rich manure might, he supposes, be saved from the sea, to which place the excrementitious matters are upon their passage."

PUTT, a provincial word, applied commonly in some districts to the mole-hill.

Q

QUADRUPEDS, such animals as walk on four legs. Among domestic animals, cattle, horses, sheep, and hogs, are of this kind.

QUAGMIRE, a sort of soft miry shaking bog, usually met with in low situations, where there is no descent for the discharge of the stagnant moisture. Besides the common moory bogs, Mr. Marshall observes, there is a species which is constantly charged with moisture, yet does not accumulate a thick covering of moory earth, owing, he supposes, probably to the want of fertility in the water by which it is fed. He has mostly found quagmires of this last sort in mountainous and hilly situations.

QUAKING BOG, a sort of soft pulpy flexible earthy deposition, formed in moist situations, by the stagnation of water. See *Bog*.

Quaking *Grass*, a sort of grass which is said to thrive well on poor cold land, and which cattle eat well. It makes tolerable hay. See *Briza*.

QUANTITY *of Matter*, a term applied to the mode of ascertaining it, which in any body is its measure, arising from the joint consideration of its magnitude and density: as if a body be twice as dense, and take up twice as much space, as another, it will be found four times as great. And this quantity of matter is best discovered by determining the absolute weight of bodies.

Quantity *of Motion*, a term applied to the manner of determining it, which in any body is by its measure arising from the joint consideration of the quantity of matter, and the velocity of motion of that body: for the motion of any whole is the sum or aggregate of the motion in all the several parts. And though in a body twice as great as another, moved with an equal velocity, it will be double; yet if the velocity be double also, the quantity of the motion will be quadruple, or four times as much.

QUAR, a provincial term used to signify a quarry.

QUARRY, a pit or drift from which stones, slates, or some other similar materials are raised.

It has been observed by a late practical writer that the more useful fossil substances which have been raised from quarries in this country, are chiefly iron ores, calcareous substances, building materials, such as slates, stones, &c. road materials, as sand, gravel, &c. earths of manufacture, vegetable moulds, and coals. And, he thinks, that they "may with truth be said to be of more real use to mankind than all the mines of precious metals in the universe." He adds that "the eye of a manager of an estate ought ever to be bent towards the discovery of these valuable productions of nature, wherever they are likely to be found." And, he thinks, "it would be well if mineralogists were to turn their attentions towards the symptoms or accompaniments of useful fossils; as it might greatly facilitate the search; and might frequently lead fortuitously, to their discovery. The practical methods of searching for substances of this kind have been shown in speaking of boring and augers. And, he supposes, the common method of working quarries is pretty well understood in most districts by professional quarrymen. "A general caution, however, which they rarely attend to, is, he says, that of making good the ground below, with the soil cast off from above. And a common difficulty is that of freeing the bottom of the quarry from water. Yet it is only in one district that he has observed the wind employed to remove this difficulty." The method of accomplishing this last object has been explained in speaking of draining quarries and pits. See *Draining*.

On this necessary point, Mr. Marshall has well observed, that "where the depth, from which the water is required to be raised, is great, and where a *shaft*-drain is found to be impracticable, a *well*-drain and pump are necessary; this being worked by water when a stream can be conducted to it; or by wind in high or exposed situations; or, in a work of importance, and where fuel is moderately cheap, by a small *steam*-engine. But in a case in which a

large body of water is required to be raised a few feet only, the marsh-mill may, he thinks, be found the readiest engine" that can be made use of for the purpose.

The usual methods of raising slate, stones, and other materials of that kind from quarries and pits, as well as those of working them, are in general well known. Extensive quarries of these sorts are met with in different districts of the kingdom, particularly in the more northern parts.

They are likewise extensive in different parts of Scotland, as in the neighbourhood of Edinburgh there are quarries of beautiful stone.

It is stated by the writer of the Report of Argyleshire, that Esdale and its neighbourhood abounds in slates, of which about five millions have for some time been sold annually at 25*s*. per thousand. And that quarries of the same kind are wrought in other parts of the country.

It is also stated in the Perthshire Report, that "slates are found in many parts of the Highlands of Perthshire, but none in the low country. Some are of a purple colour, some of an azure blue, and some of a muddy brown complexion along the cutters. It were easy to mention the various places where each of these kinds of slate is quarried. The vein of slate-rock seems to run from Drumlane, in the parish of Aberfoil, in a north-east direction to Dunkeld; and may be traced beyond the limits of this county both ways. The azure are the best metal, and rise of a greater size than any of the other kinds. Many of the villages are ornamented with this beautiful covering: The brown flags, laid on some of the houses in Auchterarder, Crieff, and Muthil, which were at one period used so much in covering houses in many parts of Scotland, scarcely make an exception. Into the lower districts of the county slates are imported from Isedale and the other quarries on the west coast of Argyleshire." And that "the granite rocks, which form the mountains of the north and west, are much akin to the nature of slate; and the freestone of the southern level country to that of coal. It is likely, both the one and the other has been formed from the contiguous masses of stone, with which they are in contact; notwithstanding the problematical opinion adopted by some writers, that coal is a vegetable substance. But conjectures must not be indulged, when our business is to detail matters of fact."

It is likewise added that "great abundance of freestone has been wrought, time immemorial, in the low parts of the county; and quarries of a greater or smaller grain appear almost in every place, except the Carses. In the lowland, and near the eastern sea, the pores and grain of the freestone are greater; and as you approach the mountains, the pores are less and the grain finer; whereby these stones admit a smoother polish. The quarry of Long-annat in the parish of Tullyallan, near Culross, affords stone of a very excellent quality. It has a white colour, admits of a smooth polish, and resists the influence of the weather. Besides the principal houses in that country, some of the most magnificent public buildings in the capital of Edinburgh, such as the Exchange, Infirmary, the Register-office, consist partly of this stone, in addition to those found at hand: and in some instances, it has been carried to the continent of Europe." And that "the quarry of Kingoodie, in the Carse of Gowrie, the property of Mr. Mylne of Mylnfield, is unquestionably the finest of this kind in the county. Many astonishing blocks are raised there, 50 feet in length, 16 feet broad, and 3 feet thick. It affords also flags, which are thin enough for pavement. The colour is grey, and the polish is remarkably fine. Between 50 and 60 labourers are employed in the quarry, whose families amount to the number of 116 souls. Such is the demand for the Kingoodie stone, both at home and abroad, that four vessels are employed in the exports from this quarry. But it is much to be regretted, that the work is on the decline, occasioned by the late act (in 1794), imposing a duty on stones. The duty is trifling; but the grievance arises from the vexatious delay and trouble in procuring coast dispatches."

In speaking of fossil fuels, as turf, or peat, and coals, the author of the Treatise on Landed Property, has, he observes, "purposely brought together these two substances, as he conceives them to partake of the same origin. In most mountainous districts, and in many low fen countries, immense collections of vegetable mould, or peat earth, lie, he says, in a state of neglect: even in places where they might be converted to valuable purposes: not as sources of fuel, merely; but also of manure; either using the vegetable mould in its raw state, or reducing it to ashes. Raw peat earth, spread over dry grass land, is said, he remarks, to have been found of singular use. He has experienced its utility to the turnip crop. And there can, he thinks, be little doubt of its being found useful in the culture of the potato." But obvious as this may seem, "he has met with one place only where it is carried into effect, on a large scale: which is in the neighbourhood of Newbury, in Berkshire; where the practice may, he thinks, be profitably studied" by the young farmer.

In respect to coals, he thinks, whether we view them in the light of agriculture, of manufacture, or of national defence, they rise in the mind of most men "superior to most other subterraneous productions. If it were not for the collieries of this country, how many hundred thousand acres of its lands, that are now appropriated to agriculture, would be required for the production of fuel? How many manufactories, especially of iron (the most valuable to civilized society) would be cramped in their operations? And how many hardy seamen would be wanting to its navy? Surely, an indigenous production, on which the prosperity of this country so much depends, is, continues he, entitled to the guardian care of its government; to ascertain the present expenditure, and the probable stock remaining. Let us not, says he, play the spendthrift; and by the follies of a day entail centuries of want on generations to come; and the

curses of millions on the memory of the present times."

In regard to the manner of searching for these fossil substances in districts where they are not, at present, raised. It should, Mr. Marshall thinks "in general be done by the land proprietors of the district, conjointly. Nevertheless, there are particular instances, in which an individual may prosecute the search, with propriety." In the execution of which "the chief things to be guarded against, are, he says, misjudgment and imposition. And hence the necessary prudence of endeavouring to procure a man of skill and integrity to make the search: first, by a close investigation of superficial symptoms; and, where those are found to be favorable, by the use of the boring-tool. At present he believes there are none who are equal to an undertaking of this kind, except professional coal-workers;—men who have an interest in existing collieries. Hence, he thinks, it becomes a matter of common prudence, in a given situation, to endeavour to procure a surveyor from a distant work; or such a one as can have no counter interest to that of his employer; and, then, closely to connect and bind them in one common interest. After having had different occasions to turn his mind to this subject, and to bestow some thought upon it, he is of opinion, that the most eligible plan of proceeding is to agree with a surveyor to pay him reasonably (not extravagantly) for his time, and for his actual expenses in prosecuting the search; and, further, to agree to give him, in the event of success, a reward sufficient to call forth his best exertions: such reward to be payable, not on "finding coal," but whenever the work, to be established in consequence of the discovery, shall have cleared the amount." In this way the proprietor will feel himself secure, while the person employed has the most powerful stimulus to industry, attention, and the accomplishment of the object.

As it has been maintained by some, that coals are *inexhaustible*, while others think the contrary to be the case; the following calculations are given by the authors of the Agricultural Survey of Northumberland as the state of the matter in that district. "Towards elucidating this point, it may, they say, be of some use to estimate what number of acres are wrought yearly in the county to supply the necessary consumption. In order to accomplish this object, the thickness and number of workable seams of coal must be first ascertained; for which purpose they have been favoured with sections, exhibiting the thickness and depth of the various strata, in some of the deepest pits in the county. One of which has a depth of 270 yards with sixteen seams of coals; the other a depth of 240 yards with fifteen seams, consequently if the medium be taken betwixt the two, it will be nearly six yards thick of workable coal, from which may be formed, they suppose, "a calculation of the quantity of coal in an acre of ground, supposing the aggregate thickness of the various seams amount to 6 yards."

An acre of ground contains - 4840 square yards,
which, multiplied by the thickness, - 6 yards,

gives - - - 29040 cubic yards in an acre.

From which deduct $\frac{2}{3}$ for waste, and the part or pillars necessary to be left in working - 9680

there remains - 19360 cubic yards to be wrought.

And as three cubic yards of coal, when wrought, afford a Newcastle chaldron,
therefore 19360 = gives 6453 Newcastle chaldrons
divided by 3 per acre.

The coals exported yearly from the rivers Tyne and Wear, with Hartley and Blyth, amount to about 825,000 chaldrons, which, with the home-consumption of the two counties of Northumberland and Durham, will make the quantity of coals raised yearly about 1,000,000 chaldrons.

And the chaldrons raised yearly 1,000,000 = gives 155
divided by the chaldrons per acre 6453 { acres nearly per year, cleared of coal 6 yds. thick.

And by estimating the breadth occupied by the caking coals to be on an average 8 miles broad, and 25 miles long in the two counties they find there will be about 200 square miles, or 128,000 acres of coal proper for exportation.

From Newcastle, 510,000 chaldrons.
——— Sunderland, 315,000 ditto

In all 825,000
Then the whole area 128,000 = 825 years. The time
divided by the yearly consumption. 155 { before this space will be wrought out.

It is added, however, that "there are some reasons to think, that a thickness of seam equal to 6 yards will not be obtained over an extent of 200 square miles; probably not more on an average than 4 yards; in which case the coal will be exhausted in 550 years: And if the aggregate thickness of the seams to be obtained should prove only 3 yards, then little more than 400 years will be the term of continuance; but it is probable, they think, that before the half of that time be elapsed, the price to the consumer will be considerably increased, from the increased expense of obtaining them, and the increased length of carriage from the pits to the river. This last, they presume, may be reduced in some situations, by adopting canals instead of waggon-ways, which they have often wondered have never yet been attempted." From this investigation, they think, it appears, that the apprehensions of exhaustion are not so chimerical as they have been represented.

QUARRY *Cart.* See *Cart.*

QUART, a measure of two pints.

Quart *of Butter*, the quantity of three pounds.

QUARTER, a measure of grain containing eight bushels: it is the common measure by which grain is sold in the southern districts, especially when in large quantities.

Quarters *of a Saddle*, the pieces of leather, or stuff, made fast to the lower part of the sides, and hanging down below the saddle.

Quarters *of a Horse*, in *Horsemanship*, the four principal parts of the animal; the fore quarters consist of the shoulders and the fore-legs; the hind quarters, of the hips and the hind legs.

Quarters *of the Foot*, in *Farriery*, the sides of the coffin, comprehended between the toe and the heel on both sides; the inner quarters are those opposite to one another, facing from one foot to the other; those are always weaker than the outside quarters, which lie on the external sides of the coffin. A horse is said to have a *false* quarter when the hoof has a kind of cleft occasioned by the casting the quarter, and getting a new one, for then the horn becomes uneven, and also softer than the rest of the hoof; and the foot should be shod with some nicety. But if the cleft be considerable, and take up a fourth of the hoof, the horse is worth little afterwards.

Quarter *Cast*, in *Farriery*, when for any disorder in his coffin, one of the quarters off the hoof of the horse is cast, and when the hoof is thus cut, a reproduction takes place.

Quarter *Evil*, in *Farriery*, a disease in cattle.

QUEECE, a term provincially applied to the wood-pigeon.

QUEEN-*Bee*, a name given by late writers to what used to be called the king-bee, or king of the bees; a large and long-bodied bee, of which kind there is only one found in every swarm, and which is always treated with the greatest deference and respect by the rest. See *Bee*.

QUERCUS, a term applied to the oak tree. See *Oak Tree*.

QUI, a term applied to the female of the cow kind while young.

QUI-CALF, a female calf. See *Why-Calf*.

QUICKS, the young sets of the white-thorn used in planting hedges.

Quick-*Hedges*, such as are raised from quicks.

QUICKS, a term applied to couch-grass in some places.

QUICK-SANDS, such sandy spots of soil as contain water in such a proportion as to form a sort of shaking *quag* at certain times. Mr. Marshall says, they are for the most part tropical, and in general only temporary, commonly appearing in and after wet seasons only; closing and becoming firm when their supplies of moisture are exhausted by long drought. In these cases the surfaces are free from the deposition of the moory earth of bog-plants, which demand a constant coolness, if not a perpetual supply of moisture, being caused by heads or small beds of sand or gravel rising through firmer strata to the surface. They are of course apt to be scorched in dry hot seasons. In order to remove them, Mr. Marshall advises that the centre of the part which is affected should, be marked out when the season is wet, in order that a drain may be cut when it is dry, of a sufficient depth quite up to the mark, letting it have the necessary descent, and then filling it with suitable materials to admit of the water being conveyed off as it is collected in the subsoil. When the defect has been thus removed where it is situated in the area of a field, it is a good practice to cover the part by soil of the same nature as that of the field where it is situated, by bringing it from those parts which are the most elevated, as by this means it may be rendered of an uniform quality with the rest, and of course have a better appearance, as well as be more advantageous in the growth of crops.

QUICKSET, a term applied to the white or hawthorn, the sets or young plants of which are raised by the nursery gardeners for sale for this purpose. See *Fence*.

Quickset-*Hedge*, a general name for all hedges, of whatever sorts of plants they are composed, to distinguish them from dead hedges; but more properly for such as are formed of the white-thorn. See *Hedge* and *Fence*.

QUICKSILVER, a ponderous fluid mineral substance made use of for various purposes. When rubbed down and blended with unctuous matters, it forms a sort of ointment which is useful in the curing of different diseases of the cuticular kind, as well as in destroying lice and other vermin that infest animals of different kinds.

It has been stated, on the authority of Mr. Bradford, as communicated to the Society for the Encouragement of Arts, &c. to have been found useful in its crude state in destroying insects on fruit-trees. On a plum tree he made the following trials: he took a small awl, and pierced, sloping, through the rind, and into part of the wood of the branch, but not to the heart or pith of it; and poured in a small drop or two of quick-silver, and stopt it up with a small wooden plug made to fit the orifice: and the result was, he says, that the insects all dropt off, from that very branch, the next day; and, in a day or two more, from off the other branches of the tree, without any other puncture: and the tree continued in full vigour, and throve well all the summer after. Encouraged by this success, he next tried it upon a honeysuckle; the leaves of which were quite covered with them: and here he scraped away the top of the ground with a trowel, and run his awl, in the same sloping manner, into the main stem just above the roots; but with the same caution as above, not quite to the inner pith; and the success was the same as before. The insects all dropt off dead the next day after the experiment was made."

These trials are said to have been confirmed by further experiments.

QUINCUNX, in *Planting*, a disposition of trees originally formed into a square, consisting of five trees, one at each corner, and a fifth in the middle; which disposition often repeated, forms a regular groove, and then viewed by an angle of the square or

parallelogram, represents equal and parallel alleys. It is a method often followed where ornament is attended to.

QUID *Lost*, See *Cud.*

QUINSEY, in *Farriery*, a disease in horses. See *Anticor.*

QUITCH, a troublesome plant of the weed kind. See *Couch.*

Quitch-*Drag*, an useful sort of tool, sometimes termed *Quicking-Drag*. See *Couch-Drag.*

Quitch-*Grass*, a very troublesome sort of weed in many districts, and which requires great exertion to eradicate out of the land. See *Couch.*

Quitch-*Rake*. See *Couch-Rake.*

QUIT-*Rent*, a small rent payable by the tenants of most manors, whereby the tenant is quit, or free, from all other services, and is an acknowledgment made by way of their subjection to the lord of the manor.

QUITTER, in *Farriery*, an ulcer formed between the hair and hoof, usually on the inside quarter of a horse's foot; it often arises from treads and bruises, sometimes from gravel, which by working its way upwards, lodges about the coronet; if it is only superficial, it may be cured with cleansing dressings, bathing the coronet every day with spirit of wine, and dressing the sore with lime-water, or a detergent application, such as red precipitate.

But where the matter forms itself a lodgment under the hoof, there is no way then to come at the ulcer but by taking off part of the hoof; and if this be done well, the cure may be effected without danger.

When the matter happens to be lodged near the quarter, the farrier is sometimes obliged to take off the quarter of the hoof, and the cure is then for the most part but palliative; for when the quarter grows up, it leaves a pretty large seam, which weakens the foot: this is what is called a *false* quarter, and a horse with this defect, seldom gets quite sound.

If the matter, by its confinement, has injured or destroyed the coffin-bone, which is of so soft and spongy a nature that it soon becomes carious, it will be necessary to enlarge the opening, cut away the spongy flesh, and apply the actual cautery, or hot iron, pointed pyramidically, dressing the bone with dossils of lint dipped in tincture of myrrh, and the wound with the green or precipitate ointment. When the sore is not enlarged by the knife, which is the best and least painful method, sublimate is generally applied, or blue vitriol powdered, and embued with a few drops of the oil, is also used for this purpose, and is said to act as effectually, and with less pain to the animal.

In the time of the action of these caustic remedies, the foot should be kept in a poultice. And where sinuses form they should be laid open by the knife, and be afterwards stimulated by the application of some detergent remedy. The following has been advised by a late writer:

Take of Corrosive sublimate,
Red precipitate in fine powder, of each equal parts;
Honey sufficient to form a paste.

The wound is advised to be afterwards dressed with common digestive ointment, pressure being given by means of a bandage.

It is sometimes written quittor.

Quitter-*Bone*, another term applied to the same disease by farriers.

R

RABBIT, a well-known animal of the hare kind.

It is sufficiently evident, that this is a description of farming stock that can only be attended to with advantage under particular favourable circumstances of soil and situation. The practice of forming rabbit warrens, can only be beneficially introduced where the lands are not capable of affording crops of tolerable grain or grass. The great uncertainty of this sort of husbandry renders it more advantageous for the farmer to depend upon such crops, than on it. In hilly tracts of land, where the plough cannot be introduced, and where the soil is of such a light sandy porous nature, as to afford little or no grass for the pasturage of sheep, this system of management may take place with profit to the farmer.

It has been observed by the author of the Rural Economy of Norfolk, that this sort of animal is there "confined to the heathlets, and the barren hills upon the coast. A level country is, says he, unfit for rabbit-warrens, but convenient for the plough: on the contrary, rabbits delight in the sides of sandy hills; which, where turn-wrist ploughs are not in use, are extremely inconvenient for tillage; and, when cultivated, are generally unproductive." For "the rabbit, on level ground, finds it difficult to make its burrow; the excavated mould is all to be dragged *upward* to the surface: hence a piece of ground, altogether level, can seldom be stocked successfully with rabbits; unless it be first laid up, by art, at a great expense, into inequalities." While "on the contrary, against the side of a steep hill, the rabbit has no difficulty to encounter: the declivity affords him a ready vent for his mould; his work is all *down-hill*: and—unless the soil be too stubborn, or too rocky, for the rabbits to work freely among,—a broken hilly country may generally be stocked with advantage; provided a tolerable market for the carcasses can be had within reach." He thinks there are, perhaps, few sandy or other *loose-soiled hills*, which would not pay better in rabbit-warren than under any other course of husbandry that could be introduced on them.

It is stated, afterwards, in a minute, that on "a considerable part of a farm which lies towards the coast, being hilly and very badly soiled—more especially the tops and sides of the hills, which have always been full of rabbits in spite of all endeavours to destroy them—the tenants last year (1782) applied for leave to convert this part, about ninety acres, into a rabbit-warren. Leave was given, and an allowance made them of half the estimated expense of raising a sod-wall fence round these ninety acres." He adds, that "the fence is nearly finished, and the warren has, this year, turned out beyond expectation: it is valued, by one who ought to be the best judge of its worth, at forty pounds a year; which is nine shillings an acre." And, that "as the part of a farm, these ninety acres are not worth five shillings an acre: at the present price of barley, they are not worth more than four shillings an acre." It is, therefore, observed, "that for ten pounds a real improvement of twenty pounds a year has been made and secured; for the warrener will, through necessity, hereafter keep the fence in repair for his own advantage." He remarks, that "the fence is made about four feet high, and three feet thick; faced with greensward; and capped with furze, so as to project eight or ten inches over the face. Some of it was done for a shilling a rod; but the spring putting in, fourteen or fifteen pence a rod of seven yards was obliged to be given. And a neighbouring warrener, this winter, gives, he says, nine-pence for the wall, without the capping; which he does not mean to put on till the wall be thoroughly settled. This is very judicious: as several rods of that abovementioned shot down in different places, as is often the case in such sort of work." It is further observed, that "there are several patches in the vallies, and some on the

tops of the hills which have usually been tilled. Some of these were, he says, last year, and some of them ought to be every year, cultivated for the rabbits: thus, when the grass gets foul or mossy it should be ploughed up; fallowed, sowing turnip-seed for present feed (they will not let rape get up), and to prepare the soil for barley and grass-seed the ensuing year. Thus a regular succession of feedage might, he says, be kept up for the use of these animals." And in the Rural Economy of Yorkshire, it is stated, that at "Dalby, there are two pretty large warrens. At Lockton there is one now 'planting.' And there are other parts of these heights which might, he says, be profitably stocked with rabbits. In general, however, property is too much intermixed to admit of an improvement, which is singularly adapted to the nature of these high grounds." And, that "in situations where the ground, as well as the soil, is suitable to rabbit warren, and where an extent of it, sufficiently large, can be collected together in one property, there is a very strong reason why it may be profitably stocked with rabbits." It is added, that "one of the warrens of this district contains eighteen hundred acres of surface; most of it covered with a black Moreland soil; part of it a barren dead gravel; some little of it a thin limestone loam; not worth perhaps, on a par, for the common purposes of husbandry, a shilling an acre; nevertheless, these eighteen hundred acres are let, as a *rabbit* warren, for three hundred pounds a year!" He "will not, he says, pretend to say, that this warren is worth three hundred pounds a year, nor assert that it is not worth a shilling an acre, to a husbandman. If it be worth two hundred and fifty pounds, as a warren, and supposing it to be worth even two shillings an acre, as a farm, it still is a sufficient evidence of the profitableness of rabbit warrens, in proper situations."

In speaking of the wolds, he observes, that the warrens are "numerous, and some of them very extensive. Coldham warren is at present, he believes, the largest upon these wolds; and, probably, the most valuable warren in the island. The Coldham farm contains about nineteen hundred acres; and, speaking generally, it is all warren: not, however, wholly appropriated to rabbits, a flock of six to eight hundred sheep being kept within the warren walls; principally, however, on one side of the warren, away from the burrowing grounds." And, "this he says, appears to be a practice peculiar to the wolds of Yorkshire and Lincolnshire, whose hills likewise abound much with rabbit warren, and where better soil is appropriated to rabbit warrens, than is perhaps in any other part of the island. The Coldham warren, in point of soil, is most of it worth ten to twelve shillings an acre; some of it fifteen or sixteen shillings. But the present bleakness of the situation renders it of little more than half the value. As these better parts become mossy, they are inclosed by a sod wall, the surface pared and burnt, and the soil broken up for arable crops. Having afforded a succession of crops of corn, turnips, &c. they are sown with grass-seeds, and again thrown open to the rabbits and sheep. In 1783, there were about two hundred acres of this farm under the plough, besides some little sheepwalk, which lay without the warren walls. The warren therefore, at that time, contained fifteen to sixteen hundred acres; and, adjoining to Coldham, are two more considerable warrens; so that there are, perhaps, three or four thousand acres of tolerably good land, lying together, and appropriated principally to rabbits."

It is remarked in respect to soil, that "there is a disadvantage in stocking a *rich* soil with rabbits: a flush of grass, after a dry season, is found to produce a scouring; which sometimes carries off great numbers.

With regard to the burrows on the high wolds, they are mostly on the sides of hills: at Coldham, principally in one deep valley; whose sides are steep; giving the rabbits great freedom in working. The soil, in this case, about eight or ten inches deep, under this a chalky rubble, of some inches thick, lying on a chalkstone rock. The burrows are in the subsoil, between the soil and the rock, and chiefly toward the tops of the hills. And thousands of daws build their nests in the burrows, to the great annoyance of the rabbits. But at Driffieldgreets, near Driffield, where there are two large warrens, the surface is a *dead flat*; nevertheless, the warrens are well stocked and productive; a proof that a flat surface may, in some cases be profitably stocked with rabbits." The soil, in this case, is a light sand or gravelly loam, which is very proper for the purpose.

In this district it is stated that "in stocking a warren, whether the surface be flat or hilly, artificial burrows are made, to reconcile the rabbits to the ground, and to preserve them from vermin, until they have time to make their own burrows." And that "in making these burrows, an improvement has lately, it is observed, he believes, been hit upon. They are bored with an auger of a diameter large enough to make a burrow of a sufficient width. In a level warren, these augers may, from time to time, be found useful in forming such holes. They, however, in most cases are capable of making burrows for themselves.

In Lincolnshire, according to the survey of that district, some of the warren lands are stocked in the proportion of three couple to the acre; while in others it is in a considerably larger proportion. And one buck or male rabbit is said to be there sufficient for one hundred does, or females; but this is certainly a much larger proportion, than in most other districts. On the wold warrens of Yorkshire, according to Mr. Marshall, *one* male is considered as sufficient for *only six* or *seven* females, and the nearer they can be brought to that proportion the greater the stock of young ones that may be expected, it being the nature or economy of the males to destroy their young, especially when the proportional number is too great.

The fencing in these situations is sod-wall, capped with furze, or of late with stiff straw, forming a kind of thatch. And it is supposed that reed would be found admirable in this intention. "The warrens near Driffield are fenced with paling; an expensive

fence in the outset, and always under repairs. A brook, though ever so deep, is found to be insufficient as a fence against rabbits: one side of Driffieldgreets warren is bounded by a brook; but it is nevertheless fenced with paling. When the rabbits can evade this, they readily swim the brook. The necessity of good fences is of course sufficiently evident in this view, as well as that of preserving them from the destruction of vermin, and birds of prey, such as eagles, kites, &c. which are taken in steel traps, placed on elevated mounds of earth where they delight to sit.

It is this fencing and coping, or kidding the top, together with food in winter, nets, traps, and other things for taking them, with charcoal for drying the skins, warreners men for killing and carrying, horses for carrying them to market, &c. that constitute the great expense of this sort of management.

There are many different breeds or varieties of these animals, but those that are employed as stock for warrens are the *common* grey and *silver* grey breeds. The former of which is found to be considerably more hardy and much better for the purposes of food; but the latter has greatly the advantage in the value of the skin.

In the above warrens till lately "the common grey rabbit—probably the native wild rabbit of the island—was the only species. At present, the *silver-haired* rabbit is sought after, and has, within the few last years, been introduced into most warrens. The skin of the grey rabbit is cut; that is, the "wool" is pared off the pelt, as a material of hats: whereas, that of the silver-haired rabbit is dressed as fur; which, the writer understands, goes principally to the East Indies. The colour is a black ground, thickly interspersed with single white hairs. The skins of this variety sell for about four shillings a dozen more than those of the common sort; a sufficient inducement for propagating it" in preference to the grey sort.

This is a sort of stock that on the whole only requires a slight attention; it is however necessary to supply the rabbits with additional food in the winter season, when the weather is severe, such as fine green hay, sainfoin, clover, turnips, and others of the same sort which must be distributed over the warrens. It is supposed that turnips answer the best in deep snows, as the rabbits can discover them by the scent. This sort of food is given in the quantity of two or three large cartfulls to a thousand couple per day, and one load of hay in the same time during a storm. It is likewise sometimes the practice to distribute billets of new cut ash-boughs, gorse or whins, and other similar woods in the warrens, the bark and other parts of which is eaten, by which the proportion of hay is lessened in a considerable degree. In great snows it is necessary to clear them away from the ditches or fences to prevent the rabbits from getting over them.

The rabbit is a sort of stock that begins to breed at an early age, as at eight, ten, or twelve months, going only about thirty days with young, the young being a little more than three weeks old before they appear from the burrows, during which time they are suckled twice in the day by the mother. It is therefore evident that they may breed three or four times in the course of the year under good keep, as the does take the buck almost immediately after producing their young. In warrens that are inclosed, it is however said that they seldom breed more than two or three times in the year. The annual produce per acre, is mostly estimated at from three or four, to eight or ten couple, yielding a profit of from eight, ten, or even fifteen shillings, where they are conducted under a good system of management. And the produce is, as has been seen, the largest on new lands; however, much of the profit must always depend on situation, so as to be near good markets.

These animals are in what is termed season from the end of October to the beginning of January, in which period the best skins are produced, of course a large proportion of them is killed in this short time. The farmer often sustains great loss in what by the purchasers are called *half* skins, *quarter* skins, and *racks*, sixteen of which are only considered as a whole skin. The rabbits are disposed of by the hundred, six score couple being considered as an hundred.

The following statements are given in the Agricultural Survey of Lincolnshire on this sort of management. On the authority of Mr. Chaplin, it is stated that "on 1000 acres it is fair to kill 2000 couple, which are sold by the hundred, as above; which have sold at 10*l.* on an average of ten years; last year 13*l.*" Killing and looking after 60*l.* for 1000 acres." And "on the warrens, between Gayton and Tathwell, silver skins have been from 15*s.* even to 21*s.* a dozen; but the common grey rabbit is so much hardier, that if a warren be stocked with both, there will, in a few years, be nothing but greys." It is added that from Louth to Castor, 18 miles, 10 of it are warrens, chiefly silvers; rent 2*s.* to 3*s.* an acre. They plough a part every year for corn and turnips, and laying down again with seeds, let down the fences for the rabbits to enter. Warrens are reckoned profitable, so that some fortunes have been made on them." It is further stated that "in point of skins, those bred about Mayday undergo no change from their white colour, but from a *white rack* become a whole skin. Bred at Ladyday, become black. In June, white. In July, black. In November, white again; then in full season, as the carcasses are also. The skins ought to have those colours on the inside, when flayed, or stripped off from the rabbits."

The writer further states, that "from 250 acres of land that was sainfoin worn out, and planted with rabbits, the following was the account many years ago; but all prices, rent, &c. &c. are calculated at the present rates; and it is to be noted, that the ground being thus new to rabbits, was much more productive than old warren land is found to be, as they breed much better on such new than on old land. Used to kill about 2000 couple; stock left about 700 couple. Sod banks cost, thirty-five years ago, 1*s.* 2*d.* a rood of seven yards, would now cost 2*s.*; furze faggots were 7*s.* a hundred,

that is, 5*s.* for the furze, and 2*s.* 6*d.* kidding; now doubled. Banks will last about seven years, in a middling way; from 3 to 20: want facing once in seven years, at half the first expense; want capping in three years with the furze. Laying on or capping 3*d.* a rood now. It was then reckoned that 250 acres would clear 100*l.* besides rent, which then was 1*s.* an acre. Fencing annually half a mile 800 yards, 133 rood at 1*s.* 6*l.* 13*s.* for facing furze, a kidd will do a yard; 2½ miles kidding, at a kidd a-yard 4400 yards and kidds, at 15*s.* now, for 120 or 27*l.* 10*s.* or per annum 9*l.* 3*s.* 4*d*, add 6*l.* 13*s.* it is 15*l.* 16*s.* 4*d.* per annum. A warrener 35*l.* a cow, fuel, and house; in all 40*l.* Extra labour killing 18*s.* a week for sixteen weeks, 14*l.* 8. Also for a month 18*s.* a week, 3*l.* 12.; in all 18*l.*" Besides "nets and thread 12 at 60 yards each; last six or seven years; would cost 1*l.* 11*s.* 6*d.* Traps 5*s.* a-year. The men who kill will carry. Four horses for six weeks, 1*l.* 4*s.* a week, 7*l.* 4*s.* Charcoal for drying skins 5*s.* A person to order the skins, that is, clear from fat, and drying, five weeks; a useful woman will do it, 1*l.* Winter food after three days snow they must be served, cannot be less than 10*l.* a year on 250 acres.

Recapitulation.

	per acre. £.	s.	d.	£.	s.	d.
Rent now	0	6	0			
Tithe	0	0	0	87	10	0
Rates	0	1	0			
Fencing	0	1	3	16	16	4
Warrener	0	3	2	40	0	0
Extra labour	0	1	6	19	0	0
Nets, traps, and charcoal	0	0	2	2	1	6
Horses	0	0	6¾	7	4	0
Winter food	0	0	0	10	0	0
	0	13	7¾			
Poison, powder and shot, and sundries; fox skins 1*s.* each				2	0	0
				183	11	10

Produce.

2000 couple at 9*d.*	75	0	0
Skins, 9*d.* to 1*s.* 3*d.*; average 1*s.*	200	0	0
	275	0	0
Expenses	183	11	10
Profit	91	8	2

It is notwithstanding this statement suggested "that if he had a warren of his own, he would plough it up for corn, &c. thinking tillage now more profitable than rabbits. And the author adds that at Partney fair, meeting with Mr. Grant of Withgul, and discoursing with him upon warrens, he informed him, that a common stock in winter was 3 couple per acre, and the produce 5 or 6 couple killed; that killing, carrying, &c. might amount to something more than 1*s.* an acre; the sort *silver sprig*, which will not do well in other counties, where they have been tried. He has now 1000 acres of warren." And "upon 1000 acres, the stock 2600 couple, and kill 5000 couple annually. New land is the most productive. On such a warren the rabbits must have 2 loads of hay a day in a storm; or two or three large waggon loads a day of turnips. The warrener has 20*l.* a-year, and 2 cows; the killers 8*s.* or 9*s.* a week, and board for ten weeks. Silver skins now are 10*s.* a dozen; have been 14*s.* to 15*s.* Fences 60*l.* a-year; no cross ones; no buildings. The immense occupation of Mr. Grant and his sons, being much the most considerable in the county; with the circumstance of making an ample fortune, made him desirous of seeing him."

It is added "that twenty years ago, Driby had a warren of 12 or 1300 acres: and the rent of the farm including it 300*l.* a-year, which rent has been doubled by ploughing. And Mr. Kershaw observed, that the community received next to nothing from warrens." Which is probably the case, as has been seen above, where the land is capable of being managed under the plough or the system of grass.

The calculation of Mr. Parkinson, of a warren of 700 acres under rabbits, stands thus: "rent 5*s.*; standing stock 2000 couple, of silver hair, valued to the incoming tenant at 2*s.* 6*d.* a couple ten years ago; and demanding a capital of 1400*l.*; and carefully *typed* to catch all extra bucks, so as to leave only one-fourth of the total number of bucks."

	£.	s.	d.
Produce 3000 couples for sale, worth, on an average of seven years past, 15*l.* a hundred	450	0	0
But as some are greys, the price 10*l.*	300	0	0
	750	0	0
Take the average of the two, that is, silver hair of the Wolds, and greys of Lincoln Heath, it will be on a medium	375	0	0

Or about 10*s.* 10*d.* per acre." And "add to these 350 sheep, kept by a course of tillage, that is, ploughing up fifty acres annually for paring and burning for turnips, then spring corn and seeds, which seeds sheep-fed one year and thrown out to rabbits; the sheep at 2*d.* a week for twenty-five weeks, will amount to 72*l.* 10*s.*; this is inferior to the common produce of sheep; but the rabbits will, he says, demand hay, &c. to the amount of the difference; and also a team of horses must be kept for the cultivation of 100 acres of land, and carrying the rabbits to market." Hence

The fifty acres of corn will be consumed by the horses, and master's and warrener's cows, &c.	447	10	0

Expenses and Profits of a Rabbit Warren Farm.

Dr.			£.	s.	d.
To rent 700 acres of land, 5s. per acre			175	0	0
To tithe one-ninth			19	8	10
To town charges			21	17	4
To master and mistress's board, and clothing	52	0 0			
To 4 children, 10l. per year	40	0 0			
To 4 servants, 10l. ditto, viz. 3 men, and 1 maid	40	0 0			
To extra labourers, carpenters and other workmen	30	0 0			
Total housekeeping			162	0	0
To Husbandry.					
A warrener, with house, and 2 cows	26	0 0			
To 3 extra labourers, mowing corn and hay, repairing, fencing, assisting in killing rabbits, &c.	72	0 0			
To blacksmith's bill 15 / Carpenter's ditto 22	37	0 0			
Extra turnip-hoers, and hay-makers in summer	20	0 0			
			155	0	0
			533	6	2

Per contra. Cr.	£.	s.	d.
By slaughter of 3000 couple of rabbits, 15l.	450	0	0
By 300 fleeces of wool, 4 and 5 to tod, about 65 tod, 20s. per tod	65	0	0
(viz.) 200 ewes, and 100 hogs			
Sell about 80 he-hogs from turnips, 24s.	96	0	0
And about 50 drape ewes, 21s.	52	10	0
By 50 acres barley, 3 qrs. per acre, and oats 150			
Deduct seed and horse corn 70			
Remains 80 quarters, at 21s.	84	0	0
By 20 beasts, to sell about 5 to graziers, 8l. per head	40	0	0
By swine, poultry, &c.	20	0	0
Profit in breeding foals	20	0	0
Total	627	10	0
Expences	533	6	2
Net gain	94	3	10

N. B. As the family is maintained out of the farm, the interest of the capital of about 1400l. is not charged, because the interest would be only 70l. per year, when they are maintained out of the farm with a profit of 94l. 3s. 10d."

Mr. Young states that "the warren of North Ormsby, occupied by the late Mr. Ansell, is supposed to be one of the best managed in the county. The rabbits chiefly consist of silver-greys, the land of the yearly value, from 2s. 6d. to 8s. and some little of it 10s. the statute acre." The occupier was of opinion, he says, that "lately his warren lands would have paid him better had they been applied to the purpose of growing corn and grass seeds for keeping sheep. The rabbit produce he supposed to be from eight to ten shillings; in some particular years they have paid from 15s. to 21s. an acre; but to obtain any extraordinary profit, very great care must, he thinks, be taken in killing the many different kinds of vermin which depredate, and without the utmost vigilance will quite depopulate the warrens. A considerable expense also attends the necessity there is for night-watchers to protect them from the infinitely worse vermin, the poachers." With him "the silver-grey skins have been sold from 8½d to 15d. and 16d. per skin; the last two years they have only brought from 10d. to 11d. per skin; but to obtain even these prices, they must be what is called full seasoned, whole skins, and of the choicest colours, with respect to which the fashion varies very greatly. The carcasses of late years have not averaged, net into pocket, more than 4d. per couple, after the expense of drying them, and by means of light diligence carts, having them carried to markets, thirty, and sometimes more than sixty, miles to obtain even that sum;" this inconvenience is occasioned partly by "its being necessary to kill eight or ten parts of a year's slaughter in so short a time as between the second week in November and Christmas, on account of their skins being then only in full prime, and as they are also very soon subject to become putrid (much more so than hares); and their being obliged to be packed close together, very greatly increases the mischief."

The estimate of the warren on the estate at Thoresway of 1700 acres, as given by the tenant Mr. Holdgate, with the silver sort of rabbits is this:

	£.	s.	d.
Labour, three regular warreners with extra assistants at killing	85	0	0
Fences	42	10	0
Winter food	42	10	0
Nets, traps, &c. &c.	14	3	4
Delivery	21	5	0
Rent is said to be seven shillings an acre	595	0	0
	800	8	4
The capital employed is that sum with the addition of stock paid for; suppose this as stated above three couple an acre, at 2s. 4d.	595	0	0
Interest of that sum one year 5 per cent.	1395	8	4
	69	5	0
	1464	13	4
Annual Account.			
Expenses as above	800	8	4
Interest	69	5	0
	869	13	4

	£.	s.	d.
Produce 10,000 couple at 2*s.* 4*d.*	1166	13	4
Expenses	869	13	4
Profit	2977	0	0

Or 24*l.* per cent. (the five per cent. included) on capital employed. This Mr. Young observes is very great, reckoned on the capital, but small reckoned by rent, as it amounts to only half a rent. But suppose the gross produce of 1500 which he takes to be nearer the fact: then the account will stand thus:

	£.	s.	d.
Produce	1500	0	0
Expenses	869	0	0
Profit	631	0	0

or 47 per cent. on the capital.

But in whatever way it is taken it explains, he says, the reason of so many of these nuisances remaining. The investment of a small capital affords a profit or interest that nothing else will, and of course the proprietor will be sure never to convert them to better use. But, says he, "what says the public interest. Here are only 200*l.* expenses to 600*l.* rent, what is the population, the industry, the improvement! The landlord gets the lowest of rents, the tenant makes a good profit, they divide all, and the rest of the world are little or no better for them."

This sort of stock is mostly taken by *nets* or *traps*, set in the form of a fold between the places where they run, and those where they feed, the rabbits being hunted into them as they return from feeding. But the "wold warreners, Mr. Marshall says, have three ways of catching their rabbits:—with *fold nets*,—with *spring nets*,—and with "*types*;" a species of *trap*. The *fold nets* are set about midnight, between the burrows and the feeding grounds; the rabbits being driven in with dogs, and kept inclosed in the fold, until morning." But the *spring net*, when used, is, he believes, generally laid round a hay stack, or other place, where rabbits collect in numbers." It is added that "the *trap* is a more modern invention. It consists of a large pit or cistern, formed within the ground, and covered with a floor: or with one large falling door, having a small trapdoor toward its center, into which the rabbits are led by a narrow muce." And "this trap on its first introduction, was set mostly by a hay stack; hay being, at that time, the chief winter food of rabbits; or on the outside of the warren wall, where rabbits were observed to scratch much, in order to make their escape. Since the cultivation of turnips, as a winter food for this species of stock, has become a practice, the situation of the trap has, he says, been changed. Turnips being cultivated in an inclosure within the warren, a trap is placed within the wall of this inclosure. For a night or two, the muce is left open, and the trap kept covered (with a board or triangular rail), in order to give the rabbits the requisite haunt of the turnips: which having got, the trap is barred, and the required number taken." He adds that in emptying the cistern, the rabbits are *sorted;* those which are fat, and in season, are slaughtered; those which are lean, or out of condition, are turned upon the turnips to improve." And that, "at the close of the season, the bucks, and the does are *sorted*, in a similar way; the bucks are slaughtered, the does turned loose to breed."

Mr. Marshall also remarks, that, "great caution is requisite in the use of these traps. If too many rabbits be admitted at once, and the cistern be kept close covered only for a few hours, suffocation and inordinate heat take place, and the carcasses, at least, are spoiled. Many thousand carcases have been wasted through this means.—The traps are therefore watched; and when, the required number are caught, the muce is stopped, or the trap covered in a proper manner."

It is observed, that some notion may be formed of "the produce of the wold warrens, from the great numbers which are frequently slaughtered at once. Five or six hundred couple having not unfrequently, been slaughtered in one night: and, it is said, that when the two Driffield warrens lay together there was once an instance of fifteen hundred couple being killed at one time."

There is often much inconvenience in this sort of stock, from their getting out of their inclosures and destroying the young corn crops, new sown grasses, young turnips, and the quick hedges as well as young plantations of apple trees that may be in the neighbourhood. This forms a material objection to this sort of stock by the farmer.

In respect to breeding and rearing tame rabbits with the view of profit, those who are engaged in the business perform it in hutches, which must be kept very neat and clean, otherwise the rabbits will be subject to disease. Care must be taken also to keep the buck and does apart, till the latter have just kindled, then they are to be turned to the bucks again, and to remain with them till they shun and run from them.

The general direction for the choosing of tame rabbits, is to pick the largest and sleekest: but the breeder should remember, that the skins of the silver-haired ones sell better than any other. The food of the tame rabbits may be colewort and cabbage-leaves, carrots, parsnips, green corn, and vetches, in the time of the year; also parsley, grass, green-leaves, milk, and sow-thistles, and other similar plants, but with these moist foods they must constantly have a proportionable quantity of dry food, as hay, bread, oats, bran, and other similar matters, otherwise they will grow pot-bellied, and die. Bran and grains mixed together have been found to be very good food. In winter they eat hay, oats, and chaff, and these may be given them three times a day; but when they eat green things, it must be observed that they are not to drink at all, as it throws them into a dropsy. At all other times a very little drink serves, but it should always be fresh. When any green herbs or grass are cut for their food, care

must be taken that there is no hemlock among it, for, though they will eat this greedily among other things, when offered to them, it is sudden poison to them. In this mode of breeding, one male to eight or ten females is sufficient.

The author of Tracts on Agriculture and Gardening, has bred these animals with much success and ornamental effect in a small artificial warren, in a lawn in the garden, made in the following manner. "Pare off the turf of a circle, about forty feet diameter, and lay it on the outside; then dig a ditch within this circle, the outside perpendicular, the inner sloping, and throw earth sufficient into the middle to form a little hill, two or three feet higher than the level of the lawn; the rest must be carried away. Then lay down the turf on the hill, and beat it well to settle it. The ditch at bottom should be about three feet wide, and three and an half deep, with two or three drains at the bottom, covered with an iron grate, or a stone with holes, to carry off the hasty rains, in order to keep the rabbits dry. In the outside bank should be six alcoves, the sides and tops supported, either by boards or brick-work, to give the rabbits their dry food in; by their different situations, some will always be dry; six boxes, or old tea-chests, let into the bank, will do very well. If the ground be very light, the outside circle should have a wall built round it, or some stakes driven into the ground, and boards or hurdles nailed to them, within a foot of the bottom, to prevent the bank from falling in. The entrance must be, either by a board to turn occasionally across the ditch, or by a ladder. The turf being settled and the grass beginning to grow, turn in the rabbits, and they will immediately go to work, to make themselves burrows in the side and in the hill. By way of inducing them rather to build in the sides, to keep the turf the neater, make a score of holes, about a foot deep, and they will finish them to their own mind; and if there be a brick wall round it, it should be built on pillars, with an arch from each, to leave a vacancy for the burrow."

But there is, he says, another way that may be practised, which is, "to dig the ditch only about two feet deep, which will yield about earth enough to make the hill; put some pales about a foot high, on the outside; for that will be a sufficient height to keep the rabbits in. Feed them as other tame rabbits are fed; and in wet weather, sprinkle saw dust at the bottom, by which means the quantity of manure will be increased; once a week is often enough to take it away: the quantity will be surprising; nor will the smell be in the least offensive, even though it be quite close to the house. In a very large lawn, two or three of these hills, with the rabbits feeding on the tops, will not be unpleasing objects. If the bucks happen to be mischievous in killing the young ones, they must be chained in an alcove; or else have their liberty as in a warren. After a great snow they will want some assistance, early next morning; because the ditch will be nearly filled and perhaps the alcove, where the hay is, will be blocked up."

He adds that "it is a great improvement to castrate the young bucks, and keep them till they are full grown, before you kill them; the flesh will be amazingly finer, whiter, and tenderer. But then it will be best to take them away, and keep them in another warren, lest they should be too numerous, and disturb the breeding does; or else have a few hutches in the alcove to fatten them in."

It is suggested that, "as oil cakes are found of great use in fattening cattle, it is probable they would be as useful in fattening rabbits: and it is asserted, that some of the oil mixed with the pollard or buck wheat, is cheaper than the cakes; but having never made the experiment, he cannot ascertain its superior advantages."

In this mode, "attention should be had to the breeding those sorts of rabbits whose skins are in the greatest esteem with the furriers and hatters. These skins are generally of more value than the flesh, especially in the winter, against which time contrive to have the greatest quantity of these fattened bucks."

It is remarked in respect to profit in this way, that "where does are kept in hutches, they are supposed to breed six times a year, and only five young ones are left to each, which is thirty from each doe: but as these are in a more natural way, and the young ones difficult to be gotten at, let us suppose about thirty-six to be produced from each doe, reckoning only seven pence for each; there is a guinea profit from each doe; as the additional value of the skins in winter, and the dung will more than pay the expense of food and attendance on them." And it is quite necessary, he says, that those who keep many rabbits in this way, should cultivate some lucern, parsley, and carrots, as no other vegetables are such proper food for them as these; they should also be fed on some of the best upland pasture hay; for if it be coarse, so far from eating, they will waste it. Lucern hay is very proper for them in these cases.

When kept in this way rabbits are subject to several diseases, as the *rot*, which is caused by the giving them too large a quantity of green food, or the giving it fresh gathered, with the dew or rain hanging in drops upon it, as it is over moisture that always causes the disease; the green food should therefore always be given dry, and a sufficient quantity of hay or other dry food, intermixed with it, to counteract the bad effects of it. And a sort of *madness* often seises them: this may be known by their tumbling about, their heels upwards, and hopping in an odd manner into the boxes. This distemper is supposed to be owing to the rankness of their feeding: and the general cure is the keeping them low, and giving them the prickly herb called tare thistle to eat as much as possible.

They are also subject to a sort of scabby eruption which is seldom removed. These should however be directly separated from the rest of the stock.

The profit in this mode of management cannot however be well ascertained, as much will depend on the care which is taken in their feeding and other management.

Rabbit *Manure*, that which is collected from the dung of those animals, and which is said to be very valuable. See *Manure*.

RABBIT-*Warren*, the place where these animals breed and rear their young. The land for this purpose should be of a light sandy quality, and it is best to have a hilly situation, being well inclosed by means of sod walls or paling-fences. See *Rabbit*.

RABIES, a term applied to canine madness. See *Canine Madness*.

RACE, in *Horsemanship*, a trial of speed between two or more animals. Races are most commonly run by horses trained for the purpose. See *Horse*.

RACE-*Horse*, a horse bred for the purpose of the turf, or such as are calculated for speed. See *Horse*.

RACK, in *Horsemanship*, a pace in which the horse neither trots nor ambles, but shuffles, as it were, between both. The racking-pace is on the whole much the same as the amble, only it is a swifter timed and shorter tread.

RACK, a wooden frame made to hold hay or fodder for cattle.

Sheep-RACK, a sort of long narrow crib fixed upon wheels for containing hay for sheep, having a lid or covering on the top. It is very useful in bad weather in the winter season, as preventing the hay from being wasted, and admitting the sheep to feed conveniently.

RACKING-*Fruit Liquor*, the fining and drawing it off. See *Cyder*.

RADDLE, a red ocher of iron, which, according to Dr. Darwin, has been found useful, as a manure in the northern parts of Staffordshire.

RADICLE, that part of the seeds of plants' which upon vegetating becomes its root. *See Root*.

RADISH, a plant of the tap-rooted kind, cultivated occasionally in the field for the purpose of the seed. It is much grown, according to the author of the Survey of the County of Kent, on the best rich loamy soils of the Isle of Thanet, and in East Kent, for the supply of the London seedsmen. The sorts usually cultivated for this use are, the early short top, the salmon and the turnip-rooted radish.

The land for the growth of this sort of crop should be in a fine state of preparation, by being ploughed to a great depth in the early part of the winter, and broken well down by harrowing, so as to render it perfectly clean, being previously well filled with well reduced manure. The ground being brought into this fine condition, "the seed is sown on furrows about ten inches apart, in a dry time in the month of March, about two or three gallons per acre.

"As soon as the plants appear, every other row is cut up with a horse-hoe, leaving the rows twenty inches apart. When the plants get two or three rough leaves they are hoed out in rows, and are then kept clean by repeated horse and hand-hoeing, when necesary, leaving the plants at about eighteen inches distance." It is added in the above Report, that the crop is seldom fit to reap till October, and sometimes is out in the fields till Christmas without receiving injury from wet weather; it being necessary that it should have much rain to rot the pods, that it may thrash well. In respect to the produce, it is from eight to twenty-four bushels per acre: and it is sold to the London seedsmen, who send it to all parts of the kingdom for retailing to the gardeners.

RAFT, a quantity of light timber, bound together so as to be floated down rivers or other waters. This means of conveying timber to navigable situations may be advantageously practised in many places.

RAFTERING, a provincial term used to a sort of ploughing in narrow ridges, or small ridglets.

RAFTY, a provincial term signifying damp and musty, as corn or hay in a wet season.

RAG, a term sometimes applied to a company or herd of young colts. It is sometimes written Rake.

RAG, a torn piece of cloth of any sort, when of the woollen kind they are used as manure.

Woollen-RAGS, this sort of materials, as well as the clippings of the pitch marks upon sheep, are good manure. The rags should be chopped small, about an inch or two square, and scattered on the earth at the second ploughing; for being thereby covered they will begin to rot by seed-time. They imbibe the moisture of dews and rain, retain it long, and, according to Dr. Home, keep loose dry soils in a moist state. They formerly cost about four-pence a bushel at London, from whence many loads were sent every year to Dunstable, which is thirty-three miles, where they are laid even on stiff lands, just after the sowing of the corn, allowing to the acre four sacks, of six bushels each; they are much higher now. See *Top-dressing* and *Manure*.

RAG-*Wort*, a very pernicious plant of the weed kind, which is sometimes termed seagrim. It has a green stalk, in its early state, but, as it advances in age, inclining to violet or purple, especially downwards. Its flowers are yellow, and thick set, and composed each of a number of small pointed leaves. It runs to seed in the latter end of summer. The smell, both of the stalk and leaves, which are jagged, as well as the flower itself are so offensive to animals, as that hardly any will feed upon it, except when almost starved.

It has been proposed to destroy it by picking out the roots, and feeding the land close with sheep. It mostly affects meadows and pasture lands when the soils are good. See *Weeds*.

RAGSTONE, a variety of stone, which is of a dull greenish colour and of a light weight, yet of a firm and compact structure, being somewhat glossy; and found in Westmoreland, and other northern districts.

RAIL, a straight piece of sawn timber used in fencing.

RAILING, a sort of fence constructed with posts and rails. It is often made use of in protecting young hedge fences, from the cropping of cattle or other animals. See *Fence*.

RAILWAY, a track constructed of iron, timber, or other material, upon the level surface of an inclined plane, or other situation, for the purpose of the easy conveyance of heavy loads of any kind of articles.

With the view of diminishing horse labour, it has

been suggested by Dr. Anderson in his Recreations in Agriculture, that where internal canals cannot be established, this may be effected, and intercourse facilitated by means of rail-ways, which have not yet been introduced into general practice. It is further stated that they were first solely employed for transporting coals to a moderate distance from the pits, to the places where they could be shipped being universally made of wood.

"Long, says he, had they been applied to this use, without any idea having been entertained that they could be employed for more general purposes. By degrees they were carried to a farther extent; the scarcity of wood, and the expense of their repairs, suggested the idea of employing iron for the purpose of improving these roads. At the first flat rods of bar iron were nailed upon the original wooden rails, or as they were technically called, *sleepers*; and this, though an expensive process, was found to be a great improvement. But the wood on which these rested being liable to rot and give way, some imperfect attempts were made to make them of cast iron, but these were found to be liable to many objections, until the business was taken in hand by Mr. Outram, engineer, at Butterly Hall, Derbyshire, who contrived at the same time so far to diminish the expense and improve the strength of the road as to bring them to a degree of perfection that no one who has not seen them can easily conceive could have been done." And it is added that "this having been carried into execution in a few cases, and found to answer, has been improved upon and simplified by practice, till it is now brought to such a state of perfection as to have given proofs, he says, that it admits of being carried much beyond the limits of what was for many years conceived to be possible, and to afford demonstrative evidence, that it may be in future employed to a wider extent still, to which no limits can be at present assigned or foreseen."

It is stated, that "rail-ways of this kind may be seen leading from Derby to the colleries in that neighbourhood,—five miles. 2d. Crick rail-way,—one mile and a half, from the lime rocks to the Cranford canal. 3d. Messrs. Barber and Walker's rail-way from Biggarlee colliery to the Cranford canal,—one mile and a half. 4th. The Peak forest rail-way, from the lime works near Boston to the canal near Whaley bridge,—six miles. 5th. The Marple rail-way, on the Peak forest canal,—one mile and a half. 6th. Rail-ways over Blisworth hill near Nottingham, on the grand junction canal,—three miles and a half long, double, just finished. 7th. The Ashby de-la-Zouch rail-way—four miles of double and eight miles single rails. These rail-ways were executed nearly in the order stated, and those last mentioned are of course the most perfect. All, he believes, in Derbyshire."

The utility of these rail-ways has likewise been found to be extremely great in other coal works and canals where they are at present very extensively employed; and it has been suggested that they may be applicable in other cases, as for shortening the team labour of a farm so as to bring it within one day's journey where more than one were formerly necessary, by which a great saving in labour and expense may be made. Also in rendering the business of lime works more easy and expeditious in different instances. It has likewise been hinted by Mr. Beatson, in the first volume of Communications to the Board of Agriculture, that they might be had recourse to on roads where there are unavoidable rises or falls, for taking up or letting down heavy loaded waggons or other carriages. It is observed that near Colebrook Dale there is one at a small distance from the iron bridge, upon which loaded boats are drawn up to a canal 220 feet above the level of the River Severn, and let down in a similar manner into it, by which means 22 locks are saved, and the work executed in a very expeditious manner. It is supposed that this is the greatest inclined plane in Europe, or perhaps in the world, for though they are much used in China in the place of locks, he has never heard of any of them being equal in height to this. The rails are best made of iron. It is added that they have been found useful in improving soft, mossy, boggy lands, on which horses cannot travel; a rail road of this sort having been formed through a peat moss near Manchester by Mr. Wakefield, at the expense only of about three hundred pounds a mile, on which a single horse is capable of drawing with the greatest facility seven waggons at once, each being loaded with about seven hundred weight of marle, bearing in the whole forty-nine hundred weight, and with the weight of the waggons upwards of three tons. This is performed, it is observed over a place where a few months before a dog could hardly even venture without the danger of being *swamped*. On the Ketley and other canals in the county of Shropshire, vast advantages have been derived from laying rail-ways upon inclined planes, as may be seen in the very able Agricultural Report of that district where excellent representations of them are given.

Besides these different cases of rail-ways, another has been suggested by Mr. Young, which is that of having them laid from the stack-yards to the thrashing machines, by which the grain may be conveyed to them at any time with ease and convenience, as well as any particular stack that may be wanted. See *Threshing Machine*.

It is further stated by the ingenious Dr. Anderson, that the "best idea that he can give of the benefit that may result to the community from the use of this kind of rail-ways will be from stating some facts respecting them, which were lately communicated to the Society of Arts by Mr. Wilkes, of Measham, near Loughborough, in Leicestershire; a spirited and judicious agriculturist. He had, he says, a rail-way of this sort made, which was about five miles in extent, leading from a coal mine to a market. He found it so fully to answer his expectations after it was finished, that he communicated to the above Society, an account of some trials that he had made of it, requesting that such of the members of that respectable institution as were desirous of information on that head, would do him the honour to witness some experiments that he wished to make upon it, for the information

of the public. A committee of the members was accordingly deputed for that purpose, and before them he showed that a moderate sized horse, about twenty pounds value, drew upon it with ease down hill (the descent being one foot in a hundred) thirty-two tons, and without much difficulty forty-three, and seven tons up hill, independent of the carriages. The Doctor concludes from these facts, that upon a perfect level a horse could draw with ease from ten to twenty tons." It is observed, that "Mr. Wilkes's rail-way on which the experiments were made, was, from local circumstances, laid upon wooden sleepers, and is not so perfect as those done upon stone." But it is added, that "twenty tons is the load which such a horse could draw with ease, travelling at the usual waggon rate, in boats upon a canal; so that the number of horses required in this way will not be much, if at all, greater than on a canal. Certain advantages attach to this mode of conveyance which do not so well apply to a canal, and *vice versâ*: but it is not his intention to draw a parallel between these two modes of conveyance. Nobody can entertain any doubt, he thinks, about the utility of canals where they are easily practicable. He only wishes to point out this as an eligible mode of conveyance where canals cannot be conveniently adopted."

The writer further remarks, that "it was customary at the first, to put the whole load to be drawn by one horse upon rail-ways into one waggon; but now, when the load is so much augmented, it has been found eligible to divide it into many parts, so that no one waggon shall carry more than one or two tons; by this method the weight is so divided, that the pressure is never so great upon one point as to be in danger of too much crushing the road; the carriages can be made much more limber and light in all their parts, and they are much more easily moved, and more manageable in all respects than they otherwise would have been." And another advantage of this arrangement, which deserves to be particularly adverted to, is, he says, that it admits of shifting the carriages so as to leave a load, as it were, in parcels at different places where they may be required, without trouble or expense. This, when it comes to be fully understood and carried into practice, will, he thinks, be a convenience of inestimable value, a thing that has been always wanted, and never yet has been found though it has been diligently sought for."

The able writer has here endeavoured to illustrate its importance and utility in transporting goods from the wet docks now forming on the Isle of Dogs to London, and in carrying roads to different distant parts of the country; in which cases, and in all where there is much business to be done, they would require to be double, one for going, and the other for coming upon, to prevent interruption and interference.

He afterwards offers "a few remarks tending to show the practicability of the measure and to guard against setting out upon a bad plan, which might, he supposes, in time to come, frustrate the good that might have resulted from the undertaking; merely premising, that he proposes these rail-ways solely for the purpose of conveying weighty loads, leaving the roads, as at present, open for coaches and light carriages."

It is added that, "with a view to discover how far it may be practicable to introduce these iron rail-ways into general use, he has made some inquiries respecting the expense of making them; and although this must vary according to the abundance and goodness of materials, and other circumstances, the following statement may serve to give some general notions on that head. In the most favourable situation, where materials are abundant and good, and circumstances favourable, the lowest expense at which a *single* rail-way of this sort can be made, will be about one thousand pounds a mile. But as a *single* rail-way must, he says, be liable to great inconveniencies, unless under very particular circumstances, double rail-ways ought to be considered as the only useful sort. These, for public purposes, according to the opinion of the inventor, should be very substantially made. The metal used should be of the stoutest sort, and of substance enough, not merely to carry the weights proposed, but to be equal to bear almost any blow or shock that they may be likely to experience; and, thus made, what they will lose by rust or wear, will, he says, be long ere it materially weakens them. Made after such a manner, in favourable situations in the country, a double rail-way may, he thinks, cost about two thousand pounds a mile, but in the neighbourhood of London, where the charge of every thing is high, and where they should be of the strongest sort, we should suppose they might cost nearly three thousand pounds a mile. It is bad economy, he thinks, to save on articles of this sort at the first; for the little expense thus laid out then will save much in repairs: how small these repairs are, may be imagined from this circumstance, that when a road is thus made the undertaker does not, he says, scruple to supply all that are broken, free of charge, for the first three years. Say then, says he, that such road cost three thousand pounds a mile, this would bring a charge upon the turnpike of 150l. a year; say 50l. more for annual repairs; this is, in all, 200l. per annum. Compare this with the expense of keeping the present roads in repair." It has been suggested to him, he says, "that there is annually laid out in repairs upon the road from Hyde Park Corner to Hounslow considerably above one thousand pounds a mile; so that the difference of expense is, even at the beginning, very much in favour of rail-ways: and were the money thus at first expended to be gradually paid off, the tolls might thus be lowered almost to nothing." And, he thinks, that "a turnpike road cannot be made in almost any situation for less, as he is told, than 1000l. per mile; but where it is of considerable width, as near great towns, it will run from 1500 to 2000l. per mile; and in annual repairs, including the purchase price of materials, carting them on the road, spreading, raking off, and carting away again, from 100l. to 1000l. a mile. Say 1500l. prime cost, the interest is 75l. and 150l. for repairs, the annual charge of

such road will be 225l. This is an expense of 100l. a year more than the other. But for the present, let us suppose that they will be equal, the extra charge for purchasing ground for a new waggon way, &c. being equal to that surplus; let us now see, says he, what would be the difference of charge to the employer of these waggons in the two cases. Supposing, says he, the road to be so much employed as that 100 waggons (or loaded carriages to the same amount) pass each day, carrying 6 tons each, drawn by 8 horses; these, at one shilling each waggon for toll (or 2 pence a ton), would produce 5l. a day, or 1825l. a year; which, at the rate of 8 miles for each turnpike, would be 228l. per mile, the surplus being produced by road horses and light carriages. The charge then to the employer, for this stage, must be 1825l. and the keep of 800 horses, besides servants, incidental charges, and owner's profits for the transporting of 600 tons of goods a day. Say that the same horses travel two stages a day, the turnpike money would be doubled; that is, 3650l. per annum; the keep of 800 horses at 2s. each per diem is 29,200l. These sums added make 32,850l.; owner's profit and incidental charges, say 10 per cent. 3285l. in all, 36,135l. or, on 219,000 tons (being 600 tons a day) about $\frac{3}{4}$ per ton." And supposing the same quantity of goods carried on the rail-way, and the same turnpike money paid, and that each horse drew only fifteen ton, this would require only, he thinks, 40 horses; the keep of which, at two shillings a day, would be 1460l. add the toll, 1825l. is 3285l. per annum. Owner's profit, &c. upon this sum 10 per cent. as above, 328l. in all, 3613l. or, about fourpence a ton, just one tenth part of the charge in the other case." He thinks, that "when the object comes to be considered in this point of view, few measures that can be proposed will hold forth such an important national improvement as this would be. Considered with regard to the consumption of the produce of the earth (an object at present deserving the fullest attention, as this improvement can be applied to almost every part of the country), it would, he supposes, reduce the number of heavy road horses to one eighth part of what they are at present, and of course augment the number of cattle or other consumable provisions in a proportionate degree, so as greatly to lower the price of the necessaries of life. It would, in the next place, lower the price of the carriage of goods of all kinds to an amazing extent, and lastly, as a consequence of that, it would give such encouragement to agriculture, as no other measure that can be contrived could ever effect, and that without costing one shilling expense to any one individual, or to the state. On the contrary, by inducing cheapness of provisions, and affording such efficacious encouragement to manufactures and to agriculture, it would produce a general prosperity, which, by augmenting the consumption of taxable commodities, would augment the public revenue; while, at the same time, every individual would feel himself relieved from the pressure of many taxes that prove distressful to him at present." After justly reprobating every sort of gambling speculations by monied men in undertakings of this nature, and showing the numerous evils that attend them, he advises it, as highly necessary "to prevent these rail-ways from ever becoming private property, on any account, to keep them open and patent alike to all who shall choose to employ them as a king's highway, under such regulations as it shall be found necessary to subject them to by law. In short, they should, he thinks, be put upon the same footing in all respects as public roads are at present, only under the direction of a distinct set of commissioners, who should have the superintendence of every thing that concerns this species of roads only. These commissioners should be vested with authority under an act of parliament, to erect turnpikes upon them, to levy certain stipulated tolls, and to mortgage the produce of these tolls for the purpose of raising money to be applied in the necessary purchases of land, and making the roads. In the act it should, he says, be expressly stipulated, that the produce of these tolls should be applied solely to keeping the road in repair, paying the interest of sums borrowed, and clearing off the principal as fast as the collections would admit; and when the whole money borrowed was thus paid off the tolls should be so lowered as only to produce money sufficient to keep the roads in a state of continually good repair. Thus would the expense of transporting goods be annually diminishing, and the prosperity of the country be thereby augmenting from day to day. He adds, that he is particularly earnest in this business, as he "has not been an unconcerned observer of the effects that have resulted from the establishment of turnpike roads in Scotland, which were begun within his recollection; and these effects have been such as no man who had not seen it would have believed could ever have taken place. Distance, says he, may be said to be thus diminished from place to place; lands that were originally far beyond the influence of the town as a market for any thing else than live stock, are thus brought, as it were, close to its gates; and the value of the produce of many articles is thus to them augmented fourfold, while they are at the same time diminished to the public. Not only is the value of produce raised, but the quantity also of that produce is augmented exceedingly by means of manures which become then accessible. Fossile manures, such as chalk, lime and marle, which were formerly confined to a narrow spot, expand themselves as if it were by a magical power, and by that expansible influence diffuse around fertility, riches, and plenty. Coals, and other weighty articles that may be useful in arts or manufactures of various kinds, which never were, nor ever could have been of any value to the owners of them so long as the expense of transportation exceeded a certain sum, find a ready market to any extent as soon as the price falls below that rate; thus contributing not only towards the enriching of the owners, but to the furnishing of employment to the various persons who must be engaged in preparing or transporting them to market, and the universal accommodation of the whole. Around every

market you may, says he, suppose a number of concentric circles drawn, within each of which certain articles become marketable which were not so before, and thus become the source of wealth and prosperity to many individuals. Diminish the expense of carriage but one farthing, and you widen the circle; you form, as it were, a new creation, not only of stones, and earth, and trees, and plants, but of men also, and, what is more, of industry, of happiness, and joy." It is added, "by making these roads the property of the public, and free to every person to bring his own waggons upon them wherever he pleased, farmers, when near them, would make bye roads of the same sort leading into these from their respective premises; the inhabitants of villages and country districts would join together, and at one common expense make roads of the same sort leading to a greater distance inwards, as they now make bye roads for themselves. Thus would all be accommodated: those who had business enough to furnish a sufficient load for one horse might go to market with it when they pleased: those who had dealings on a smaller scale could have one, two, or more waggons of their own conjoined with those of others to make up a load for one horse; and those of still smaller means could have one waggon loaded with the joint articles belonging to two, three, or more. A ton weight might then be pushed before a man to market for many miles, as a wheelbarrow is now. It is scarcely possible, he supposes, to contemplate an institution from which would result a greater quantum of harmony, peace, and comfort, to persons living in the country, than would naturally result from this arrangement." In fact, he "knows, he says, no *one* measure that would tend so effectually to lower the price of the necessaries of life, and restore abundance."

In respect to the method of forming and constructing these railways, it is observed by Dr. Anderson, that the following has been given by the inventor as the most improved plan: "first, that the best line that the country affords should be traced out, having regard to the direction of the carriage of articles or trade to be expected; and if such trade be both ways in nearly equal quantities, a line as nearly horizontally level as possible should be chosen. If the trade is all in one direction, as is generally the case between mines and navigation, then the most desirable line is one with a gentle gradual descent, such as shall make it not greater labour for the horses employed to draw the loaded waggons down, than the empty ones back; and this will be found to be the case on a rail-way descending about one foot vertical in one hundred feet horizontal. Or, if the rail-way and carriages are of the very best construction, the descent vertical may be to the length horizontal as 1 to 150, where there is little or no upgate loading. In cases between mines and navigations the descents will often be found greater than could be wished. On a rail-way on the improved plan, where the descent is more than as 1 to 50; six or eight waggons, loaded with 30 or 40 hundred weight each, will, he says, have such a tendency to run downwards, as would require great labour of one horse to check and regulate, unless that tendency was checked by sledging some of the wheels. On such, and steeper roads, iron slippers are applied, one or more to a gang of waggons, as occasion may require. Each slipper being chained to the side of one of the waggons, and, being put under the wheel, forms a sledge. Where the descent is very great, steep inclined planes, with machinery, may, it is observed, be adopted, so as to render the other parts of the rail-way easy. On such inclined planes the descending loaded waggons being applied to raise the ascending empty, or partly loaded ones, the necessity of sledging the wheels is avoided; and the labour of the horse greatly reduced" and lessened.

And that in order "to obtain the desired levels, gentle descents, or steep inclined planes, and to avoid sharp turns, and circuitous tracts, it will often be found prudent, he says, to cross valleys by bridges and embankments; to cut through ridges of land; and in very rugged countries short tunnels may, he thinks, sometimes be necessary. The line of rail-way being fixed, and the plans and sections by which the same is to be executed settled, the ground for the whole must, he says, be formed and effectually drained. The breadth of the bed for a single rail-way should be, in general, four yards; and for a double one six yards, exclusive of the fences, side drains, and ramparts."

And that "the bed of road so formed to the proper inclination, and the embankments and works thereof made firm, the surface must be covered with a bed of stones broken small, or good gravel, six inches in thickness or depth. On this bed must be laid the sleepers, or blocks to fasten the rails upon. These should be of stone in all places where it can be obtained in blocks of sufficient size. They should, he says, be not less than 8, nor more than 12 inches in thickness; and of such breadths (circular, square, or triangular) as shall make them 150lbs. or 200lbs. weight each. Their shape is not material, so as they have a flat bottom to rest upon, and a small portion of their upper surface level, to form a firm bed for the end of the rails. In the center of each block should be drilled a hole, one inch and a half diameter, and six inches in depth, to receive an octagonal plug of dry oak, five inches in length; for it should not reach the bottom of the hole; nor should it be larger than so as to be put in easily, and without much driving; for if too tight fitted it might, when wet, burst the stone. These plugs are each to receive an iron spike or large nail, with a flat point and long head, adapted to fit the counter-sunk notches in the ends of two rails, and thereby to fasten them down in the proper position, or situation in which they are to lie.

In regard to the rails, they "should be of the stoutest cast-iron, one yard in length each, formed with a flanch on the inner edge, about two inches and a half high at the ends, and three and a half in the centre; and shaped in the best manner to give strength to the rails, and keep the wheels in their track. The soles of the rails, for general purposes,

should not, he thinks, be less than four inches broad; and the thickness proportioned to the work they are intended for. On rail-ways for heavy burdens, great use, and long duration, the rails should be very stout, weighing 40lbs. or, in some cases, nearly half an hundred weight each. For rail-ways of less consequence, less weight of metal will do; but it will not be prudent to use them of less than 30lbs. weight each, in any situation exposed to breakage above ground." But it is observed that, "in mines, and other works under ground, where very small carriages only can be employed, very light rails are used, forming what are called train-roads, on a system introduced by Mr. Carr; and these kinds of light rail-ways have been much used above ground in Shropshire, and other counties where coals and other minerals are obtained."

It is added that "in fixing the blocks and rails great attention is required to make them firm. No earth or soft materials should be used between the blocks and the bed of small stones or gravel, on which the rails must all be fixed by an iron gauge, to keep the sides at a regular distance, or parallel to each other. The best width of road for general purposes is 4 feet 2 inches between the flanches of the rails; the wheels of the carriages running in tracks about 4 feet 6 inches asunder. Rails of particular forms are necessary where roads branch out from or intersect each other; and where carriage roads cross the rail-ways; and, at turnings of the rail-ways, great care is required to make them perfectly easy. The rails of that side forming the inner part of the curve should, he says, be fixed a little lower than the other; and the rails should be set a little under the gauge, so as to bring the sides nearer together than in the straight parts: these deviations in level and width to be in proportion to the sharpness of the curve. The blocks and rails being fixed and spiked fast, nothing more, he says, remains to be done than to fill the horse-path, or space between the blocks, with good gravel, or other proper materials; a little of which must also be put on the outsides of the blocks, to keep them in their proper places. This gravel should always be kept below the surface of the rails on which the wheels are to run, to keep the tracks of the wheels free from dirt and obstructions. The form of the rails must be such as will free them from dirt if the gravelling is kept below their level."

It is added that, "in the constructing of the carriages great attention to avoid friction is necessary, particularly in the formation of the wheels and axles, which must be adapted to the sort of rail-ways and the kind of loading;" but for which general directions cannot be given in a narrow compass.

It is probable that this valuable invention may also be applicable to many other purposes in agriculture or manufactures, as it becomes more fully understood.

RAIN, the watery fluid descending from the atmosphere in the form of drops. The water thus afforded is found highly refreshing to almost all sorts of vegetable crops, and to promote their growth in a rapid manner, when not produced in too great abundance at a time. This effect, which may often be perceived to take place in a sudden manner, after warm showers in the early spring months, is probably caused by the large proportion of oxygen that is contained in rain-water, as well as from the necessary moisture being afforded to the fibres of the roots of the plants. Too much rain may be injurious, however, by lessening the necessary cohesion and compactness of soils, by which they may not afford proper firmness to the roots of growing vegetables. And another injury may be produced by the too frequent occurrence of hasty showers, by which a large proportion of the decomposing vegetable and animal materials of lands, which are soluble or diffusible in water, may be conveyed away into the ditches, rivers, and ultimately into the sea, and of course, prove the cause of infertility. In hilly situations this effect may arise from even slight showers, on which account they have been advised to be ploughed in a slanting direction, as by that means the rains may be more perfectly detained in the soils. And it has been suggested by Dr. Darwin, that as the foliage or buds of plants, require more moisture for their vigorous growth, than their flowers, in this climate continued rains may be liable, not only to wash off the farina from the bursting anthers, and in that way prevent the impregnation of the pistillum, but also delay the ripening of the seeds or fruit from the want of a due evaporation of their perspirable matter, as well as from the less solar light in cloudy seasons. On this account it is, he supposes, that in the north of Scotland the oats are said seldom to ripen till the frost commences, with the dry season which accompanies it."

As the effects of rain are very considerable on vegetation it would be highly useful to ascertain the quantity or depth of rain that falls annually in different districts, and the difference in the effects which are produced by it. See *Water* and *Weather*.

RAKE, in *Farriery*, is a term applied to a horse which is said to rake, when, having been strained, he goes lame, and drags one of his fore legs in a semicircle, which is most apparent when he trots, or walks fast.

RAKE, *of Colts*. *See Rag*.

RAKE, a tool of the toothed kind, made use of for many different purposes of husbandry.

Corn-RAKE, a large strong rake, made use of in different districts for bringing together the mown grain crops; it is sometimes constructed with wooden teeth, but a better mode is to have them of iron, being a little bent forward, having the length of seven or eight inches. As it requires much exertion to perform the work with them, they should always be made as light as possible, so as to have sufficient power to perform the work.

It is stated by Mr. Somerville, in his able Survey of the District of East Lothian, that "though the common hay-rake is used, a different kind for grain has been partially tried and found to answer the purpose much better. In this, the length of the head is from

ten to fifteen feet, the handle about seven feet, with a piece of wood across the end of it, by which it is drawn by two men. The teeth are of wood or iron, the last are the best, as well as the most durable, and are a little bent forward at the point, which gives them the power of retaining and carrying the ears along with them much better than they would otherwise do. To make clean work, especially if the ridges are gathered, the field is raked across; in that way every thing is taken up; but when it is preferred to draw the rake in the direction of the ridges, it may be considerably improved by cutting the head into two or three lengths, and joining them with hinges, which will allow it to bend and accommodate itself to the curvature of the ridges. The advantage of this kind of rake has been found, he says, considerable, even in cases where every possible attention has been paid to the cutting of the crop; but as it frequently happens, that owing to the dampness, greenness of the straw, or a foul grassy bottom, it is necessary to leave the crop unbound for a day or two, during which, if it be overtaken by a high wind, much of it will be scattered and lost, unless considerable pains are taken to gather it by hand-raking or otherwise. Where the long rake is used for that purpose, the expense will, in no instance, he thinks, exceed four pence sterling per acre. An experiment made on a field of thirty acres will convey some idea of the benefit that may be derived from the use of that instrument. The field was in barley, and the rakings, when threshed, yielded,

	£.	s.	d.
7½ Bolls, sold at 28s. per boll	10	10	0
150 Stones straw, sold at 6*d.* per stone	3	15	0
Total produce	14	5	0
Expense of raking 31 acres, at 4d. per acre	0	10	4
Bread and beer to the rakers - - - -	0	1	6
Carting from the field, stacking, &c. -	0	2	6
Threshing - - - - - - - - -	0	7	6
Total expense	1	10	10

which, deducted from 14l. 5s. leaves a profit of 13l. 3s. 2d. sterling." It is necessary to observe, he says, that about ten acres of the field were left unbound, and a good deal disordered by a high wind; but as considerable pains were taken in the binding the proportion obtained from these ten acres did not greatly exceed what was got from the rest of the field, the whole of which was cut with a great deal of care.

Dew-Rake, a sort of large rake, or hand drag, so named from being used before the dew is off the ground, or other sort of harvest work can be begun.

Hay-Rake, a well-known tool, with short teeth and a long handle, made use of in making hay. It is usually made of willow, or some other similar wood, in order that it may be light and handy. The teeth, should not be too long, as when that is the case they are apt to hang and pull among the stubs of the grass in raking with them, and thereby retard the operation.

Different improvements have been made on this implement. A late useful alteration is, the making the teeth to screw into the head, and fasten with screw nuts, by which the inconvenience of their dropping out in dry seasons is obviated. It has been observed that, with the *spring-toothed* rake, the operator is capable of performing much more work than by the common one. They are likewise capable of being conveniently made use of both for hay and corn. They were made and sold by Mr. Cort, of Leicester.

Another improvement is mentioned in Young's Report of Norfolk, which is the addition of wheels. It is stated that "the hand wheel-rake, of Fleg, is an excellent implement for both hay and corn; it is to answer the purpose of the common hay-rake, and is about four feet long in the rake, and the two wheels of nine inches diameter, so fixed that the teeth are kept in any posture, at the will of the holder."

Horse-Rake, an implement much used in Norfolk and Suffolk, on the large and middling sized farms, and from its great utility extending itself into other districts. It is employed for barley and oat crops, being drawn by a horse. And it has been stated by Mr. Young, that one man and a horse, driven by means of a line or rein, are capable of clearing from twenty to thirty acres, in a moderate day's work; the grain being deposited in regular rows or lines across the field, by simply lifting up the tool and dropping it from the teeth, without the horse being stopped. It costs from four to five pounds. It is seen at *fig.* 5, plate X. in vol. I.

Horse Stubble-Rake, a large heavy kind of horse rake, having strong iron teeth, fourteen or fifteen inches in length, placed at five or six inches from each other, and a beam four inches square, and eight or ten feet in length. In drawing it two horses are mostly made use of, by which it is capable of clearing a considerable quantity of stubble in a short time. Tools of this sort are highly useful on corn farms for collecting this useful material.

Twitch-Rake, a large horse rake, employed in certain cases for clearing lands from the roots of *couch*, *twitch*, or *quitch*-grass, as well as those of other sorts. It is constructed in different ways, as with one or two rows of teeth, but the latter is probably the better method, as by placing one row opposite the intervals of the other, it must be rendered a very effective tool. See *Couch-grass-Rake.*

RAKING, the operation of performing work with a rake. It is a sort of work that requires little art or trouble in its execution. But whether performed with the common or horse-rakes, it should always be done in an effectual manner.

In the business of hay-making, clean raking not only affords a neatness in the appearance, but over a great extent of surface, a considerable saving of hay. See *Hay-making.*

Raking, in *Farriery.* See *Back-raking.*

RAIT, a term used to signify the dissipating the

sap of vegetables by exposure to moisture, or the influence of the atmosphere. It is mostly applied to hemp, flax, and sometimes to hay, when it has been much exposed to alternations of wet and dry weather.

RAITCH, a term signifying a line or list of white, down the face of a horse.

RAM, the male of the sheep kind. It may be observed that the rams of different breeds of sheep vary greatly in their forms, wools, fleeces, and other properties; but the following description by that excellent stock-farmer, Mr. Culley, deserves the attention of the breeder and grazier.

According to him "his head should be fine and small, his nostrils wide and expanded, his eyes prominent, and rather bold or daring, ears thin, his collar full from his breast and shoulders, but tapering gradually all the way to where the neck and head join, which should be very fine and graceful, being perfectly free from any coarse leather hanging down; the shoulders broad and full, which must at the same time join so easy to the collar forward, and chine backward, as to leave not the least hollow in either place; the mutton upon his arm or fore-thigh must come quite to the knee; his legs upright, with a clean fine bone, being equally clear from superfluous skin and coarse hairy wool from the knee and hough downwards; the breast broad and well forward, which will keep his fore-legs at a proper wideness; his girth or chest full and deep, and instead of a hollow behind the shoulders, that part by some called the fore-flank should be quite full; the back and loins broad, flat, and straight, from which the ribs must rise with a fine circular arch; his belly straight, the quarters long and full, with the mutton quite down to the hough, which should neither stand in nor out; his twist or junction of the inside of the thighs deep, wide, and full, which, with the broad breast, will keep his four legs open and upright; the whole body covered with a thin pelt, and that with fine, bright, soft wool."

It is observed that, "the nearer any breed of sheep comes up to the above description the nearer they approach towards excellence of form."

The practice of letting out rams in the mid-land districts for the purpose of improving the breeds of sheep, having produced such beneficial effects, the rise, nature, and progress of it may deserve the attention of the stock-farmer. It has been ably and accurately delineated in the following manner by Mr. Marshall in his Rural Economy of that part of this kingdom.

It is observed, that in this district, in general, "the management respecting rams, is similar to that of other parts of the island; the breeders *rearing* or *purchasing* them." But that it is observable, however, that the advocates of the old breeds, though they will not adopt the modern stock, have fallen, in some degree, into the modern practice of *letting* by the *season*. "But that the rams of the *modern* breed are never *sold*; but are passed from breeder to breeder, by the *season* only." And that "for the purpose of promoting this intercourse, each principal breeder has his *show* of rams; commencing, by common consent, the 8th of June, and lasting until Michaelmas, or until the season of letting be past." It is added that, "during a few weeks after the shows commence, every ram-breeder may be said to keep open house. Breeders and others, from all quarters of the kingdom, as well as the promoters of the breed who reside in the neighbourhood, attend, he says, these shows; going, in parties, from one to another: some to take, others to see and pass their judgment." And that "these private exhibitions close with a *public show*, at Leicester, the tenth of October; when rams of every description, but mostly an inferior sort of the improved breed, are collected; being brought in waggons; many of them from a considerable distance; some to be *sold*, but chiefly to be *let*" for the season. He states that "this show has been held, he believes, time immemorial; not, however for the purpose of *letting*, but for that of *sale*. But the letting of rams by the season, has long, he understands, been a practice in Lincolnshire. However, "the origin, in the midland district, may, he says, be traced—to a ram let by Mr. Bakewell, at Leicester fair, about forty years ago, at the low price of sixteen shillings. But humble, however, as was this beginning, it proved, Mr. Marshall says, to be the first stone of the foundation of a department of rural business, that has already risen to an astonishing height, and may, for some length of time, continue to bring in a copious source of wealth to the country." In the management of this business, "the principal ram-breeders save, he says, annually, twenty, thirty, or perhaps forty ram-lambs; castration being seldom applied, in the first instance, to the produce of a valuable ram. For in the choice of these lambs, they are led more by blood, or parentage, than by form; on which, at an early age, little dependence can be placed." He adds that "their treatment, from the time they are weaned, in July or August, until the time of shearing, the first week in June, consists in giving them every indulgence of keep; in order to push them forward for the show: it being the common practice to let, such as are fit to be let, the first season; while they are yet yearlings—provincially *sharhogs*." Their first pasture, after weaning, is pretty generally, he believes, clover that has been mown early, and has got a second time into head: the heads of clover being considered as a most forcing food for sheep. After this goes off, turnips, cabbages, colewort, with hay, and report says, with corn. But the use of this the breeders severally, he says, deny, though, collectively, they may be liable to the charge. However this may be, "something, says he, considerable depends on the *art* of making *up*,—not lambs only, but rams of all ages. Fat, like charity, says he, covers a multitude of faults; and, beside, is the best evidence their owners can produce, of their *fatting quality*,—their natural propensity to a state of fatness: while in the fatness of the sharhogs is seen their degree of inclination to fat at an *early* age." And that "the fatting quality being the one thing needful in grazing stock; and being found,

in some considerable degree at least, to be hereditary, —the *fattest* rams are of course the *best*; though other attachments, well or ill placed, as to form, or fashionable points, will perhaps have equal or greater weight in the minds of some men; even in this enlightened age and district." It is added that "the shearlings which will not make up sufficiently, as to form and fatness, are either kept on to another year, to give them a fair chance, or are castrated, or butchered, while sharhogs.

In regard to the showing, it is remarked, that "the shows of the principal breeders consist, by common consent, of forty rams each; mostly from one to five years old; they being seldom found efficient, after that age: some, however, will continue in vigour to the sixth or seventh year." And that "during the show they are mostly kept in small inclosures, of two, three, or four acres; with three, four, or more rams in each; according to their ages, and the advancement of the season." And "in a corner, or other convenient part of each paddock, a small pen, made with hurdles, is placed; for the purpose of handling them. Into these pens they go, he says, through custom, as tractably as worked oxen to their stalls. Indeed, the old rams, from the unwieldiness of their frame, and the load of fat they have to carry at this season, as well as from habit, will suffer themselves to be handled abroad: and even, he says, appear to take a pleasure in the respect which they have shown them." But he observes that "of late, a new method of showing has been struck out, by the leading breeder, and adopted by *one* at least of his followers. Instead of showing them abroad, and driving three or four of them up together into a pen, they are shut up in hovels, and brought out separately; being *never seen* together." He thinks, that "among accurate judges this mode of showing may be well enough; but, to those who have had less experience, it gives offence, as it deprives them of their best guide, comparison; and he can see no fair advantage accruing from it to the latter."

It is remarked that, "though the desirable *points* of a ram are such as have been noticed, the choice of the hirer is determined in some measure, by the intention for which he is about to hire: as whether it be that of getting wedders, or mere grazing stock: or rams for the purpose of letting." Hence, says he, the grazier and the ram-breeder choose different sheep, so as to suit their different purposes." He adds that, "the characteristic difference between what is termed a *ramgetter* and a *weddergetter*, or a good grazier's sheep, is that of the former being every where cleaner, and finer, the head small, the bone and offal light, the flesh good, and the form beautiful. The mere grazier likes a ram no worse for having a strength of frame, and is less scrupulous about his form than the ram-breeder, whose great object is fineness: his ewes, and the natural tendency of the breed, serve to give his offspring size and substance when it is wanted."

In respect to the practice of letting, it is observed that, "a novel circumstance has likewise taken place lately, in the business of letting. The long-established custom of setting a price was exploded, at least, by the late Mr. Bakewell and one of his disciples, whose customers were left to make their own valuations, and bid what they pleased." But "this, as well as showing them separately, it is observed, gives great offence, especially to strangers, who cannot brook the idea of being "both buyers and sellers." The latter, however, has, he says, more than one advantage in reserving the price (provided he do not thereby drive away his customers): he is, in effect, letting to the best bidder. Beside, he is, through this mean, enabled to *regulate* his *prices* to his customers, without giving any of them *pointed* offence." For, as "the principal breeders are, in the nature of their business, competitors; it is no more than common good policy, in the leader at least, to advance himself, and keep back those who press upon him closest. It is therefore good management, Mr. Marshall thinks, in him, to let a superior ram to an inferior breeder, whose ewes are yet of base blood, at a lower price than to one who is farther advanced, and whose ewes, perhaps are nearly equal to his own; for, if the hirer may not thereby be able to get the lead from him, he may run away with part of the best prices; and the only line the leader has to tread is, either to refuse him, or to make him pay in the first instance. And again,—sometimes two or three capital breeders will join in the hiring of one superior ram; and, in this case, the blood being more widely dispersed, the price ought to be, and always is, he says, advanced, in proportion to the number of partners there may be in the business. Hence, says he, in the leader, a reservation of price may be allowable, especially in the letting of first-rate rams."

He observes in regard to the "conditions of letting, that notwithstanding the number of years the letting of rams has now been in use, and the extraordinary height to which the prices have risen, the transaction does not appear to have yet received any settled form; nor to have been rendered *legally* binding, by any written articles, or conditions of letting; much being still left to the *honor* of the parties; it is however, he says, generally understood, that the price agreed upon shall not be paid unless the ram in contract, "*or another as good*," impregnate the stipulated number of ewes. If through accident or inability, part only be impregnated, a proportional part of the price is abated. If he die while at ride, the loss falls on the letter, whether his death happen through accident or neglect: no *case*, he understands, having yet been otherwise determined; it is likewise understood, that the hirer shall not suffer him to serve any other than his own ewes; and, of these, no more than a stipulated number, which is proportioned to the age or ability of the ram, and the mode of using him. And further, that if a grazier hire a valuable ram, at a weddergetter's price, (which is not unusual at the wane of a season, when valuable rams happen to be unlet) it is understood—or rather agreed—that he shall not rear rams from him: a condition which may frequently be advantageous to both parties. The letter pock-

ets five or ten guineas, which otherwise he might not have had, and the hirer, by suffering himself to be "tied down," as it is termed, gets a greater improvement in his stock than otherwise he could have got for the same money." He adds, that "the time of paying the money is, he understands, unfixed: seldom, he believes, until after the ewes have brought proofs of the ram's efficiency," or after the lambing season.

It is observed that with regard to "the prices for letting rams, by the season, that from the first letting to the year 1780, the prices kept gradually rising from *sixteen shillings* to *a guinea*; and from one guinea to *ten*. In 1780, Mr. Bakewell let several at *ten guineas* each;—and what is *rather* inexplicable,—Mr. Parkinson of Quarndon let one, the same year, for *twenty-five guineas*: a price which then astonished the whole country." That "from that time, to 1786, Mr. Bakewell's stock rose rapidly, from ten to *a hundred guineas*; and that year he let two thirds of one ram (reserving one third of the usual number of ewes to himself) to two principal breeders, for an hundred guineas each; the entire services of the ram being rated at *three hundred guineas*! This excellent breeder, making, he says, that year, by letting twenty rams only, more than a thousand pounds! !" and that "since that time the prices have been still rising. *Four hundred guineas* have been repeatedly given." The above breeder, this year (1789) makes, he understands, twelve hundred guineas by three rams (brothers he believes), two thousand of seven, and, of his whole letting, full three thousand guineas! ! ! And that he now lets nothing under twenty guineas: a well-judged regulation, which Mr. Marshall thinks will probably be beneficial both to himself and his customers."

It is added that, "beside this extraordinary sum made by Mr. Bakewell, there are six or seven other breeders, who make from five hundred to a thousand guineas each. The whole amount of monies produced this year, in the midland counties, by letting rams of the modern breed for one season only, is estimated, by those who are adequate to the subject, Mr. Marshall says, at the almost incredible sum of *ten* thousand pounds." He knows, he says, "that it is a popular idea; especially of those who, living at a distance, have only heard of these extraordinary things, without having an opportunity of coming at facts, that the extravagant prices which are talked of are merely nominal; the principal part of the money being returned: the actual prices given, being small, in proportion to those held out. This, however, is, he believes, and on the best authority, an erroneous idea. At the first setting out of the high prices there might be some transactions of that nature; but, if they ever existed, they have ceased long ago. Mr. Bakewell, at present, has the name, at least, of being parsimonious, even to the shepherds of the flocks on which his rams are employed. His highest present, he understands is five shillings; if the price be under fifty guineas, only half a crown." But "the enormousness of these prices may be explained, he thinks, on other grounds. The *high* prices are not given, he says, by graziers, for the purpose of getting wedders, as grazing stock, but by ram-breeders, for the purpose of getting rams, to be let to graziers: the *highest* being given by the principal breeders only; not for the purpose of getting rams, to be let to graziers, as wedder-getters; but for that of getting rams, to be let out again to inferior tupmen, as ram-getters."

It is further stated that, "the grazier's prices run, even now, from one to ten guineas. He has not heard of more than ten guineas being given, by a mere grazier, for a ram, for the sole purpose of getting grazing stock: five or six guineas is the common price." And, says he, "supposing he gives the highest price, ten guineas, and that the ram serves a hundred ewes (some single, some double,) the expense of getting amounts to no more than two shillings a head; which is inconsiderable compared with the difference between a well and an ill grazing sheep: between a sheep that will get as fat at two years old, as another will at three: or, in other words, which will, at two years and a half old, fetch ten or fifteen shillings more than his comrades of another breed, but of the same natural size, and going in the same pasture, or feeding on the same sort of food." In respect to "the *middle* prices,—as those from twenty to fifty guineas," they "are, under present circumstances, equally reconcileable, he thinks, to common-sense. If a breeder, who gives fifty guineas, rear ten tolerable rams, fit for the grazier's use, and let them at five guineas each, he brings himself home, even the first season of letting; beside having the rams for another and another season; and beside a general improvement in his stock" for the future. "And those who give the higher prices,—as one to two hundred guineas,—have, or ought to have proper bases to build upon—sufficient stocks of well-bred ewes; in which case they have a fair chance of producing ram-getters, worth—while the present spirit of improvement lasts—twenty to fifty guineas a season." And that "with respect to the *very high* prices, they are given by a few first-rate breeders, he says, who are playing a high game—running a hard race—for the pride and profit of being leader, when Mr. Bakewell is not. A contention which may last as long as Mr. Bakewell; and be, at once, an honour to his genius, and a reward of his services."

In respect to the "treatment of rams after letting, it is remarked that the breeders of rams, as well as of bulls, find it expedient to reduce them from the cumbrous state in which they are shown, previously to the season of employment; the old rams in particular being frequently returned upon their hands, non-efficient. Hence, as they are let, they are transferred to private pastures, and moderate keep; it being a pretty general rule, not to show a ram after he is let," or contracted for to a person.

In the sending out let rams, "the usual time of beginning is the middle of September. The means of conveyance—carriages of two wheels, with springs, or hung in slings; some of them being large enough to hold four rams. In these, they travel from twenty to thirty miles a day: being sometimes sent, in this

way, two or three hundred miles, and sometimes more."

It is observed by the same writer that the manner "of using these rams has lately received a very great improvement. Instead of turning them loose among the ewes, at large, as heretofore, and agreeably to the universal practice of the island,—they are kept apart, in a separate paddock or small inclosure, with a couple of ewes only each, to make them rest quietly; having the ewes of the flock brought to them, singly; and leaping each only once." He thinks that "by this judicious and accurate regulation a ram is enabled to impregnate near twice the number of ewes he would do, if turned loose among them, especially a young ram." And he adds, "in the old practice, sixty or eighty ewes were esteemed the full number for a ram: in the new, from a hundred to a hundred and twenty are allowed: seven score have been served by one ram in a season," this is, however, much too great a number.

While "at ride, the treatment of the ram is merely that of keeping him well, and free from disorders, suffering him to serve no other than the hirer's own ewes, and of these the limited number only, and to return him safe when he has done; generally, the beginning of December; or, if the hirer has met him on the road (which is customary), the latter, in return, meets him on his journey home." And the "after treatment consists in striving, by every devisable means, to reload his carcase, and make him fat and handsome for the ensuing show, in order that he may be let again with advantage."

This is the plan that was pursued in that district, which has led the way to so much improvement in the breeding of sheep stock; and from which the country has derived such vast benefits. See *Sheep*.

Ram, a term also signifying any thing that has a strong smell or taste.

RAMGETTER, a term applied by the midland breeders to such rams as are proper for getting ram stock, in contradistinction to such as are fit for getting wedder stock. See *Ram*.

RAMMELY, a word used to signify such crops as are tall or rank, as beans, &c.

RAMMED *Earth Buildings*, such as are raised with that material, this mode of building with earthy materials is supposed to have been known at a very early period, and has been long practised with success in the southern parts of France, especially near Lyons, though but little understood in any other part of Europe until lately. It however, appeared to have so many advantages, that it was made trial of in different places here, and the result has been so favourable, that the practice seems to deserve the attention of the proprietors of land, in all situations where buildings are to be erected on a cheap and economical plan. In order to facilitate the knowledge of the art Mr. Holland has presented the public with the method of performing the business, in a paper, translated from a French work on the subject, inserted in the first volume of Communications to the Board of Agriculture. He says that the French writer, M. François Cointeraux observes, that "the possibility of raising the walls of houses two or even three stories high, with earth only, which will sustain floors loaded with the heaviest weights, and of building the largest manufactories in this manner, may astonish every one who has not become an eye witness of such things." It is a method, which in the above district of France is known by the term *Pisé*; but, as it is accomplished by the ramming or compressing earth, or earthy substances in moulds or cases, the above name may be more expressive.

Implements necessary for. In this sort of work, in addition to the common tools, such as spades, trowels, baskets, watering pots, a plumb rule, hatchet, hammer, and nails, a mould and rammer are, likewise, required. Of which, the following are the different constituent parts. In plate XX, *fig.* 1, is an outside view of mould, *fig.* 2, inside ditto, *fig.* 3, head of the mould, seen without, *fig.* 4, the other face, seen within: *fig.* 5. wedges, *fig.* 6, a round stick, termed the wall-gage, *fig.* 7, post to be set upright, but seen flatwise, with its tenon, *fig.* 8, the same on its back, also with its tenon, *fig.* 9, joists in which the mortises are cut, seen flat, *fig.* 10, the same, with the side and bottom seen, *fig.* 11, a mould put together, all the parts seen, as well as a small rope, *fig.* 12, the rammer (or *pisoir*) for ramming earth in mould, *fig.* 13, side view of same on a large scale, *fig.* 14, plan of instrument, seen on top.

In constructing the mould, it is advised to "take several planks of light wood, each ten feet long, in order that the mould may be easy to handle; deal is the best, as being less liable to warp, to prevent which the boards should be straight, sound, well seasoned, and with as few knots as possible. They should "be ploughed and tongued, and planed on both sides. Of these planks, fastened together with four strong ledges on each side, the mould must be made two feet nine inches in height; and two handles should be fixed to each side, as at *fig.* 1, and 2. The head of the mould, which serves to form the angles of the building, must be made of two narrow pieces of wood, ploughed, and tongued, and ledged; in breadth eighteen inches, and height three feet; and it should be planed on both sides, as at *fig.* 3 and 4, where it will be remarked, that this part of the mould diminishes gradually to the top, in order that the wall may be made to diminish in the same degree." It is added that, "all the boards and ledges must be, after they are planed, something more than one inch thick." And that "the wedges, *fig.* 5, must be an inch thick, and from eight to twelve inches high; and the gage, *fig.* 6, be cut in length equal to the thickness of the wall that is to be erected.

It is further stated that, "the eight ledges that are necessary to secure the two large sides of the mould, serve also to receive eight upright posts, standing on four joists. The posts, *fig.* 7 and 8, may be made either of wood sawed square, or of round wood of any kind; so that one may use indifferently the ends of rafters, joists, small trees, or their branches. These posts are to exceed the height of the mould by eighteen inches; they must therefore be about five feet high, including their tenons (which should be

six inches long), and three by four inches. That part which is to bear against the ledges of the mould must be made flat and straight, the other sides need not be worked with so much truth." And the joists may be of the same sort of stuff, three feet six inches long, three inches and a half broad, and three inches thick. On the broad part must be made the two mortises, as at *fig.* 9, ten inches and a half long, and rather more than an inch wide, and at each end three inches and a half must be left beyond the mortises, so that the interval between them will be fourteen inches. These dimensions must be observed, in order that the two sides of the mould may incline towards each other, and the thickness of the wall be gradually diminished, till it is reduced to fourteen inches at the roof. Of course the dimensions for the joists are these:

	ft.	inch.
The two ends, remaining beyond the mortises, three inches and a half each	0	7
The two mortises, ten inches and a half each	1	9
The interval between the mortises	1	2
Total length of the joist	3	6

The elevation of the whole machine, is seen at *fig.* 11; and the following is a list of its several parts, enumerated in the same order that the workmen must follow when they erect the mould on a wall. "A, stone foundation eighteen inches thick, on which wall of earth is to be raised; B. joists placed across the foundation wall; C C. the two sides of the mould, including between them three inches of the foundation wall; D D. the two upright posts, the tenons of which fit into the mortises of the joist; E. wall gage, which fixes the width of the mould at the top, and which is shorter than the thickness of the wall at bottom, to regulate the diminution of the wall to be erected; F. a small cord, something less than half an inch diameter, making several turns round the posts; G. a stick, which by being wound round fastens the cord, and holds the posts tight together; H H, wedges which enter into the mortises in the joists, and keep the posts and the mould firmly fixed against the wall."

But though "such is the process of erecting the mould; a contrary order must be observed in taking it to pieces. The rope must be loosened, the wedges taken out, and the posts, the mould, and the joist removed, in order to refix the whole again." And the rammer "with which the earth is rammed into the mould, is a tool of the greatest consequence, and on which the firmness and durability, in short, the perfection, of the work depends," and in making which "more difficulty will be found than is at first apprehended. It should be made of hard wood, either ash, oak, beech, walnut, &c. or what is preferable, the roots of either of these sorts of wood."

In regard to the nature of this sort of work, it differs very essentially from that "miserable way of building with clay or mud mixed with hay or straw, which is often seen in country villages; it "contains all the best principles of masonry, together with some rules peculiar to itself." At *fig.* 15, is represented the plan of a house, the building of which is regularly described, according to this method.

"The foundation may be made of any kind of masonry that is durable, and must be raised to the height of two feet above the ground; which is necessary to secure the walls from the moisture of the earth, and the splashing of the rain, which will drop from the eaves of the roof. When these foundation walls are made level, and eighteen inches thick, mark upon them the distances at which the joists are to be set for receiving the moulds; those distances should be three feet each from centre to centre. Each side of the mould being ten feet long will divide into three lengths of three feet each, and leave six inches at each end, which serve to lengthen the mould at the angles of the house, and are useful for many other purposes. After having set the joists in their places, the masonry must be raised between them six inches higher, that is, to a level with the joists; there will, therefore, upon the whole, be a base of two feet and a half, which in most cases will be found more than sufficient to hinder the rain, frost, snow, or damp, from injuring the walls. Raise the mould in the manner mentioned above, immediately on this new masonry, placing it over one of the angles of the wall."

The head of it, which is to be placed against the angle, should have eighteen inches in breadth at the bottom, and only seventeen inches and a half at the top; thus the sides of the mould will incline towards each other, and produce that diminution in the thickness of the wall, which is usual in buildings of this nature. The wedges must then be driven in, and the posts well fixed by cords, and the head of the mould secured by iron pins" when the whole is ready for the workmen.

It is stated, that "a workman should be placed in each of the three divisions of the mould, the best being placed at the angle. He is to direct the work of the other two, and by occasionally applying a plumb-rule, to take care that the mould does not swerve from its upright position. The labourers who dig and prepare the earth must give it in small quantities to the workmen in the mould, who after having spread it with their feet, begin to press it with the rammer. They must only receive at a time so much as will cover the bottom of the mould to the thickness of three or four inches. The first strokes of the rammer should be given close to the sides of the mould, but they must be afterwards applied to every other part of the surface; the men should then cross their strokes, so that the earth may be pressed in every direction. Those who stand next to one another in the mould should regulate their strokes so as to beat at the same time under the cord because that part cannot be got at without difficulty, and must be struck obliquely; with this precaution the whole will be equally compressed. The man at the angle of the wall should beat carefully against the head of the mould, and for the sake of the appearance, or perhaps to increase the strength of the building it is usual to spread every six inches high a layer of mortar near the head, in imitation of the

joints of stone-work. Care must be taken, that no fresh earth is received into the mould till the first layer is well beaten, which may be ascertained by striking it with the rammer: the stroke should leave hardly any print on the place. They must proceed in this manner to ram in layer after layer till the whole mould is full. When this is done, the machine may be taken to pieces and the earth which is contained will remain firm and upright, about nine feet in length, and two feet and a half in height. The mould may then be replaced for another length, including one inch of that which has first been completed; the regular manner of joining the different lengths may be seen in the geometrical elevations, in plate XXI, *fig.* 1, and more particularly at *fig.* 2, where it will be observed, that no joints are left in this work, as the different lengths are united, and made to press one on the other. In the second length, and most of the following, the head of the mould is useless; it is only made use of at the angles." As soon as "the workmen have gone round the whole building, taking the mould to pieces and putting it together again successively, they should begin upon the partition marked C in plate XXI, *fig.* 14, where the head of the mould must be used, as the door jambs are squared like the angles of the wall. The jamb next to the exterior wall, which is too narrow to be made of pisé, caneasily be made of wood, brick, or stone." And "the first course being thus completed proceed to the second, and here it must be observed, that if in laying the first course the work begin with one angle, as the angle A, *fig.* 15, and proceed towards E, it must, for the second course, begin with A, and proceed towards B, and so in each successive course it must proceed in a direction contrary to that of the preceding. It may easily be conceived, that with this precaution the joints of the several lengths will be inclined in opposite directions, which will contribute very much to the firmness of the work. There is no reason to fear overcharging the first course with the second, though but just laid; for three courses may be laid without danger in one day; mark the grooves for receiving the joists in the first course, at the distance of three feet from one another, but not immediately over the former grooves, but over the middle points between them, as seen at *fig.* 2, in plate XXI. These grooves must be cut with a pick-axe, and the second course completed in the same manner as the former, except that it must proceed in a contrary direction, as was before observed, and that the head of the mould and wall-gage must be diminished, in order that the same inclination of the sides to one another that was given to the first course, may be preserved in this second.

"It must, however, be remarked, that this second course is not to be continued without interruption like the first, as it is necessary that the partition wall should join or bond into the exterior wall; or rather, that all walls in the building, whether outside or partition walls, which meet at an angle, should cross each other at every course. In pursuance, therefore, of this rule, when the work has been advanced from A and C, or perhaps not quite so far as C, leave the exterior wall, and turn the mould to the partition, applying the face of it to C. This will appear more clearly by the letter G, in Plate XXI, *fig.* 1. When the work has been carried on along the partition wall as far as the door, bring back the mould to the part which remained unfinished in the exterior wall, marked C, at *fig.* 15, in Plate XX.; and after having filled up that space, carry the mould on beyond the partition wall, and complete the course. The reason of the partition wall on the side opposite to C, not being connected in the same manner with the interior wall, is that it ought to be made of wood, or brick-work, and not of this material, but the third course must be carried over the door, and join into the wall, as above." It is observed that, "this description of the two first courses is equally applicable to all the others, and will enable any person to build a house, with no other materials than earth, of whatever height and extent he pleases."

It may be remarked that, "the gables cannot be crossed, as they are detached from one another; but as their height is so inconsiderable, and they are besides connected together by the roof, this is not of any consequence. They may be made without any difficulty, by merely making their inclination in the mould, and working the earth accordingly. It has been observed, that each course will be two feet and a half high, if the mould is two feet nine inches; for the mould must include three inches of the course beneath. For this reason the grooves are made six inches deep, though the joists are only three inches in thickness. If the directions which have been given for diminishing the thickness of the walls are observed, that thickness will be reduced to fifteen inches at the roof, in a house (like that of which a design is annexed) consisting of six courses; for in each course there will be an inclination of half an inch. The gables might have been reduced to fourteen inches only in thickness, as an interval of fourteen inches only was left between the mortises of the joists: and by increasing or diminishing that interval the thickness of the walls may be regulated at pleasure."

In this mode of building, according to the account of the Rev. Mr. Jancour, as practised at Montbrison, capital of the Forêts in France, as transmitted to the Board of Agriculture, "the earth is pounded as much as possible, in order to crumble any stones therein; clay is added thereto in a small quantity, about one-eighth part. It is all beaten and mixed up together by repeated blows with a mallet about ten inches broad, and ten or fifteen inches long, and two inches thick. The earth being thus prepared, and slightly wetted, the foundation of the house is dug for; this is laid with stone, and when it is about one foot high above the surface of the ground planks are arranged on each side, which are filled with earth intended for the wall. It is strongly beaten; and this method is continued successively all round the building. The walls have more or less thickness, according to the fancy of the owner; he has seen them, he says, of six and of eighteen inches thick. Some builders intersperse from space to space a thin layer of lime. If several stories are intended in such erections, they do not fail to place beams to

support the floors before they build higher; the windows and doors are attended to in the same manner. Of such buildings he never saw any consisting of more than two stories at most; generally they have but one besides the ground-floor. When the building is thus finished, it is left for some months to dry: then such as wish to make the building more solid and durable, give it a rough-cast coating on the outside with lime and sand."

In regard to the manner of forming the openings for the doors and windows, they should be "left at the time of building the walls. This may be done by placing within the mould either two or one of the heads, (as represented, *fig.* 3, and 4,) as may be necessary, wherever the wall is to terminate and the opening commence. They should be made sloping a little, in order to leave room for the frames and sashes. And the exterior decorations of the windows and doors are usually made, by the rich, of stone or brick, and by the poor, of wood, which latter have a bad effect on the appearance of the house, as wood will never unite well with pisé-work; and notwithstanding the greatest precautions, the exterior covering will break and fall off the wood; whereas stone or brick-work unite perfectly with the pisé, and retain their plaster, and of course the paint, of which it forms the ground. The chimney-pieces of brick or stone are laid and united with the walls in the same manner as in common buildings; and the flues are also very firmly connected with them, being made of brick-work. But a very particular advantage is, that the apartments may be very handsomely finished, without making any jambs to the inside doors, either of stone, brick, or wood. The finishing of the earthen walls will make jambs unnecessary; and it is not requisite to be at the expense of any other finishing, as the doors may be hung on the grounds or wainscot of the apartment."

Nature of, and manner of preparing the earth. It is observed that "beating, or compression, is used in many different sorts of work; the ancients employed it in making their rough walls; the Italians employ it for the terraces which cover their houses: the Moors for all their walls; the Spaniards, the French, and others, for some of the floors of their apartments. The intent of the ancient architects, when they recommended the beating of cement, and other compositions used in building, was to prevent them from shrinking and cracking; and it is employed for the same purpose in walls which are made of earth. The beater, by repeated strokes, forces out from the earth the superfluous water which is contained, and closely unites all the particles together, by which means the natural attraction of those particles is made powerfully to operate, as it is by other natural causes, in the formation of stones. Hence arises the increasing strength and astonishing durability which houses of this kind are found to possess." It is added that "upon beating a small portion of earth, and weighing it immediately afterwards, it was found to contain thirty-nine pounds and a half; fifteen days after it had lost four pounds and a quarter; in the space of another fifteen days it lost but one pound; and in fifteen days after that its weight diminished only half a pound. In the space of about forty-five days the moisture was completely evaporated, and its weight was diminished about one-eighth; consequently only one eighth of the whole mass was occupied by moisture, and this small proportion cannot at all affect the solidity and consistency of the earth so treated. This experiment is also sufficient to show the difference between this kind of building, and that vulgar kind, called in England "mud-walling;" the latter cannot be executed without adding a great deal of water, to soften the materials employed, which entirely destroys their consistency; the water, which occupies a considerable space in the mud, leaves, in evaporating, an infinite number of pores or little cavities, and thus the walls become weak and brittle, and incapable of supporting several stories, or such ponderous weights as the beaten earth or pisé can sustain."

With regard to the quantity or height of walling of this sort that may be done in one day, it is stated that "three courses of about three feet each may be laid one over the other in the course of a day; so that a wall of earth of about eight or nine feet, or one story high, may be raised in the same time. Experience has proved, that as soon as the builders have raised their walls to a proper height for flooring, the heaviest beams and rafters may without danger be placed on the walls thus newly made; and that the thickest timber of a roof may be laid on the gables of this sort the very instant they are completed."

On the proper sorts of earth for this use, it is stated that "1st. All earths in general are fit for such use, when they have not the lightness of poor lands, nor the stiffness of clay. 2dly. All earths fit for vegetation 3dly. Brick-earths; but these, if they are used alone, are apt to crack, owing to the quantity of moisture which they contain This, however, does not hinder persons who understand the business from using them to a good purpose. 4thly. Strong earths, with a mixture of small gravel, which for that reason cannot serve for making either bricks, tiles, or pottery. These gravelly earths are very useful; the best work of this sort is made of them. And from the following marks may be known what earths are fittest to be employed by themselves. When these have been described, it will remain to point out such as must be mixed with others, in order that they may acquire the necessary quality. And the following appearances indicate that the earth in which they are found is fit for building: when a pick-axe, spade, or plough, brings up large lumps of earth at a time; when arable lands lies in clods or lumps; when field-mice have made themselves subterraneous passages in the earth; all these are favourable signs. When the roads of a village, having been worn away by the water continually running through them, are lower than the other lands, and the sides of those roads support themselves almost upright, it is a sure mark that the work may be executed in that village. One may also discover the fitness of the soil, by try-

ing to break with one's fingers the little clods of earth in the roads, finding a difficulty in doing it; or by observing the ruts of the road, in which the cart-wheels make a sort of *pisé* by their pressure; whenever there are deep ruts on the road one may be sure of finding abundance of proper earth. And proper earth is found at the bottom of the slopes on low lands that are cultivated, because every year the rain brings down the fat or good earth. It is frequently found on the banks of the river; but above all, it is found at the foot of hills where vines are planted, and of all cultivated lands which have much slope. In digging trenches and cellars for building it generally happens that what comes out of them is fit for the purpose of this sort of building."

But "as it may sometimes happen that earth of a proper quality is not to be found on the spot where it is intended to build, it becomes of importance to attend to the method of mixing earths, for though the earth which is near at hand may not of itself be proper, it is very probable that it may be rendered so by the mixture of a small quantity of another earth fetched from a distance. The principle on which a mixture must be made is very simple; strong earths must be tempered with light; those in which clay predominates, with others that are composed more of chalk and sand; and those of a rich, glutinous substance, with others of a poor and barren nature. The degrees in which these qualities of the earth prevail must determine the proportions of the mixture; which it is impossible here to point out for every particular case, but which may be learnt by a little practice. And it will not be amiss to mix with the earth some small pebbles, gravel, rubbish of mortar, or in short any small mineral substances; but none of the animal or vegetable kind must be admitted. Such hard substanc s bind the earth firmly between them, and being pressed and pressing in all directions contribute very much to the solidity of the whole: so that well-worked earth, in which there is a mixture of gravel, becomes so hard at the end of two years, that a chisel must be used to break it, as if it was freestone, or other solid stone.

The following experiments are detailed in order to ascertain the qualities of any earth. "Experiment 1. Take a small wooden tub or pail, without a bottom, dig a hole in the ground of a court or garden, and at the bottom of that hole fix a piece of stone, flat and level; place your tub upon the stone, fill around it the earth that has been dug out to make the hole, and ram it well, that the tub may be enclosed, to prevent its bursting. Then ram into the tub the earth you mean to try; putting in, at each time, about the thickness of three or four finger's breadths; when this is well rammed, add as much more, and ram it in the same manner, and so the third and fourth, &c. till the earth is raised above the brim. This superfluous earth must be scraped off extremely smooth, and rendered as even as the under part will be, which lies on the stone. Loosen with a spade the earth around the tub, and you will then be able to take it out, and with it the compressed earth that it contains; then turn the tub upside down, and if it is wider at the top than at the bottom, as such vessels usually are, the pisé will easily come out; but if it should happen to stick, let it dry in the air about twenty-four hours, and you will then find that the earth is loose enough to fall out of itself. You must be careful to cover this lump of pisé with a little board; for though a shower of rain, falling in an oblique direction, will not injure it, yet it may be a little damaged if the rain falls perpendicular, and especially if it remains upon it. Leave the lump exposed to the air, only covered with a board or flat stone, and if it continues without cracking or crumbling, and increases daily in density and compactness as its natural moisture decreases, you may be sure that the earth is fit for building. But you must remember, that it is necessary that the earth employed should be taken from a little below the surface of the ground, in order that it may be neither too dry nor too wet: it must be observed also, that if the earth is not well pressed around the outside of the tub before it is filled, though the hoops were of iron, they would burst, so great is the pressure of the beaten earth against the mould, of whatever size it may be.

"Experiment 2d. This trial may be made in the house. Having brought from a field the earth you want to try, press it in a stone mortar, with a pestle of wood, brass, or iron (the latter is best), or with a hammer. fill the mortar above the edge, and then with a large knife, or some other instrument, take away the superabundance of earth even with the brim. If you then find that the earth will not quit the mortar, you must expose it to the sun, or near a fire; and when it is sufficiently dry, it may be taken out without d fficulty, by turning the mortar upside down on a flat stone or the floor. It will have the shape of the mortar, and if exposed as above directed, will show the quality of the earth.

"Experiment 3d. Press with the end of a stick or cane, your earth in a little box, round which you had better first tie a piece of packthread, lest it should burst in the operation; when you have filled it above its brim, cut off the overplus with a knife; you will undoubtedly be obliged to break the box to get it out, unless you had rather wait, and let it dry in the air, in the sun, or before a fire. It will take the exact form of the box, be it either round, square, or oval; if your earth be red, or any other colour, that which is enclosed in the box will still remain the same. It is not improper to remark, that the colour of the earth neither adds to, nor diminishes, the goodness of the pisé, therefore every proprietor may be at ease on that head. Besides every person in walking on his ground may make little balls of earth, and press them as tight as he can between his hands. If he brings them home and puts marks on them, he will by that means know the quality of every piece of land, and also be a judge of the mixture it will be necessary to make."

In preparing the earth "all the operations are very simple and easy; there is nothing to be done but to dig up the earth with a pick-axe, break the clods with a shovel, so as to divide it well, and then lay it in a heap: which is very necessary, because as the labourers throw it on that heap, the lumps of

earth and large stones roll to the bottom, where another man may break them or draw them away with a rake. He must observe, that there should be an interval of about an inch and a quarter between the teeth of the rake, that the stones and pebbles of the size of a walnut, or something more may escape, and that it may draw off only the largest. If the earth that has been dug has not the proper quality, which is seldom the case, and that it is necessary to fetch some better from a distance, then the mixture must be made in this manner: one man must throw one shovel full of the best sort, while the others throw five or six of the inferior sort on the heap, and so more or less according to the proportion which has been previously ascertained. No more earth should be prepared than the men can work in one day, or a little more, that they may not be in want; but, if rain is expected, you must have at hand either planks, mats, or old cloths to lay over the heap of earth, so that the rain may not wet it; and then as soon as the rain is over the men may resume their work, which, without this precaution, must be delayed; for it must be remembered, that the earth cannot be used when it is either too dry or too wet, and therefore if the rain should wet it after it has been prepared, the men will be obliged to wait till it has recovered its proper consistency; a delay which would be equally disadvantageous to them and their employer. When the earth has been soaked by rain, instead of suffering compression, it becomes mud in the mould; even though it be but a little too moist it cannot be worked: it swells under the blows of the rammer, and a stroke in one place makes it rise in another. When this is the case, it is better to stop the work, for the men find so much difficulty that it is not worth while to proceed. But there is not the same necessity of discontinuing the work when the earth is too dry, for it is easy to give it the necessary degree of moisture; in such a case it should be sprinkled with a watering pot, and afterwards well mixed up together; it will then be fit for use. It has already been observed, that no vegetable substances should be left in the earth; therefore in digging, as well as in laying the earth in a heap, great care must be taken to pick out every bit of root, great and small, all sprigs and herbs, all bits of hay and straw, chips or shavings of wood, and in general every thing that can rot, or suffer a change in the earth" after it has been prepared in this manner for use.

Kind of timber necessary in. In order "to make good walls it is not sufficient that the earths be well beaten, but they must be well united together. In houses of brick or stone, to consolidate their parts, they make use of angles and binders of freestone, and of iron braces, and cramp irons, which are very expensive; but here the binders cost very little; they consist only of thin pieces of wood, a few cramps and nails, and these are sufficient to give the greatest stability to buildings of pisé." It is added, that "the first course A, *fig.* 15, being laid on the front and inner walls of a house, then begin the second; and if for the inferior course the mould has been directed from A to E, it must, for this second, be directed from A to F, as has been explained above. But before this second course is begun lay at the bottom of the mould a board about five or six feet long, resting on the angle A, and extending lengthwise towards B. This board must be rough as the sawyers have left it, something less than an inch thick, and in breadth about eight, nine, or ten inches, so that there may remain on each side four or five inches of earth, if the wall is eighteen thick: by this means the board will be entirely concealed in the body of the wall. When thus placed, neither the air nor damp can reach it, and of course there is no danger of its rotting. This has been often proved by experience, as in taking down old houses of *pisé* such boards have always been found perfectly sound, and many that had not even lost the colour of new wood. It is easy to conceive how much this board, from the pressure of the work raised above it, will contribute to bind together the two lengths A and B, and to strengthen the angle A: but this is not all, it is useful (particularly when the earth is not of a very good quality) to put ends of planks into the *pisé* after it has been rammed about half the height of the mould. These ends of planks should be only ten or eleven inches long, to leave as before a few inches of earth on each side of the wall, if it is eighteen inches thick; they should be laid crosswise (as the plank before mentioned is laid lengthwise) over the whole course, at the distance of about two feet from one another, and will serve to equalize the pressure of the upper parts of the works on the lower course of the *pisé*, or rammed earth. But these boards need only be placed at the angles of the exterior wall, and in those parts where the courses of the partition walls join to those of the exterior wall; the same directions that have here been given for the second course, must be observed at each succeeding course, up to the roof. By these means it is seen an innumerable quantity of holders or bindings will be formed, which sometimes draw to the right, sometimes to the left of the angles, and which powerfully unite the front walls with those of the partitions; the several parts deriving mutual support from one another, and the whole being rendered compact and solid. Hence these houses, made of earth alone, are able to resist the violence of the highest winds, storms, and tempests. The height that is intended to be given to each story being known, boards of three or four feet in length should be placed before hand in the *pisé*, in those places where the beams are to be fixed, and as soon as the mould no longer occupies that place, the beams may be laid on, though the *pisé* be fresh made: little slips of wood, or boards, may be introduced under them, in order to fix them level. The beams thus fixed for each story, the *pisé* may be continued as high as the place on which you intend to erect the roof of the building.

Beside the use of this sort of material in the building of houses, it may be applied to the raising of walls for different sorts of inclosures, as "parks, gardens, yards, &c. in which the mould must be fixed in an angle, or against a building, if the wall is to reach so far, and the workmen must proceed from thence to the other extremity of the wall; and when they have finished the

first course, they must raise the mould to make the second, returning to the place where they began the first. But when a very great inclosure is to be made, as for instance, a park wall, then, for the sake of speed, it is necessary to set several moulds and men to work. In such a case, a mould should be placed at each end, and the number of men be doubled; they will work at the same time, and meet in the middle of the wall, where they will close the first course; after which, each set of men raise their mould to make the second; and both setting out from the middle continue working, in opposite directions, towards the ends where they first began."

In this way houses may be built, which are strong, healthy, and very cheap; and which will last a great length of time, as the "author says, he had pulled down some of them, which, from the title deeds in the possession of the proprietors, appeared to be 165 years old, though they had been ill kept in repair. The rich traders of Lyons have, he observes, no other way of building their country-houses. An outside covering of painting in fresco, which is attended with very little expense, conceals from the eye of the spectator the nature of the building, and is a handsome ornament to the house. That method of painting has more freshness and brilliancy than any other, because water does not impair the colours. No size, oil, or expense is required, manual labour is almost all it costs, either to the rich or poor. Any person may make his house look as splendid as he pleases for a few pence laid out in red or yellow ochre, or in other mineral colours." And he adds that, "strangers, who have sailed upon the Rhone probably never suspected that those beautiful houses which they saw rising on the hills around them, were built of nothing but earth; nay, many persons have dwelt for a considerable time in such houses, without ever being aware of their singular construction. Farmers in that country generally have them simply white-washed, but others, who have a greater taste for ornament, add pilasters, window-cases, pannels, and decorations of various kinds."

It is suggested that, "there is every reason for introducing this method into all parts of the kingdom; whether we consider the honour of the nation as concerned in the neatness of its villages, the great saving of wood which it will occasion, and the consequent security from fire, or the health of the inhabitants, to which it will greatly contribute, as such houses are never liable to the extremes of heat or cold. It is attended with many other circumstances that are advantageous to the state, as well as to individuals. It saves both time and labour in building, and the houses may be inhabited almost immediately after they are finished; for which latter purpose the holes made for the joists should not be closed up directly, for the air, if suffered to circulate through them, will dry the walls more speedily."

And the durability of this sort of building is fully shown by the statement of the Rev. Mr. Jaucour, who resided at Montbrison in France, where he says, "the church was the most remarkable in this style of building; it is about eighty feet long, forty feet broad, and fifty feet high; the walls built in *pisé*, eighteen inches thick, and *crépé*, or rough-cast on the outside with lime and sand. Soon after his arrival, the church, by some accident was destroyed by fire, and remained unroofed for about a twelvemonth, exposed to rains and frost. As it was suspected that the walls had sustained much damage, either by fire or the inclemency of the season, and might fall down, it was determined to throw them down partially, and leave only the lower parts standing; but even this was not done, he adds, without much difficulty, such was the firmness and hardness these walls had acquired, the church having stood above eighty years; and all the repairs required, were only to give it, on the outside, every twelve or fifteen years, a new coating of rough-cast."

It is further remarked, that "besides the advantages of strength and cheapness, this method of building possesses that of speed in the execution. It is found that a mason used to the work can with the help of his labourer, when the earth lies near, build in one day, six feet square of the *pisé*. If two men can build in one day six feet square, it is evident that six men, which is the necessary number to work the mould (viz. three in the mould, and three to dig and prepare the earth), will build in the course of sixteen days, or three weeks at most, such a house as at *fig.* 15. containing 228 square feet of wall: a very short time therefore is sufficient for a man to build himself a solid and lasting habitation. These facts, which have been proved by numberless instances, afford a proportion by which every one may determine the time that his house or wall will take in building, having first ascertained the number of feet it will contain. Thus, if he wishes to have a wall 540 feet long, and six feet high, it will be finished in one month, with one single mould, and six men; but if he doubles both mould and men, it will be done in fifteen days. These are simple but necessary instructions, for they will prevent the inconvenience to which many are exposed from having the completion of their building protracted beyond the time that they originally expected. All persons who wish to build, may now contract with the builder that the work shall be finished on such a day; or that he shall indemnify them for all the losses which they may incur from his failure to make good his engagement in that respect."

In regard to the "outside covering of plaster, which is proper for rammed earth or *pisé* walls, it is quite different from that which is made use of on any other walls: it is necessary too, to take a proper time for laying it on. When a house of this sort has been begun in February, and completed in April, the covering may be laid on in the autumn, that is to say, five or six months after it is finished; or if it is finished in the beginning of November (at which time the masons generally give over working) it may be laid on in the spring. In this interval the walls will be sufficiently dried; but it must not be imagined, that it is the drought or cold that extracts the moisture from an earthen wall; it is only the air, and particularly the north air, which is of itself sufficient

either in summer or winter, to dry a *pisé* or rammed earth wall thoroughly. If the plaster be laid over them before the dampness is entirely gone, it must be expected that the sweat of the walls will cast it off."

In order "to prepare the walls for plastering, they should be indented with the point of a hammer, or hatchet, without being afraid of spoiling the surface left by the mould; all those little dents must be made as close as possible to each other, and cut in, from top to bottom, so that every hole may have a little rest in the inferior part, which will serve to retain and support the plaster. And to do it the masons must make a small scaffold in the holes which the joists of the mould have left at *fig.* 2 and 3. This scaffold may be made in a few minutes; and when with the assistance of it they have indented the upper parts of the house, they must run a stiff brush over the indented surface, to remove all dust or loose earth. The walls when thus prepared, may receive the plastering; but it should be observed, that there are two kinds of plaster that may be used in the *pisé*; rough-cast, and stuccoing. Rough-cast consists of a small quantity of mortar, diluted with water in a tub, to which a trowel of pure lime is added, so as to make it about the thickness of cream. Stucco is nothing more than poor mortar, which the labourers make up in a clean place near the lime-pit, and carry it to the masons on the scaffold.

For the purpose of rough-casting one workman and his labourer are sufficient; the workman only sprinkles with a brush the wall he has indented, swept, and prepared; after that he dips another brush, made of bits of reed, box, &c. into the tub which contains the rough-cast, and throws with this brush the rough-cast against the wall; when he has covered, with as much equality as possible, so much of the wall as is within his reach, he lowers his scaffold, and stops up the holes of the joists with stones, or old plaster, &c. does as before, and continues lowering his scaffold in the same manner till he comes to the bottom of the house. This rough-cast, which is attended with so little trouble and expense, is notwithstanding the best cover that can be made for *pisé* or rammed-earth walls, and for all other constructions: it contributes to preserve the buildings, and though not beautiful, has the recommendation of being attainable by people in moderate circumstances. It is the peculiar advantage of these buildings that all the materials they require are cheap, and all the workmanship simple and easy to be performed."

In regard to the process of stuccoing "it is very different; two workmen and two labourers are requisite, the two workmen being on the scaffold, and one of the labourers making up the mortar, while the other carries it with water, and serves the workmen. One of the workmen holds in his right hand a trowel, and in the other a brush, with which he sprinkles the wall, having before hand indented and swept it; after that, he lays on a few trowels full of stucco, which he spreads as much as possible with the same trowel, and then he lays on more, and thus continues his work. The second workman has also in his left hand a brush, and in his right hand a small wood float; he sprinkles water over the mortar that his partner has spread, and rubs over that part he has wetted with his wood float. Thus the first workman lays on the plaster, and advances gradually, the second follows and polishes; one labourer makes up the stucco, the other carries it, and serves the workmen. By this progress the smoothest, finest, and cheapest plastering is made. And at the same time that the plaster is laid on, it may also be whitened by the use of lime alone, which is also an object of economy, since it saves white lead, &c. For this purpose dilute lime in a tub of very clear water, and let a labourer take some of it in a pot, and carry it to the workmen, who must lay it on with a brush; this, as well as all other colours, adheres to the plaster, and never falls, although it is used with water only, without size or oil. This is to be attributed to the precaution of laying on the colour whilst the plaster is still wet; as it grows dry, it incorporates mineral colours with its own substance, and makes them last as long as itself." This is on the principles of fresco colouring or painting.

It is added, that the "lime is of very general utility; it is used in building, in plastering, and in whitewashing; and it will appear that for painting also it may be employed with advantage. Those who intend to build, therefore, ought always to have a store of it by them, and it should be slaked a long time before it is used, to prevent crevices and blisters, which, without this precaution, will arise in the plaster, and give it so disagreeable an appearance that it will be necessary to do the work over again. The reason of it is this, there will always remain in the lime some particles that have not been slaked in the pit; all the stones are not entirely reduced to lime in the kiln, and those stones will resist the action of the water for a time, and will burst from the plaster after it has been laid, leaving the crevices above mentioned. This inconvenience will not happen if the lime, after being slaked, is left to stand some time before it is used. Indeed it will not be amiss to let it lie by a whole year, or longer, when it can be done with convenience."

It is observed on the painting in fresco of the outside covering, that, "that kind of painting which is known by this name, is the most beautiful and cheapest of any, and it is that which the author recommends for the decoration of *pisé* or rammed-earth buildings. The most celebrated painters were very partial to it, and Rome furnishes many excellent models, which should engage us to restore it from that neglect and disuse into which it has, without reason, been suffered to fall. And it is added that, whoever wishes to have his house painted in fresco, must have a painter ready, and place him on the scaffold with the workmen. The latter lay on the mortar, as before directed, and are attentive to spread it very even, to receive the paint. When they have finished one part, they suspend their work, to give the painter time to do his; for if they continued

working on, the painter, who cannot go on as fast as they, would find the mortar too dry, and the colours would not incorporate with it. It is absolutely necessary that the plasterer's work should be subordinate to that of the painter; it is sometimes so arranged, that the latter works while the former are gone to their meals; and when in his turn he retires from work, he traces out the part that the plasterers are to cover during his absence, foreseeing how much he shall be able to paint in the course of the day. All these precautions are taken to prevent the too speedy drying of the mortar, and to seize the proper time to lay on the colours while it is fresh."

In order "to make the colour meant to be given to a country house, dilute in a large tub a sufficient quantity of lime which has been slaked a long time; and also dilute in another tub or pot some ochre, either yellow, red, or any other mineral colour, but always in very clear water; after which, pour a little of the colour into the large tub, and stir it about with a stick, so as to mix it well with the lime; take some of the colour on a brush, and try it on a board or wall, if it is too deep or too light add fresh lime or colour from the tub, and by repeated trials bring it to the tint that is wished to be given the house. The colour being made for the body of the house, the frames of the doors and windows are next to be considered, and a new colour chosen, to distinguish them from the rest of the front. If the body of the house is painted yellow, or of a pale red, the angles and frames may be white or blue; if it is grey, they may be yellow or deep red," and in all cases it will be a very easy matter to find the most suitable colours.

It is added that "the plasterers are equal to painting the fronts of houses in a common way; but when builders or proprietors wish to have them decorated in a superior manner, they must call in a painter, whose business it is to do it." The writer asserts that "these paintings in *fresco* are more lively and more brilliant than any other; because the colours are not deadened by size and oil, which do not enter into their composition; their effect is surprising, and may be had at a little expense."

And, in concluding, it is remarked that "the plaster proper to serve as a ground for fresco painting or colouring, is made of one part lime and three parts clean, sharp, washed sand;" and that "this sort of painting has lately been executed with great success at Woburn Abbey, and some other places. It is not very usual, it is observed, to slake the lime in this country so long before it is wanted; but it is an excellent practice, especially if it be wood-burnt."

This method of building seems, from its cheapness, and durability, and the readiness with which it is executed, to deserve the attention of the proprietors of lands in this country, as the means of raising comfortable houses for their labourers and cottagers, which, from the increased prices of the usual sorts of building materials, are now become seriously expensive.

Different buildings of these earthy materials are represented in the annexed Plate.

RAMMER, a well known implement formed of wood in different ways, according to the purpose for which it is to be used. These implements are very necessary in putting posts into the ground, in order to close the earth firmly about them, as well as for laying down turf or sward, in order to render it smooth and even.

RANCID, a term applied to things which have contracted a strong offensive smell and taste by keeping, as bacon, butter, and all fat substances are apt to do.

RANGER, a term applied to a sworn officer of a forest or park, whose business it is to walk daily through his charge, to drive back the wild beasts out of the purlieus, or disforested places, into forested lands, and to present all trespasses done in his bailiwick, at the next court held for the forest.

RANGIFER, a term applied to a kind of stag, from his lofty horns, resembling the branches of trees.

RANK, a term provincially signifying any sort of crop of large growth, standing thick or close on the ground, as corn, pease, beans, &c. and even trees in woods.

RANNEL-BAUK, a word provincially used to signify the wooden bar or bauk laid across the cottage chimney, for hanging the pot-hooks on.

RANNY, a provincial word, applied to the small field-mouse.

RANULA, in *Farriery*, the name of a tumor seated under the tongue. It is formed in the salivary glands under the tongue, and is seated on either side the frænum, or bridle.

RAPE, the name of a plant much cultivated for its seed, and also as a green food for cattle and sheep. The methods of culture and management, that are necessary in raising crops of this sort, have been already described. See *Cole*. But it may be here necessary to detail a few of the experiments that were made under the direction of the Dublin Society, by Mr. Whyn Baker, about the years 1769 and 1770, as they tend to throw additional light on the nature of the plant, as well as its cultivation, though the soil was not the most suitable for it. It was, he says, "a shallow soil, of a strong adhesive nature when wet, and when perfectly dry, in lumps, almost impregnable; but between wet and dry reducible. It lies upon a bed of limestone quarry, and has a natural declivity to the north-west; naturally very poor, and, he believes, never received any manure until he dressed it. Three acres of this land was, he says, in 1768, under potatoes, in the ordinary method of the country, in seven feet beds, and four-feet trenches. In 1769 it was under drilled turnips."

"The frost, snow, hail, and rain, which they had this year in the months of March and April, rendered it impossible, he says, to get the ground in any tolerable condition for the rape seed before the 28th day of April. On that day twenty broad sets were sown, with twelve ounces of rape-seed to each set, or ridge. He intended to have sown it earlier, but the event will show, that, as it was, he sowed it too early, at least upon this ground.

"It was slow, he adds, in coming up, and made but

poor figure until July. After which it shot forward; but instead of affording a plentiful mowing crop for the purpose of foddering cattle, it soon began to run up very fast, broke out into branches, with few and small leaves, like rape in blossom from autumn sowing, but with strong branches and few leaves: and, in a short time after, began to grow hard, pipey, and the seed to form.

"In September he began to mow it for cattle, and they ate it with great eagerness, but every day it became worse, by growing harder; insomuch, that before it was exhausted there was very great waste, as to the object of fodder, but it wonderfully raised the dunghill, which in his mind is of the first moment to the farmer: for if he has manure in plenty, and disposes of it judiciously, there is hardly any thing he need to fear except climate.

"It was pretty far in October before all this rape was cut, (and the seed coming forward very fast) although it was brought home in great profusion. It was so strong that the mowing of it could not be accomplished with a common scythe; it would have broken an hundred; but he had by him a short, strong scythe, with a thick back, intended to mow bushes, and other rubbish: with this instrument he got it mowed, but not so close to the ground as he wished, it being next to impossible to mow such strong plants as these were close to the ground; and he became the less solicitous about it, as from the strength of the rape stumps and roots, and the weeds which were upon the ground, owing to the rape shooting up in tall stems, he gave up his intention of sowing the ground with wheat, as was originally intended. Hence, he concludes that the rape was sown much too early.

"On the 16th of July he transplanted some of this rape in rows upon ridges four feet wide; these plants flourished much better than the former, and were at least four times the size of any of those left in the ground where they were sown. Nevertheless, these also ran to seed; but the cold nights coming on prevented their forming their seed like the former. They were vastly more sappy, and much better food for cattle.

"On the 24th of July, he drilled rape-seed upon the same ground.

No. "1. Six ridges four feet wide, and thirty-two perches long, in single rows.

"2. Six ridges the same length and breadth, in double rows, ten inches asunder.

It is observed that, "the double and single rows were drilled alternately on the same ground, on the 18th day of July."

No. "3. Six ridges, four feet wide and thirty-two perches long, drilled in single rows.

"4. Six ridges, the same length and breadth, in double rows, ten inches asunder.

He remarks that "these were sown in alternate rows, on the same ground, on the 24th of July." And that "the several rows were thinned the latter end of August, and twice horse-hoed during the summer. On the third of April 1771 he had a row of each of these cut and weighed, and the produce was as follows:

	Weight. Ton	cwt.	qr.	lb.		*Prod. p. Plant. acre.* Ton	cwt.	qr.	lb.
"No. 1. Single row produced	1	2	1	11	Sown July 18th.	29	6	1	16
"2. Double row ditto	1	4	3	13		32	12	2	23
"3. Single row ditto	1	5	2	22	Sown July 24th.	33	14	1	26
"4. Double row ditto	1	6	3	25		34	18	0	6

It is stated that, "the last sowing in July afforded considerably greater produce than the first, for the plainest reason, that the earlier we sow this seed, the sooner it runs; and consequently affords the less produce for the purpose of foddering cattle in the yards for making dung, and seems to account very strongly for the state of the first experiment.

"The double rows produced uniformly more than the single rows; and indicate, he says, that the double are to be preferred in drilling rape for foddering cattle.

The following trials are on sowing *rape-seed broad-cast*.—"On the 24th of July two acres were sown broad-cast, with ten pounds of seed to each acre, in the same field where the other experiments were carried on: but the soil not so stiff by a good deal, has abundantly fewer loose stones in it, is very shallow, and poor, to an incapability of producing any thing to profit, without great assistance of manure.

"In July he manured it with the dung of his yard, consisting of that of horned cattle, horses, and swine. The dressing was indeed very high; about two smart one-horse cart loads to a perch. He having ever found, he says, that one acre, highly improved, is much more valuable than five imperfectly handled, was the reason why he gave this poor piece so liberal a dressing.

"The rape came up but slowly for a time, as he finds to be the nature of the plant, but at length it shot forward, and flourished away: but in winter, it met with a fate which he was not aware of, nor did he expect. The wood-pigeons lay upon it prodigiously, and did it great damage. Some plants he observed in the frost to appear as if they had been tinged: whether that was owing to the wounds given by the birds, and thereby giving the frost the greater force, or whether it was owing entirely to the severity of the frost, is not in his power to determine. However, very early in the spring this rape shot forward, and as the days lengthened the visits of the pigeons were less frequent, until they totally left it.

"From this rape breaking out into blossom sooner than he expected he is inclined to believe that the 24th of July is too early to sow it, for the purpose of foddering cattle in the yard.

"However, early in April he began to mow this

rape for the horned cattle, such as cows, plough bullocks, young cattle, calves, and swine. They all ate it with the greatest eagerness, and were foddered with it every evening, until the 19th of May inclusive, and wheat straw in a morning, save four calves of the preceding year; and they were foddered twice a day with rape, and had straw before them also, and throve upon it vastly better than the other cattle; for no other reason, he believes, than because they were allowed more than the others: in short they were in such order that he dares believe the butchers would have been glad to have had them for killing.

He observes that, "he need not tell the farmer how necessary it is to be frugal of provender, in an harsh dry spring, as the last was, when he was like to be hard run with forty head of cattle, many of which he should actually have been obliged to sell, at so improper a season, had he not been possessed of these two acres of rape."

He adds, that "there is yet another circumstance which renders this a truly valuable fodder. The milk of the cows increased prodigiously; and the milk and butter were as good, sweet, and well flavoured, he thinks, in every particular, as ever he tasted in June. Even the cream for the tea appeared to be perfectly free from any foreign flavour. The cows got hay every day, in the same manner as he has in former years mentioned them to have, when feeding upon cabbages.

"The simplicity of the culture for rape, for this purpose of feeding cattle, he cannot but think a particular recommendation of it to the farmer, and the cheapness of the seed in purchase, or the ease with which he may raise it, are objects which cannot fail, he thinks, of being persuasive to him. And all persons, who have annexed to their farms any bog, or other waste ground, the improvement of which can be executed by burning, might surely, he says, raise such quantities of rape for the purpose of mowing pasture, as would enable them to keep almost any number of cattle; by which they would not only be bringing in the waste land, but making that the foundation of improvement to their sound land, by the immense quantities of dung they might raise by this means from the waste land. Here the advantage to the cultivator would be double.

"On the first day of May he had four perches of this rape measured out for weighing. It was mowed, immediately drawn home, and weighed. The four perches afforded seven hundred and two quarters: multiplying this by forty, shows the acreable produce to be fifteen tons. The quantity indeed but small. However, the season in which it is to be had renders it more than ordinary valuable, and, he thinks, bids fair to make it an object of husbandry, as a pasture for cattle.

"This year, 1770, Mr. Baker ploughed up six acres of wheat stubble, as soon as the wheat came off, harrowed it down the 12th, 13th, 14th, and 15th of September, then sowed rape seed over the whole field, and gave it a light bush harrowing. The rape came up very thin, and made so poor an appearance in the spring, that he ploughed up the field, and sowed spring corn. This is a strong indication that but little is to be expected from sowing rape upon wheat stubble; because after the wheat comes off it seems to be too late in the year to sow rape. But something may be charged, as he observes, to the natural moisture of the soil. See *Cole*.

The following is the recapitulation of his experiments on rape, as pasture for cattle:"

Experiments:

			Produce; Ton.	cwt.	qr.	lb.
"Exp. I.	April sowing.	Ran, not answering the purpose.				
"II.	Ditto transplanted.	Ran, but not so soon as the other.				
"III.	July 18, sowing	Single rows produced per acre	29	6	1	16
		Double rows ditto	32	12	2	23
	"July 24,	Single rows ditto	33	14	1	26
		Double	34	18	0	9
"IV.	Ditto	Broad-cast ditto	15	0	0	0
"V.	September sowing on wheat stubble	ditto	0	0	0	0

Rape *Cake*, the refuse or cake remaining after the oil has been expressed from rape-seed. It is said to be useful as a manure.

Rape *Dust*, the small reduced parts of the dried refuse of rape-seed, after the oil has been obtained from it. This substance has been found useful as a *top-dressing* for crops of different kinds.

The rape-cake, when reduced into powder or dust by means of a machine, has been extensively used in Norfolk, and when for turnip crops, it has been the custom to sow it some weeks before the seed of that root is put into the ground. In the practice of Mr. Coke of that district, it has, however, been found, that by having it brought into a fine powder it may be drilled from the same machine, at the same time with the turnip seed; and that, by thus delivering the manure and the seed into the same pipes and shares of the drill machine, a ton of dust does six acres in the place of three. See *Turnips*.

Rape *Oil*, the oil obtained by means of expression from the seeds of this plant, in mills constructed for the purpose.

RAT, the name of a well known animal, very troublesome to farmers, &c.

It has been observed that this country was formerly infested with two kinds of rats, the *house*-rat and the

water rat; but that it is believed that the latter within this last half century has destroyed the former. This is probably however, only imaginary, since it is well known that the house rats are frequently brought, in great abundance, into the different seaports of the kingdom, in corn, and other vessels. It seems not improbable, but that these different varieties of rats may intercopulate, and by that means the latter become house rats, as there is considerable diversity in the colours of the house rats, some approaching to nearly black, which is the natural colour of the water rat, while the genuine house rat is always of a darkish or dapple brown. In their habits they have some circumstances in which they agree, as in that of making burrows in the ground; but the water rat is capable of living much in the water, and of feeding on fish and other aquatic animals, while the house rat mostly lives upon grain, and other produce of that kind. The water rats are also said, by Dr. Darwin, to eat the foliage as well as the seeds and fruits of vegetables, as he has seen a young rat of this kind devour a large leaf of the water-plantain *(alisma plantago)*. They likewise, as well as the house rats, are destructive of young animals, such as ducklings, goslings, chickens, and rabbits. But the great mischief which the water rats produce is in feeding on, and destroying the roots of a great variety of vegetables, in their innumerable burrows. The above writer remembers to have seen some new-planted apple trees taken out of the ground with nearly the whole of their smaller roots eaten, and the larger ones peeled by them. With the house kind, they are, likewise, extremely destructive of the food of poultry, and swine, and of course are highly detrimental near waters. It is remarked by the above able writer, that "as these animals, like the dog, are of a lascivious nature, and, as some materials have a strong scent, resembling perhaps, that of their venereal orgasm, they are liable to be attracted by such smells, as dogs are, on the same account, he supposes, inclined to roll themselves in putrid carrion; and male cats to eat *marum* valerian, and cat-mint. It is on this principle that rat-catchers avail themselves, and by indulging the propensity, deceive them to their destruction, by blending with their favourite foods different strong-scented substances, such as the essential oil of rhodium, or musk, with the poisonous powders of strychnos nux vomica, or of delpineum stavisagria or perhaps of arsenic."

The first step taken by rat-catchers, in order to clear a house, &c. of those vermin, is to allure them all together, to one proper place, before they attempt to destroy them, for there is such an instinctive caution in these animals, accompanied with a surprising sagacity in discovering any cause of danger, that if any of them be hurt, or pursued, in an unusual manner, the rest take the alarm, and become so shy and wary that they elude all the devices and stratagems of their pursuers for some time after. The place where the rats are to be assembled should be some closet, or small room, into which all the openings, but one or two, may be secured: and this place should be, as near as may be, in the middle of the house, or buildings. It is the practice, therefore, to attempt to bring them all together in some such place before any attempt be made to take them; and even then to avoid any violence, hurt, or fright to them, before the whole be in the power of the operator. In respect to the means used to allure them to one place they are various: one of those most easily and efficaciously practised is the trailing some piece of their most favourite food, which should be of the kind that has the strongest scent, such as toasted cheese, or broiled red-herring, from the holes or entrances to their accesses in every part of the house, or contiguous buildings, whence it is intended to allure them. At the extremities, and in different parts of the course of this trailed tract, small quantities of meal, or any other kind of their food, should be laid, to bring the greater number into the tracks, and to encourage them to pursue it to the centre place, where they are intended to be taken; at that place, where time admits of it, a more plentiful repast is laid for them, and the trailing repeated for two or three nights. But besides this trailing, and way-baiting, some of the most expert of the rat-catchers have a shorter, and, perhaps, more effectual method of bringing them together which is, the, calling them, by making such a kind of whistling noise as resembles their own call, and by this means, with the assistance of the way-baits, they call them out of their holes, and lead them to the repast prepared for them at the place designed for taking them. But this is much more difficult to be practised than the art of trailing; for the learning the exact notes, or cries, of any kind of beasts or birds, so as to deceive them, is a peculiar talent, not easily attained to in other cases.

In practising either of these methods great caution must be used by the operator to suppress and prevent the scent of his feet and body from being perceived; which is done by overpowering that scent by others of a stronger nature. In order to this the feet are to be covered with cloths rubbed over with assafœtida, or other strong smelling substances; and even oil of rhodium is sometimes used for this purpose, but sparingly, on account of its dearness, though it has a very alluring, as well as disguising effect. If this caution of avoiding the scent of the operator's feet, near the track, and in the place where the rats are proposed to be collected, be not properly observed, it will very much obstruct the success of the attempt to take them; for they are very shy of coming where the scent of human feet lies very fresh, and intimates, to their sagacious instinct, the presence of human creatures, whom they naturally dread. To the above-mentioned means of alluring by trailing, way-baiting, and calling, is added another of very material efficacy, which is the use of oil of rhodium, which, like the marum syriacum in the case of cats, has a very extraordinary fascinating power on these animals, This oil is extremely dear, and therefore very sparingly used. It is exhaled in a small quantity in the place, and at the entrance of it, where the rats are intended to be taken, particularly at the time when they are to be last brought together in order to their destruction; and it is used

also, by smearing it on the surface of some of the implements used in taking them, by the method before described, and the effect it has in taking off their caution and dread, by the delight they appear to have in it, is very extraordinary.

It is usual, likewise, for the operator to disguise his figure as well as scent, which is done by putting on a sort of gown or cloak, of one colour, that hides the natural form, and makes him appear like a post, or such inanimate thing; which habit must likewise be scented as above, to overpower the smell of his person: and besides this he is to avoid all motion, till he has secured his point of having all the rats in his power.

When the rats are thus enticed and collected, where time is afforded, and the whole in any house or outbuildings are intended to be cleared away, they are suffered to regale on what they most like, which is ready prepared for them, and then to go away quietly for two or three nights; by which means those which are not allured the first night are brought afterwards, either by their fellows, or the effects of the trailing, &c. and will not fail to come duly again, if they are not disturbed or molested. But many of the rat-catchers make shorter work, and content themselves with what can be brought together in one night or two; but this is never effectual, unless where the building is small and entire, and the rats but few in number.

The means of taking them when they are brought together, are various. Some entice them into a very large bag, the mouth of which is sufficiently capacious to cover nearly the whole floor of the place where they are collected; which is done by smearing some vessel, placed in the middle of the bag, with oil of rhodium, and laying in the bag baits of proper food. This bag, which before laid flat on the ground, with the mouth spread open, is to be suddenly closed when the rats are all in it. Others drive, or frighten them, by slight noises or motions, into a bag of a long form, the mouth of which, after all the rats are come in, is drawn up to the opening of the place by which they entered, all other ways of retreat being secured. Others, again, intoxicate or poison them, by mixing with the repast prepared for them the coculus indicus, or the nux vomica. A receipt for this purpose has appeared, which directs four ounces of the coculus indicus, with twelve ounces of oatmeal, and two ounces of treacle or honey, to be made up into a moist paste with strong beer; but if the nux vomica be used, a much less proportion will serve than is here given of the coculus. Any similar composition of these drugs, with that kind of food the rats are most fond of, and which has a strong flavour, to hide that of the drugs, will equally well answer he end. If, indeed, the coculus indicus be well powdered, and infused in strong beer for some time, at least, half the quantity here directed will serve as well as the quantity before mentioned. When the rats appear to be thoroughly intoxicated with the coculus, or sick with the nux vomica, they may be taken with the hand, and put into a bag or cage, the door of the place being first drawn to, lest those which have strength and sense remaining should escape. By these methods, when well conducted, a very considerable part of the rats in a farm, or other house, and the contiguous buildings, may be taken and destroyed. But various other methods have been practised.

In the Transactions of the Bath Agricultural Society the following compositions are advised for destroying these mischievous reptiles, and which are stated to have been attended with great success. "First, to a quart of oatmeal, add six drops of oil of rhodium, one grain of musk, and two or three of the nuts of nux vomica finely powdered; make them into pellets, and put them into the rat-holes. This, it is said, was at first greedily eaten, and did great execution; but the wise animals, after a time, ceased to eat it. Second, this consisted of three parts of oatmeal and one of stave's-acre, mixed well into a paste with honey. Pieces of this paste were laid in their holes, and again did great execution. Third, this is a method of destroying them by laying a large box down on its front side with the lid supported open by a string over a pulley; and by trailing toasted cheese and a red herring, from their holes to this box, and placing oatmeal and other food in it, which they are for a few nights to be permitted to eat unmolested; and finally to watch them by moonlight, the inside of the box being painted white; and, when many of them are seen, to let down the lid; by which contrivance sixty of them are stated to have been taken at one time.

But though the usual ways of destroying rats are by traps and poison, Mr. Forsyth advises never to use arsenic, or corrosive sublimate, for that purpose, except under particular circumstances, as they are deadly poisons: nux vomica will, he thinks, generally answer the end as well, without the danger. He suggests it as a very good plan to prevent accidents, to "enclose the traps in cases, having holes in the ends of them, large enough to admit rats, but small enough to exclude dogs, cats, &c.

And that, as a bait for rat-traps, the following composition may be made use of with advantage: "Take a pound of good flour, three ounces of treacle, and six drops of the oil of carraways: put them all in a dish, and rub them well together till they are properly mixed: then add a pound of crumb of bread. The traps baited with this mixture should, he says, be set as near their haunts as possible; but, for two or three days, so as not to fall or strike on the rats going in, but letting them have free liberty to go in and out at pleasure, as this makes them fearless. Some of the bait should also, he thinks, be laid at the rat-holes, and a little of it scattered quite up to the traps, and so on to the bridge of each trap, where a handful may be placed." It may also, he thinks, "be proper to scent the traps with the following mixture for the purpose of enticing the rats into them. "Take twenty drops of oil of rhodium, six or seven grains of musk, and half an ounce of oil of aniseed; put them in a small phial, and shake it well before using; then dip a bit of twisted paper or rag in the mixture, and rub each end of the trap with it, if a box trap, and put two or three drops on the bridge, leaving the paper or rag in the trap. Of

whatever kind the trap is, it should, he says, be scented; but once in a twelvemonth will be sufficient. Then throw some chaff mixed with a little wheat about the bottom of the trap, in order to deceive the rats; for they are very sagacious, and will not enter a suspicious place. This will be necessary to be done only at the first time of setting the traps; for, after some rats have been caught and have watered and dunged in them, rats will enter boldly when they find others have been there before them: do not therefore, wash or clean out the trap, as some people do before they set it again, but let the dung and urine remain in it. Keep the places where the traps are set as private as possible; and when they are set for catching, mix no bread with the bait, as the rats will, in that case be apt to carry it away."

It is, useful this writer thinks, "when the holes are found quiet, and that no rats use them, to stop them up with the following composition: Take a pint of common tar, half an ounce of pearl-ashes, an ounce of oil of vitriol, and a good handful of common salt, mix them all well together, in an old pan or pot. Take some pieces of paper, and lay some of the above mixture very thick on them; then stop the holes well up with them, and build up the mouth of the holes with brick or stone, and mortar; if this be properly done, rats will, he asserts, no more approach these, while either smell or taste remains in the composition."

With a view to destroy rats in places where traps cannot be set, it is recommended to "take a quart of the above bait, then to rasp into it three nuts of nux vomica, and add a quarter of a pound of crumb of bread, if there was none before; mix them all well together, and lay it into the mouth of their holes, and in different places where they frequent; but first give them of the bait without the nux vomica, for three or four succeeding nights; and when they find it agrees with them, they will eat that mixed with the nut with greediness."

As it is frequently found that "rats are very troublesome in sewers and drains, in such cases arsenic may be used with success in the following manner: "Take some dead rats, and having put some white arsenic, finely powdered, into an old pepper-box, shake a quantity of it on the foreparts of the dead rats, and put them down the holes, or avenues, by the sides of the sewers at which they come in; this puts a stop to the live ones coming any further; for when they perceive the arsenic, they will, he says, retire immediately; whereas, if they were put down without the arsenic, the live ones would eat them."

By means of arsenic is, notwithstanding the above observation, the most certain method of destroying these troublesome vermin, (provided they can be made to eat it,) which we have found does best, when it is prepared by being finely levigated, and mixed up with very strong old cheese and oatmeal.

It is stated in a note in the Agricultural Survey of Lancashire, that it is greatly to be lamented that Mr. Heathcote's method of destroying rats and mice is not generally known and practised; if it was, there would be a total extirpation of those obnoxious and destructive animals; for in one night he totally destroys them (where he is employed) be they ever so numerous, as can be well attested by hundreds in the neighbourhood of Ormskirk, who have employed him." And, it is added that, "the composition he makes use of he puts in their holes or burrows, and from the small quantity he uses, it is astonishing it should have such an effect: it will keep good two years." It is also stated that, "a farmer recommends, for the destruction of rats, one ounce of pounded quick lime to four ounces of tallow cake, to be beaten tōgether and made into balls, and placed in their runs, which has cleared many buildings. But it has been proved by experience, it is said, that an ounce of aerated barytes, finely powdered, mixed with the tallow, in place of lime, is more effectual."

It has been remarked by the author of Phytologia, with the view of destroying the water-rats, that "they possess some kind of ingenuity similar to the beaver in the construction of their houses near the brinks of rivers and pools; which have two apertures, one above ground amongst the grass, and the other beneath the surface of the water; and unless they can hide their upper opening amid weeds or grass, they forsake the situation. Thus, says he, if a rim, three or four feet in breadth, round a fish-pond be kept so low as to rise only two, or three, or four inches above the level of the water; and if this be kept clean from high grass or weeds, the rats will desert the pond."

After all, it is probable that this highly destructive animal, and great pest of the farmer, might be most readily exterminated by parishes uniting for the purpose, and raising certain sums of money to be applied in this way, under the direction of a proper person who is fully acquainted with the business. See *Vermin*.

RATH RIPE, a term applied to some early ripe corn crops, and which have a degree of redness in the straw.

RATTEN, a provincial word, used to signify a rat.

RAT-TAILS, in *Farriery*, a term applied to excrescences which creep from the pastern to the middle of the shank of the horse; and which bears the resemblance of a rat's tail. Some are moist; others dry: the former may be treated as in the cure of the grease; and the latter with the following mercurial ointment.

Take of Crude mercury, one ounce;
Venice turpentine, half an ounce:
Rub them together in a mortar, till the globules of the quicksilver are no longer visible; then add
Hogs-lard, two ounces. Mix them well together.

Where the hardness does not submit to this remedy, it is usually pared off with a knife, and dressed with turpentine, tar, and honey, to which verdigris, or white vitriol, are occasionally added. But before the use of the knife the following ointment has been advised to be tried.

Take of Black soap, four ounces;
Quick-lime, two ounces;
Vinegar, enough to make an ointment;
Mix them well.

It should be used frequently to the parts.

RATTLING, in *Farriery*, is a term used to a horse where a noise is produced by the air entering between the prepuce and the penis, in trotting or going fast.

RAUNPIKED, a provincial word used to signify stag-headed, as an old over-grown oak, having the stumps of the boughs standing out.

RAW, a term applied to wet cold lands unfit to receive the seed.

Raw *Cream*, such as is raised in the natural way, not *scalded* or *clouted*.

RAY-GRASS, an useful sort of early grass that has been much cultivated by the farmer in some districts. There are said to be different varieties of this grass, but that grown by Mr. Peacey of Devonshire has been found on experience much superior to the common sort. This grass has sometimes the title of rye-grass. See *Lolium Perenne*.

It has been remarked by the Rev. Mr. Duncan of Kilmarnock, in the fourth volume of Communications to the Board of Agriculture, that it has been found of late that there is an *annual* and *perennial* kind; that the latter should only be sown; but that the annual seed, he thinks, affords the greatest and most palatable crop of hay, and may be sown on those light soils which more readily tend to grass, at least a considerable proportion of it should be blended with the perennial seed. He adds, that the two kinds of seeds are readily distinguished by a careful observer, as the perennial is smaller, and fairer in colour, than the annual, and likewise much lighter. Good annual seed weighs from 21 to 24lbs. avoirdupois weight per bushel, but the perennial only from 16 to 18 lbs. As no distinction of these sorts was formerly made by farmers, he suggests it as probable that they have come to be known and distinguished, from the circumstance of no ray-grass disappearing wholly the first year, by which some persons have been tempted, from the high price of the seed, to allow what remained in the second year to advance to maturity, though to the great injury of the pasture. It is therefore from the seed of the second year's crop that he supposes the perennial grass has gradually originated; and its inferiority in point of substance seems, he thinks, to prove the supposition. By this means the farmer may, he says, by allotting a small portion of good land for the purpose, supply himself with what is said to be the perennial seed, without submitting to the imposition of an extravagant price, and may probably ensure or improve upon the durability of it, by collecting seed from the third or fourth year's growth.

It is found to be an excellent grass for pasture as well as hay. It has an early but not very abundant foliage. It is highly relished by cattle and sheep. From its being apt to run up into flowering stems it should be kept well fed down. From its secreting and depositing much saccharine matter in the joints of the stems, it affords a large proportion of nutritious matter for the support of animals, both in its green state and when made into hay. And it is said not to affect the wind of horses, which renders it particularly valuable for hunting and racing horses.

It has been objected to by some from the quantity of flower stems which it sends up; but this is asserted by others to be only the case when it grows in dry upland situations. It is found of course to vary much under different circumstances and situations.

The soils that are most suitable for it are those of the loamy and sandy kinds, but it is capable of being grown on those of the clayey sorts when not too stiff. On the two first sorts in mixture with other grasses, it frequently becomes permanent, and affords an useful spring food, especially for sheep stock.

As it is found to produce a thick well-connected sward in soils of the rich fertile kinds, it has been supposed only suited to them, though occasionally met with in those of the poorer descriptions.

It has been well remarked by Dr. Campbell, in the third volume of Communications to the Board of Agriculture, that "when land is in a proper state of manure, ray-grass united with white clover will form a perfect sward the latter end of the second year after it is sown. A particular field, of about five acres, that was sown with these two grasses only, was, he says, more perfectly grassed over, than others, which had the addition of trefoil and rib-grass, and which were sown at the same time. A neighbour of his, the only man in the country that had tried ray-grass, told him it would not answer, and referred him to a particular field where some had been sown. The fact was, the Doctor says, that he had cropped this field with oats, until it was no longer worth ploughing; and then, with his last seed, he sowed ray-grass, which certainly did not flourish. But his argument would, he thinks, have been equally conclusive against any grass or grain whatever. The ray-grass languished, and, finally died away, giving place to the vegetation suited to the state of the land. If it be expected that ray-grass, or any other good grass, should thrive and produce abundant crops on exhausted or poor land, it must not, he says, be in the soil which occurs here." And he adds the following useful remarks, "on converting ray-grass into hay it is necessary to cut it at a period previous to its being so ripe as to have perfected its seed, and changed to a yellow colour; for in this case a great part of the juices of the plant, which constitute a principal part of the nutriment it is to afford, will be converted into a species of straw, and its nutritive properties be proportionably diminished. When it is made into hay, persons not acquainted with its qualities are apt to object to its apparent coarseness, which proceeds from its consisting almost entirely of flowering-stems, the ray-grass having a comparatively smaller proportion of leaves than any other grass. Whether this be a defect or a merit, will, he thinks, depend upon a solution of this question: Do the stems and flowering parts of grass, or the leaves taken weight for weight, contain the greater proportion of nutriment? It does not appear, he says, that this has been determined

by experiments instituted for the purpose; but it seems probable, from the stems being so much sweeter than the leaves, (which is particularly perceptible upon chewing them when about half dry,) and from those vegetables which contain much saccharine matter being particularly nutritious, that the greater proportionate quantity of nutriment will be found to reside in the stalks; and if so, the advantages of ray-grass will be decisive. But, however this may be, it is certain that, supposing wet weather comes on during the process of hay-making, the first part of the grass that decays is the leaf, which soon becomes yellow, and then black, losing all pretensions to nutritive properties; in which case it is evident that almost the whole nutriment contained in the hay must reside, exclusively, in the flowering-stalks. Ray-grass then has, in unfavourable hay-seasons, an advantage, he thinks, over all others, inasmuch as from having fewer leaves it is not so apt to be injured by a continuance of rain: and it is besides, when in the cocks, more accessible to the air and wind from lying more open and light; and consequently not so apt to heat and mould as other grasses in similar situations and seasons." And he concludes that, "it certainly possesses the following valuable properties: 1. That there are few grasses so early in the spring. 2. That there are none better relished by cattle, or more nutritive. 3. That it has the power of resisting the effects of bad weather, in ticklish hay seasons, in a greater degree than other grasses. 4. That there is a greater facility in collecting its seed than of any other grass." It is supposed that the prejudices against it have proceeded, "1. From its having been sown in land not capable of producing a full crop of any good vegetable. 2. From allowing it to shoot up so far as to have formed the seed in the flowering-stalk, before cattle have been turned into pasture, or that it has been cut for hay. Ray-grass appears, he thinks, to partake more of the nature of grain than any other grass. Hence, when it has perfected its seeds, it shoots out no more stalks, and but few leaves that season, as lord Kaimes has justly observed. Hence it is necessary to turn cattle into a field of this grass early in the spring, and to keep it well under by a sufficient quantity of stock; in which case it will continue to put out fresh flowering stalks and leaves during the whole season. 3. The hay, for the reasons just assigned, should be cut before it becomes a mere straw. Common hay grass, being composed of grasses in various stages of growth and ripeness, admits of a greater laxitude than a field of ray-grass, because many of them will generally be in a proper state for cutting, although others may have passed their prime." He adds the following facts in support of its nutritious properties. "No hay, says he, could be better relished by my horses than this was; not a particle of it was wasted by them, or left in the rack; no animals could thrive, coat, or do their work better than they did, whilst they had this ray-grass hay to take to. Never was there a greater contrast than when they were put to the natural hay grass of the country after they had finished the other. They were literally starved into the eating of it; and in spite of an additional quantity of corn they fell away (agreeable to his farming man's mode of expression) a limb a-piece. This year nothing can look better than his horses do upon this hay, (with which some red clover is mixed,) and this, with the addition of very little corn, and that mostly light, the tailings of oats and barley."

These facts place the utility of this grass in a very striking point of view. And the following, given by Mr. Duncan, are of the same tendency, as he found in a comparative experiment of pieces of ground laid to pasture with it and meadow soft grass alone and in mixture, that the ray-grass portion was not only more early ready for the scythe by nearly three weeks, but the hay of it always more greedily eaten by the horses and cattle, as well as the pasture in succeeding years, on the ray-grass division, constantly eaten bare before the cattle stock would touch that of the soft grass. See *Grass*.

RAZE, in *Horsemanship*, is a term applied to the horse, which is said to have razed, when the corner teeth cease to be hollow. In fact, the cavity where the black mark was is filled up and becomes even, so that the mark wholly disappears. See *Age of Horses*.

REAPER, a person whose business it is to reap or cut grain.

REAPING *of Corn*, the practice of cutting it with the sickle, or otherwise, by persons employed for the purpose.

The business of reaping or cutting grain crops differs much in the manner of performing the work in different districts of the kingdom, and kinds of crops. In the more southern parts of the island the crops of this sort are mostly cut by means of short stiff scythes, made for the purpose, having bows formed of bent sticks, or what in some places are termed *cradles*, fixed upon the lower parts of the handles, for the more readily depositing the ears or heads of the corn in one uniform direction as much as possible, in order that it may be afterwards bound up into sheaves. But in other cases the naked scythe is made use of; the corn being seldom bound up, being simply raked together into small heaps, in a similar manner to hay.

In the more northern parts of England, and in Scotland the reaping of grain crops is, however, in general performed by the sickle or reaping hook, the different handfuls as soon as cut being deposited upon bands, formed by twisting together a few of the stalks of the corn at the ends next the ears, and afterwards bound up into sheaves, in order to their being set up into *shocks* or *hattocks*. This method is in most instances adopted with the wheat and rye crops, in every part of the island, as in cutting them with the scythe it is difficult to be performed without much loss being sustained by the shedding of the grain. And in addition, it is of great advantage to have these sorts of crops bound up regularly into sheaves, the straw being much better.

Besides these there is another mode sometimes practised, which is, by means of a hook with a sharp edge without any teeth, the labourer in executing the

work, hooking up the corn towards him. It is mostly made use of in the southern districts where it is known by the name of *bagging*, the grain in this way is cut very low.

In the reaping of grain crops, whether the sickle or scythe be employed for the purpose, there is much difference in the height at which the crops are cut in different places. In some it is the practice to have the business performed in as close a manner as possible; while in others a stubble of eight, ten, and fifteen inches or more is left. These different practices having their advocates, one party supposing that the work proceeds more slowly where it is executed in so close a manner, while the other contend that the contrary is the case. But as the stubble which is left is not only useless to the land, but in many cases very troublesome in its succeeding culture, being frequently under the necessity of being removed, it would seem to be the best as well as cheapest practice, to have the business constantly executed in a close manner. It has been observed by a late practical writer, that "by this means the agricultor will not only have more litter at command for the bedding of his yards, stalls, and other places, and consequently an increase of manure, but have the business more expeditiously performed, with much less waste of grain, and at the same time be freed from the trouble and expense of removing the stubble. It has, indeed, been fully shown, by a careful trial, made with the view of ascertaining the difference between high and low reaping, that the advantage is considerably in favour of the close method."

The result of the trial is thus stated by the writer of the Agricultural Survey of the West Riding of Yorkshire, who observes that the "experiment was made upon part of a field of wheat, two ridges of which were cut close by the ground, and the other two considerably higher, though not so high as the general run of the Yorkshire stubbles. Each of the divisions was apparently of equal quality, and measured a trifle more than a quarter of a Scotch acre, which is about one fifth larger than the English statute acre. The crop was stocked separately, and the time taken to the part cut low was 1 hour and 24 minutes, of 8 shearers, while the high cutting was performed by the same number of hands in 48 minutes. The wages paid that week were 18*d.* per day, and the supposed expense of maintenance 6*d.* or 2*s.* per day altogether. When threshed, the grain and straw were carefully measured and weighed, and the result of the experiment was as follows:

Result—8 shearers, 1 hour 24 minutes at 2*s.* per day, or 22½*d.* per hour	£.	s.	d.
	0	2	4
The same hands 48 minutes –	0	1	4
Difference of expense - - -	0	1	0

in favour of high cutting one shilling, or four shillings per acre.

	£.	s.	d.
1¼ pecks of wheat more upon the low cut ridges, than those cut high at 1*s.* 4*d.* per peck - -	0	1	8
14 stones (22 avoirdupois pounds) of more straw, at 2*d.* per stone -	0	2	4
	0	4	0

or sixteen shillings per Scotch acre.

From which deduct the increased expense of cutting, there remains a benefit of twelve shillings per acre in favour of low cutting."

It is added, that "the above trial, according to the best of the reporter's judgment, was fairly made, and the reason which urged him to make it was to silence the objections of some neighbours, who alleged low shearing was not profitable. It is proper to observe, he says, that the field of wheat on which the trial was made was not broke down nor straggled, so was in a favourable condition for high cutting. We have seen wheat fields where three times the quantity might have been left, unless great pains were used."

The methods of reaping grain crops, both with the sickle and the scythe have each their advantages and disadvantages. In the first manner, the crops are deposited with more regularity and exactness, and consequently bound into sheaves with greater facility and dispatch. Besides, in many cases less loss is incurred by shedding in the time the work is in performing; but the labour is executed with greater difficulty and trouble. The latter possesses the superiority of being more expeditious, and of being performed to any degree of closeness that may be required; while it has the evident disadvantage of leaving the cut grain in a more irregular and uneven situation, by which it is rendered less fit for being bound up into sheaves, which in many cases is an inconvenience of great consequence. When the grain has attained a high degree of ripeness, there may, likewise, be great loss sustained, by its being shed during the operation, in this way of reaping or cutting the crop. Where this method is practised, it is, however, not unfrequently the case to have it bound into sheaves, though the more common custom is to let it remain in the rows or swaths till fit for being put into the stack. When bound, it is generally the practice to cut it inwards against the crop on which it rests: In the other case, it is cut in the manner of grass for hay. It is obvious, therefore, that where labourers are procured with difficulty this mode of reaping is the most advisable, while under the contrary circumstances, the former may be had recourse to with more advantage, as the work may be executed in a neater and more exact way. See *Harvesting of Grain*, and *Sickle*.

This is a sort of work that is often let by the acre to persons that go about for harvest work, and it may, in many cases, be the best performed in this manner; but great attention should be paid by the farmer to see that the grain is cut and bound up in a proper method, and that the work be not performed in improper weather. The prices vary according to the nature of the crops, the season, and other circumstances, sometimes rising as high as eleven or twelve shillings the acre, or more.

REAPING *Hook*, an implement of the sickle kind with which the business of reaping is performed in some districts. See *Sickle*.

REAPING *Machine*, a contrivance for the purpose of reaping grain by means of animal labour. With this view, and to facilitate an operation of such importance to the farmer, different attempts have been made to construct machines, so as to dispatch the work in a rapid manner by the assistance of horse labour, but the success with which they have been attended, has hitherto been far from complete. An implement of this sort has lately been made by Mr. Plucknett; it is upon a somewhat new principle, the horse drawing the machine instead of pushing it forward, as was the old mode of applying the power.

In this machine, the horse tracks from the front side of it which is seen at *fig.* 1, in plate XXIII, so as to be clear of the crop—the large wheels by the axle drives the wheel *a*, which communicates with the wheels *b* and *c*, the latter of which is found in the axis of the cutter *d*,—a man at the handles regulates the direction, &c. And a reaping machine for clover is seen at *fig.* 2.

REAPS, small parcels of corn laid along on the stubble in reaping, to be afterwards gathered into sheaves by the binder.

REAR, in *Horsemanship*, the action of a horse when he rises upon his hinder legs, as if he would fall quite over.

REAVE, a provincial term, used to signify the unroofing or disturbing the thatch or other covering of a building by winds, &c.

RECKLING, a provincial word signifying the last of the farrow or brood.

RECKON, a term sometimes applied to pot-hooks of a certain make.

RECREMENT, a term signifying any superfluous matter deposited on or mixed with another: thus, the recrements of vegetables are useful as manures.

RED-CLOVER, an useful artificial grass. See *Clover*.

RED-GAME, the name of a bird, common in the mountainous parts of Yorkshire, and some other of the northern counties. It is of the shape of a partridge, but much larger, and of a mixed colour of red and black, and is feathered down to the ends of the toes.

RED-HAY, a term used to signify such as is mow burnt, in opposition to such as is green from a moderate heat, and *vinny* hay, or such as is mouldy.

RED-LAND, a term used by husbandmen to express a sandy soil of a reddish hue, interspersed for the most part with pieces of sand-stone of the same colour, or somewhat deeper.

There are several varieties of this soil, one of which is almost entirely made up of sand; another with an admixture of loam with the sand, the whole making a loose loamy earth, and a third full of fragments of a poor sandy iron ore, and often containing shining speculæ of selenite. See *Soil*.

RED-ROAN, a term signifying the red tinge in ripening barley.

RED-ROW, a provincial term applied to the grains of barley when in a ripening state, or streaked with red. The crop is then said to be in the red row.

RED-WATER, in *Farriery*, a disease in sheep. It has been supposed by farmers to be caused by taking too much watery food, such as turnips, clover, rape, eddish, &c. but it is not peculiar to sheep feeding on turnips or rape as has been believed by some. Its removal has been attempted by the use of common salt: and the frequent driving the animal about; and it is asserted that the disease may be wholly prevented by having recourse to the use of dry food, in the night time, while the sheep are feeding upon these juicy kinds of food. See *Sheep*.

RED-WORM, the name of an insect very destructive to young corn. The following description of this worm has been given by Mr. W. Baker, after observing, that he has often heard of the havoc which red-worms make in young wheat, barley, and oats; and in some few writers upon husbandry has read of them, but never saw them till May 1764; when to his great mortification, in a few days, they destroyed, almost totally, nine acres of his wheat, for he did not reap above half a barrel per acre: and that "the ingenious M. de Chateauvieux speaks of an insect, which is certainly of the same kind, if it be not the very insect which he has now under consideration; and in noticing the loss sustained in wheat crops, says, they "found in it many little white worms, which afterwards became of a chestnut colour. They post themselves between the blades, and eat the stems. They are usually found between the first joint and the roots; every stalk, which they attacked, grew no more, but became yellow, and withered." And, that "the same misfortune happened to them in the year 1732. The insects appeared about the middle of May, and made such havoc, that the crops were almost destroyed; that Stillingfleet, also, in the second edition of his Miscellaneous Tracts, speaks of an insect, which is probably the same as in Suffolk and in some parts of Norfolk, the farmers find it their interest to encourage the breed of rooks, as the only means to free their grounds from the grub, from which the tree or blind-beetle comes, and which in its grub state destroys the roots of corn and grass to such a degree, that he has seen a piece of pasture-land, where you might turn up the turf with your feet: that further, "Mr. Matthews, a very observing and excellent farmer, of Wargrove in Berkshire, told him that the rooks one year, whilst his men were hoeing a turnip field, sat down in a part of it, where they were not at work, and that the crop was very fine in that part, whereas in the other part there were no turnips that year; that, though M. de Chateauvieux describes this worm as being first white, and afterwards becoming of a chestnut colour, he has carefully sought them at different periods during the past year, but always found them of the same chestnut colour, never varying in any particular except that of size, which he finds to be the case at all seasons, in which he has seen them; that the insect spoken of by Stillingfleet, as a grub, which, he says, destroys corn and grass: induces him to believe that

it is the same insect (though the report which he relates from Mr. Matthews seems to contradict it) because he has observed that the red or chestnut worm, never appears voluntarily upon the surface; but when the earth is turned up, either with plough or spade, the rooks or crows are very bold in their approach to pick them up; a circumstance which he owns has in some degree abated his enmity to these birds: he therefore never destroys or frightens them off his land whilst he is ploughing it; but when he sows, when the corn rises, and when it is ripe, he destroys or banishes them as well as he can, because the mischief which they do at those times is intolerable; that he has observed his lucerne to decay in its tops soon after it has been up; and upon examining the roots he has found the red-worm which had eat them off; that in fact, this insect seems to be every where in Ireland called the red-worm, but by some of the English writers, who have spoken of an insect which destroys the corn in the manner already mentioned, which he thinks is undoubtedly the same, it is called a grub, by others the large maggot, and the rook-worm, because the rooks eat it.

"These worms are, says he, about half an inch long, and about one tenth of an inch in diameter; they are jointed in their skins, and are of a very firm texture: they have many short legs, two small black specks, which appear to be their eyes; and two small points springing from their heads, with which he believes they eat the corn, and which in that work, he apprehends, act like forceps: and all that he has seen of this species are of a bright chestnut colour. For this reason, he should conceive it would be more descriptive to call them the chestnut-worms. When they are exposed to the air, by turning up the earth which is infested with them, they will very soon cover themselves again in the soil, which they are very capable of doing by the strength which their make gives them, although they appear to be a sluggish insect, and have not the advantage of a sliminess upon their skins, which the common large creeping worm has, which enables that inoffensive worm to penetrate the earth, and get under timber and stones with ease. The red-worm, immediately endeavouring to cover itself from the air, is certainly, he thinks, from natural instinct, as it will soon die when exposed to the air; as will appear by the experiment, No. 10," mentioned below.

It is added, that "these worms destroy wheat, barley, oats, and lucern, while in an infant state, in the months of March, April and May. Late sown barley and oats they will destroy as late as June. He has not yet experienced that they destroy any other crops. The mischief done by them is in dry weather. Rain sufficient to penetrate the ground makes them desist from destroying the corn; and he supposes every thing else which they at any time injure. They eat wheat off just above the crown of the roots; barley and oats in the same place, and also higher up, upon any part of the stem which is below the surface of the earth." And these worms seem, he says, to abound more in ground which is lightly tilled, than in such as hath been well tilled; but, in lay ground they seem to be more numerous than any where else: and the fields upon his farm, in which he has found them, are wetter than other fields where they are not; whether that circumstance contributes to their increase, he cannot say; but the following experiments prove that they will live longer in water than they can when exposed to the open air.

Experiment, "Numb. 1. He put ten red-worms into a wine glass with common salt in it. They were all dead in four hours.

——— "Numb. 2. Into a glass with brine in it he put ten red-worms. They were all dead in six hours.

——— "Numb. 3. Into a glass with lime in it, which had been slaked for a long time, and exposed to the weather, he put the like number. They were all dead in forty-four hours.

——— "Numb. 4. Into a glass with the above lime, and some water in it, he put the like number. They were dead in twenty hours.

——— "Numb. 5. Into a glass with lime newly slaked, and when cold, he put the like number. They were dead in fourteen hours.

——— "Numb. 6. Into lime-water, made with cold water, he put the like number. They were dead in ten hours.

——— "Numb. 7. Into a glass with soot in it, he put the like number. They were dead in four hours.

——— "Numb. 8. Into soot and water, he put the like number. They were dead in four hours.

——— "Numb. 9. Into pure water, he put the like number. They were dead in fifty-two hours.

——— "Numb. 10. Into a glass, without any thing in it, he put the like number. They were dead in thirty-two hours."

It is stated that "by these experiments it is seen that all the articles used will kill this insect in a short time, particularly the salt and soot. He thought it necessary to consider different articles, the better to suit different parts of the kingdom.

"Where lime can be conveniently had, and that it is used as a manure, he is apt to believe, from the experiments, that no injury can be sustained from these worms; but he is afraid a small quantity will not effectually destroy them; besides, he should fear, if it were not put on before the sowing of the corn, that it might singe the blades of the corn; for, from these experiments, it appears that lime newly slaked, is more suddenly destructive to them than old lime, and therefore it is to be preferred.

"Where lime is used for no other purpose than to destroy this worm, he should conceive, that about eight barrels, regularly sown by hand on an acre of

ground, might be sufficient: it must be first slaked and cold before a man can possibly cast it upon the ground with his hand, lime being a very strong caustic; and even when it is cold the man should have a thick glove upon his hand.

"Where salt may be used to destroy this worm, it must always be sown upon the ground, before the intended crop; for, although corn will vegetate, and receive benefit from salt as a manure, when it is used antecedent to the sowing the corn, yet if it be added after the corn is growing it will certainly destroy it: therefore, it should never be used for this purpose, but before the corn is sown, or at least before it vegetates.

"He conceives that where salt is used for this purpose only, about four hundred and a half to an acre will answer the purpose, which is a trifle more than one ounce to every square yard."

It is seen, he says, "by the experiment, that soot kills this worm as soon as salt; and as in most places it is to be had at a much less price than salt, he thinks there can be no doubt about preferring of it; besides which, it may be safely used after the corn is up.

"He had some small parcels of barley under experiments, which these worms began to destroy; and in order to convey the soot as soon as possible to the roots of the plants, he mixed a little of it in water, and poured it on the plants with a garden watering-pot: the consequence was that he did not lose one plant afterwards.

"It will hardly be imagined, he says, that he means that the same method is to be pursued upon a whole farm: no; the method he would recommend to the practice of the farmer is this; to spread or cast by hand, as he sows his corn, about six or eight barrels of soot on an acre, and let him be careful to choose a calm day for the work, otherwise the wind will carry away great part of it: and as what remains cannot be regularly disposed, let him be careful to do it early enough in the spring, that the rain may wash in the soot and convey it to the roots of the plants before the worm begins the mischief; if he does this, he is persuaded his crop will be preserved."

It is seen, he says, "by the experiments, that this worm will live longer in water, by twenty hours, than when exposed to the open air; but at length, that is in fifty-two hours, they died in the water; perhaps this might be from the effect of drowning; but if so, he might have expected they would have been totally destroyed in his two fields in the winter of 1763 and 1764, by the immoderate rains which fell at that season for a long continuance, by which the land was often flooded. But they survived that winter, as appeared by the great loss he afterwards sustained by their destroying his wheat; and therefore, whether water be an enemy to them or not, it seems not easy to determine: but if these which died in the glass of water were really drowned, he thinks we may conclude that water is necessary to their existence in the earth, and probably aids them in getting their food from it: and what seems to confirm this notion is, that when the land is wet, they do not touch the corn, but as soon as ever the land is dry, they begin their mischief. However, this speculation he must submit to the consideration of persons more capable of discussing it than he is."

It is seen "by experiment, Numb. 10, that they cannot live in the open air, which seems to prove, that, were they abound in land, the oftener it is ploughed, particularly in the summer, when they cannot penetrate the ground so easily as when it is moist, they must be, by such ploughing, greatly diminished: besides which, the frequent ploughing gives the crows more opportunities of picking them up, in which, as he before said, they are very watchful.

"Frequent ploughing has been recommended by some writers as the only means of destroying this worm; and they have recommended the ploughs being stuck with nails, urging, that by those nails the worms are cut to pieces; others have recommended walnut leaves being soaked in water, to sprinkle the land: and steeping seed-corn in various liquors, as infallible remedies, but such methods as these are founded upon mistaken principles; they only mislead the farmer, and must disappoint him.

"Worlidge recommends a strong lye made of fixed salts, but that would be impracticable. Mortimer recommends sea-water for such lands as are near the sea coast, which he believes would answer very well. He says, he used soot once with success, but that it did not succeed with him afterwards. Mr. Baker is persuaded he did not use the soot early enough to have it washed into the ground by rain, or perhaps he used too small a quantity." He concludes by observing, that he would not be thought to arrogate any merit to himself, on account of what he has here offered on this subject, since it appears that other persons have used the articles which he has recommended, against this common enemy; but many persons have been disappointed in their expectations from these remedies, which must have arisen, he thinks, from their either having used too small a quantity, or not having observed the necessary precautions; if those which he has recommended shall be put in practice and found to answer, he shall think himself amply rewarded."

RED-WEED, a provincial term, signifying the round smooth-headed poppy, a pernicious weed in corn fields. See *Weeds*.

REEANGED, a term provincially used to signify listed or discoloured in stripes.

REED, the name of an aquatic plant, infesting boggy low lands or meadows on the sides of rivers.

The best method of destroying reeds, is by draining the land; for if the drains be cut deeper than their roots it will take away their nourishment, and, consequently, destroy them. Ashes, or soot, will likewise sometimes kill them; and so will ploughing up the land, and laying it in high ridges. They always indicate a deep good moist soil, as a bad one will not nourish or support them. There are many different sorts of reeds, but those of the more strong and tall kinds are often of much use in thatching the different sorts of farm buildings, where other better kinds of coverings are scarce, and these abundant. There is also a sort of reed found in Huntingdonshire, and some of the

adjoining counties, that is very valuable for the purpose of laying plaster floors with. In other situations, reeds of other kinds may be met with, that may be found useful for different purposes either of the farmer or in the arts. In such situations they may be cultivated with advantage as an article of profit.

Reed, a term applied to such straw of the wheat or rye kinds as has not been bruised.

Reed-Ronds, a provincial word signifying plots or beds of reed, or the swamps in which they grow.

REEK, a term provincially used. See *Stack* and *Rick*.

Reek-*Stavel*, a term applied to a frame of wood placed on stones, on which the mow or stack is raised. It is sometimes written *Reek Staffold*.

REINS, in *Horsemanship*, two long slips of leather on each side of a curb, or snaffle; by which the rider keeps his horse in subjection.

Reins, the long thongs or strips of leather, or other materials, by which horses or other animals are directed in carriages or teams. These reins are much used in some counties, as Norfolk and Suffolk, in directing the plough teams, in order to save the expense of another person, the ploughman directing them in this way.

Check-Reins, a term signifying the same thing, and which is made use of in particular districts.

Whip-Reins, a term used to signify a sort of hempen rein employed for directing the team in ploughing in some districts.

REIN-DEER, a particular species or variety of the deer kind. It is slender in its make, rather lower than the fallow, and without the stateliness of the red deer. Its palmated horns cover its brow. It is docile and easily domesticated. See *Deer*.

REMOLADE, in *Farriery*, a term applied to a sort of compounded honey charge for horses, recommended by old writers on farriery. It is formed in this way:—Take three pints of lees of wine, half a pound of hogs-grease, boil them together for half an hour till they be very well incorporated; then add honey, common pitch, Burgundy pitch pounded, and common turpentine, of each half a pound; stir them in the other over the fire, till they are all melted and well mixed; then add bole ammoniac, a quarter of a pound; take the vessel off the fire, and stir it continually for a quarter of an hour longer. If the charge is not thick enough it may be brought to a due consistence with a little wheat-flour; and if it be too thick it may be thinned with the lees of wine.

REMOVING *Obstructions to Tillage*. See *Tillage*, and *Clearing Land*.

RENDLING-*Curd*, a term used provincially to signify the broken curd in cheese making. See *Cheese*.

RENETTE in *Farriery*, the name of an instrument of polished steel, which with farriers discovers a prick in a horse's foot.

RENKY, a term provincially signifying tall or high, when applied to animals, &c.

RENNET, a term applied to the coagulum for making cheese. It is prepared from the bag maw, or stomach of the young calf, by a sort of salt pickle. It is of vast advantage in the art of cheese making to have good sweet rennet, the particular mode of managing which may be seen under the head cheese. See *Cheese*.

The following method of preparing rennet is practised in the northern parts of the island, and described as the most approved method in the Report on Agriculture for Argyllshire. "Take the maw skin of a calf which has fed entirely upon milk; after it is cold wash it gently in water, fill it nearly with salt, and place it on a layer of salt in the bottom of an earthen mug. One or two more with salt between and a good deal above them, may be put in the same mug, and kept in a cool place, with a slate on the top, for six or eight months, or till cheese making time next year. The skins are then taken out, and the brine allowed to drain from them; after which they are distended on small hoops or splinters put cross-wise within them till they dry. Put the skins then in an open vessel with three pints of pure spring water for each skin. Let them stand twenty-four hours; after which take them out, and infuse them other twenty-four hours in other water; but no more than a third of the former quantity. Mix these two infusions together, pass them through a fine linen sieve, and give them salt till the water is more than saturated and some remain undissolved at the bottom. When any is taken out the whole should be stirred, the scum from time to time taken off the top; and a little fresh salt added, when it is observed that there is none undissolved at the bottom. Rather less than a gill will serve for thirty-eight pounds of cheese." It is remarked, that "instead of two infusions, some use only one, giving four English pints to the skin, and direct the water to be first boiled, and mixed with salt into brine that will swim an egg, and then to let the heat go off till it is lukewarm, before the skin is put in for twenty-hours to steep."

It was formerly the practice to mix different kinds of aromatic herbs with the rennet, but the custom is much laid aside at present. The manner of doing it is this, "when the maw skin is well prepared, two quarts of soft pure water should be mixed with salt, in which should be put sweet-briar, rose-leaves, and flowers, cinnamon, mace, cloves, and in short almost every sort of spice and aromatic that can be procured: boil them gently till the liquor is reduced to three pints, taking care it be not smoked; strain it clear from the skins, and when milk warm, pour it into the maw: a lemon may then be sliced into it, and remain a day or two, after which it should be strained and put in a bottle well corked; and it will keep good for a year or more. A small quantity of it will turn the milk, and give the cheese a pleasing flavour."

REPELLENTS, in *Farriery*, such remedies as are supposed to drive away or discuss swellings.

RENT, the price paid for lands as farms by the tenants of proprietors. The rents of lands are so extremely various according to the nature of the soil, situation, markets, the state of the fences, buildings, and other conveniences, the ease of obtaining manures, and many other circumstances, as to be incapable of having any general specific prices affixed to them. They were formerly, especially in the northern parts of the island, paid in produce and personal services, but at present according to Mr. Donaldson, "over the greatest part of the island, they are paid in money, and at two periods or terms in the year. In England, Michaelmas and Lady-day are the customa-

ry terms of payment; the first payment commences six months after entry to the possession of the farm." But that in Scotland "the ordinary terms are Martinmas, and Whitsuntide, or Whitsuntide and Martinmas, the tenant being allowed twelve months credit of the first half of the rent, in the one case, and in the other, eighteen." And he observes that "this difference in the terms of the payment of rents is material in the purchase of landed property; being in general, nearly one year's purchase in favour of England."

He further remarks, that "it was the custom of former times, in various parts of Great Britain, for the tenants to pay what was called *forehand* rents, that is, paying the half, and in some cases, the whole year's rent immediately on entering to the farm, and before any benefit was derived from the possession of it. This practice is, however, now generally disused, although still kept up in some parts of Stafford and Perthshires." And we believe that it still prevails in some places in Ireland.

And it is added, that "letting lands for a term of years at the former rent, but making the farmer pay a considerable sum in ready money by way of fine, was also a very common custom; but is now chiefly confined to the crown and church lands in England. This mode was evidently, he says, attended with bad consequences. By draining the tenant of all, or greatest part of his ready money he was prevented from improving his farm. Leases of lands are considered in law as heritable property; therefore, in the event of the demise of the tenant, soon after having completed a transaction of this nature, his eldest son succeeded to the lease, and the widow and other children were of course, in many instances, reduced to poverty: all that was left to them being their proportion of the stock on this farm, and often thereby the heir was rendered incapable of keeping possession of the farm. In a word, in nine cases out of ten it was robbing the tenant of the well-earned reward of his industry, during the existence of the former lease, and depriving him of the means of turning out his new acquisition to the best account, without giving any solid advantage in return for it."

It is remarked also, that "along the greatest part of the east coast of Scotland, which is the principal corn country in the kingdom, a considerable proportion of the rent of almost every farm is paid in grain and oat-meal. These articles being less fluctuating in their value than money, this appears the most equitable mode in which the rents of corn farms can be paid. It may indeed affect the farmer's interest when any sudden and unexpected rise takes place in the price of grain; but if a judgment can be given from experience it will be found this very seldom happens. On the contrary for these last twenty years, with only two exceptions, he says, 1783 and 1795, the price of grain, owing to the operation of the corn-laws, has been extremely moderate, while every other production of a farm has been doubled in value, and in many cases tripled. The public are often essentially benefited by so great a proportion of the rents being paid in this way. Many of the proprietors have granaries erected on their estates, where in times of plenty they store the grain and meal which they receive from their tenants. And every person, who is in any degree acquainted with the agricultural exports and imports which take place between some districts in Scotland, and others, must, he thinks, know that the supplies afforded on many occasions from these store-houses have been the means of preventing scarcity, and an unreasonable advance in the price of these articles in the large manufacturing towns," and other populous places. In East Lothian, according to the Report of that district, it has been suggested by some proprietors, that one half of the rent should only be paid in money, the other in kind, and assigned as a reason that the profit or loss arising from any material, the rise or fall in the price of grain would, in that way, be equally divided between the landlord and tenant. This is a mode probably founded in equity and justice.

And it is further stated, by the first writer, that "in the most northern parts of Scotland, the rents are to a certain extent, paid in personal services. The tenants are bound to plough and harrow a certain portion of the landlord's farm, to reap, carry home, thresh, dress, and mill a certain quantity of the crop. They are also bound to pay poultry, eggs, butter, cheese, sheep, swine, linen yarn, fish, &c.; in a word, they are more the slaves of the landlords than their own masters."

This is a shameful feudal practice, which the proprietors of such lands should remove as soon as possible, as without it their interests must suffer greatly from the lands remaining without improvement. Besides it is a species of bondage highly disgraceful to civilized society. The able author of the Agricultural Report of the county of Argyll in Scotland thinks that "all services, whether paid to the master, or to any under him, should be entirely abolished: and all rents formed into one sum of money, including public burdens, such as minister's stipends, schoolmaster's salary, road money, &c. Thus, says, he the tenant would have always a clear view of the amount of his rent; and save time and trouble, and perhaps expense, by having to settle with one only instead of many. His time, says he, is precious, and should never be thrown away without necessity."

In regard to the "parliamentary and parochial taxes they may be said to be paid, the first writer says, by the tenants over the greatest part of both kingdoms; and many leases contain a clause, he observes, binding the tenants to pay, not only all the taxes that are imposed, but also all that may be imposed. But, he thinks, that it appears absurd that the proprietors, whose interest it is to attend to the increase or decrease of all such taxes as more immediately concern their property, should devolve the payment of those taxes on their tenants. They must know, that whoever pays them in the first instance, to them the lands are of less value, in consequence of such taxes having been imposed. They ought also, he thinks, to consider that their influence might be the means of keeping the most extravagant of them, such as the tithes and poors rates within more reasonable bounds, than it is to be expected the utmost exertions of the tenants can be able to effect." And that further, "proprietors could ascertain the

value of their property with more minute exactness, were they, on the one hand, to receive from their tenants the full rents which their lands are worth, and, on the other, pay all taxes to which they are subjected. The interest of agriculture, and the ease and comfort of the farmers, would at the same time, he thinks, be essentially promoted, were they relieved from these teasing exactions and compositions with which they are so frequently molested," particularly in this part of the kingdom.

And he suggests, in respect to the general price of renting lands, that when "it is considered how many circumstances operate in determining the rent of land, and how much these frequently vary in the same parish or lordship, it will be found impossible to form any correct idea in regard to the rents payable by the acre for the various kinds of soils over the whole island. Any conjecture that may be formed, (for the subject admits, he says, no more), must be vague" and incorrect.

It is supposed that the "remarkable change that has of late taken place in the situation of the kingdom, and the manners of the people, by the abolition of the feudal system, the increase of commerce, manufactures, and agricultural improvements, with the immense additional quantity of paper money introduced within these few years into circulation, have the effect of enhancing both the value and rent of lands. While these flourish, and paper money supports its nominal value, lands in property or lease must necessarily, he thinks, continue to advance." But that "should any cross accident interrupt the former, or depress the value affixed to the latter, the recent great advance in the rent of lands, in various parts of the island would, he says, render such calamities more universal in their effects," and of course of more serious consequence to the country.

But the ascertaining of the rents of lands in the different districts of the kingdom is a point of considerable importance both in a political and agricultural view, as by such means the produce of them may be better and more certainly calculated.

Mr. Smith, in his valuable Agricultural Survey of Argyleshire, states that "the quality of the soil is there extremely different; so that such valuations as have been lately made differ, sometimes on the same farm, from 2s. to 15s. the acre of arable ground. The pasture too, being partly green hill, but mostly heath, differs no less in its quality than the arable land. Some of it is valued below 4d. and some above 4s. the acre. In the neighbourhood of Campbelton, a few spots of arable land let from 2l. to 3l. the acre. But this price may be said to be put, not altogether upon the land, but partly upon the accommodation." But "what proportion the rent of a farm should bear to its produce, depends so much on soil, climate, situation, and other circumstances, that no general rule can, he thinks, be laid down on the subject. In regard to arable lands more particularly, it is a common, though perhaps not a just remark, that one third of the produce should go for rent, one third for expense and management, and one third for the farmer's profit, interest, &c."

And Mr. Middleton remarks that "the method practised by some gentlemen, of estimating the produce of land by trebling the rent, is very fallacious: three times the rent is not by any means equal to the value of the produce of the land under the best systems of husbandry now in use; though under the old exploded course of fallow, wheat, oats, in the scanty produce of common fields, and when taxes and the expenses of living were at one half of the present amount, it was not very distant from the truth. But under the more improved courses of husbandry on land at and under twenty shillings an acre, the produce is now, he thinks, more generally worth from five to seven times the rent."

In the north riding of Yorkshire, as stated in the report of that district, "the average rent of farms of pretty good soil is from 15 to 21 shillings per acre, in which there may be land rated at from 5 to 35 shillings per acre, so that the average value of a farm will vary according to its proportion of good and bad land. Some farms of the latter kind may be let as low as five shillings per acre, and some let cheaper at 30s.; so great is the inequality of the soil that nothing accurate on this head can be stated. Near large towns, land for convenience in small parcels, and in the aggregate to no great amount, is let at 3l. or 4l. per acre."

But in the western district of that county, as about Skipton and Settle, the lands were found to let as high as 40s. and 50s. the acre, while from the best information in the corn part of the county at the same time, 20s. and 30s. were considered as a high rent, and in many places it was still much lower.

In Shropshire the rents of lands, where the roads are bad, and the grounds little improved, are from 8s. to 12s. the statute acre, and in more favourable districts and situations from 15s. to 20s. the farm together. But near towns the price is much higher, as from 2l. to 6l. the acre.

And in Norfolk, according to Mr. Young, in the light sand district as marked in the Survey, the average price of letting is 6s. the acre; the various loams at 16s.: the better sands at 12s.; the rich loams 26s. and the marsh land clays 28s. In Suffolk the several soils are stated to be rented as below, the whole county included, sheep-walk, waste commons, &c. which are very large deductions from the rate of the cultivated lands:

	s.	d.
Strong, wet loam or per acre.	13	0
Rich loam	14	0
Sea district of sand	10	0
Western district of ditto	5	0
Fens	2	6

But in all the districts, with the exception of the Fen, there are tracts that are let at 20s. to 25s. and even higher, especially meadows.

It has been stated by Mr. Collingworth of Daventry, in the Fourth Volume of Communications to the Board of Agriculture, that in respect to the principle of increasing rents, where liberty is given to break up old grass or pasture lands that are under lease, that he has known within this five years past, a double

rent given for leave to plough up an old pasture for cropping for three years; and that consequently it appears to him that a statement of the expenses and profits upon arable and pasture lands should be severally made out, to ascertain by how much the balance of profit of the one exceeds that of the other. He therefore states them upon a probable calculation in the following manner:

Expences:

	1. Wheat.	2. Wheat.	3. Pease.	4. Wheat.	5. Beans.	6. Sp. Wheat.	7. Total.
	l. s. d.	*l. s. d.*	*l. s. d.*	*l. s. d.*	*l. s. d.*	*l. s. d.*	*l. s. d.*
Rent and Taxes	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	10 10 0
Seed	0 18 0	0 16 0	0 18 0	0 16 0	0 10 0	0 14 0	4 12 0
Ploughing	0 12 0	0 12 0	0 12 0	0 12 0	0 12 0	1 4 0	4 4 0
Harrowing	0 2 6	0 2 6	0 2 0	0 2 6	0 2 6	0 2 6	0 14 6
Manure and Carting	0 0 0	0 0 0	2 10 0	0 0 0	2 10 0	0 0 0	5 0 0
Frightening Birds	0 2 0	0 2 0	0 2 0	0 2 0	0 2 0	0 2 0	0 12 0
Weeding and Hoeing	0 1 6	0 1 6	0 1 6	0 1 6	0 3 6	0 1 6	0 11 0
Reaping and Mowing	0 6 0	0 10 6	0 6 0	0 10 6	0 6 0	0 10 6	2 9 6
Cocking and Raking	0 2 0	0 0 0	0 2 0	0 0 0	0 1 0	0 0 0	0 5 0
Carrying and Stacking	0 4 0	0 4 0	0 4 0	0 4 0	0 2 0	0 4 0	1 2 0
Thatching	0 1 0	0 1 0	0 1 0	0 1 0	0 1 0	0 1 0	0 6 0
Threshing and Winnowing	0 6 0	0 9 0	0 6 0	0 9 0	0 7 6	0 9 0	2 6 6
Carrying to Market	0 4 0	0 4 0	0 4 0	0 4 0	0 4 0	0 4 0	1 4 0
Contingencies	0 4 0	0 4 0	0 4 0	0 4 0	0 4 0	0 4 0	1 4 0
	4 18 0	5 1 6	7 7 6	5 1 6	7 0 6	5 11 6	35 0 6

Produce:

	£.	*s.*	*d.*
1. Pease, three quarters, at 48*s.*	7	4	0
2. Lammas wheat, three quarters and a half, at 52*s.*	9	2	0
3. Pease, three quarters, at 48*s.*	7	4	0
4. Lammas wheat, three quarters and a half, at 52*s.*	9	2	0
5. Beans and turnips; five quarters of beans, at 30s.; turnips, 30*s.*	9	0	0
6. Spring wheat, three quarters, at 48*s.*	7	4	0
Straw	5	4	0
	54	0	0

Tillage produce	*£.*54	0	0
Ditto expenses	35	0	6
	6)18	19	6

(=*£*3. 3*s.* 3*d.* profit per acre for the farmer.

Grazing Expenses:

	£.	*s.*	*d.*
Rent and Taxes per acre	1	15	0
Labour ditto	0	10	0
	2	5	0

Grazing Profit:

	£.	*s.*	*d.*
A bullock and a half to three acres, at 5*l.* per head	7	10	0
Three sheep upon ditto, at 25*s.* per head	3	15	0
	11	5	0

	£.	s.	d.
Grazing produce of three acres	11	5	0
Ditto expenses of ditto	6	15	0
3)4	10	0	
Profit per acre to the grazier	1	10	0
Then say grazing profit per acre	1	10	0
To which add for grass seeds	1	0	0
The additional rent to make up the sum as per contra, will be	0	13	3
£.	3	3	3

In this way the rent that can be afforded to be given may be ascertained with tolerable correctness, in many cases. See *Grass Land.*

The intelligent author of the Argyllshire Agricultural Survey, after remarking that there is very little arable land in that county, "but which is capable of higher cultivation; besides the great quantity of waste ground that may be improved in almost every farm, says, that the land is therefore capable of being made to yield a much higher rent when better cultivated; though not a great deal of it, as is generally thought, can bear much more, in the present stage of improvement, than what is laid on already, unless it be under a different management, which in sheep lands might be by the introduction of better woolled breeds, and in arable lands by adopting a better system of husbandry.

He thinks that the notion "that high rents are a spur to improvement and exertion, is a common, and, to a certain extent, a just maxim. No doubt there may be some, he says, who if they had the land for nothing, would be ruined by their indolence. But the more common case is, that, when a tenant sees that all his exertions will not do, he becomes dispirited and desperate, and allows himself to be carried along by the stream which he cannot stem. The land suffers, the tenant fails, the farm gets a bad name, and the rent must be lowered. Thus the landlord, as well as the tenant, he says, suffers, by raising the rent higher or faster than the improvement of the land will bear." But he adds, that "a substantial tenant is generally cautious of engaging to pay a rent that is exorbitant. He sees, he says, the success of those who invest their money in other branches of business; and he follows their example, if he has not the prospect of a farm's yielding him full interest for his money, and an adequate return for his diligence and labour. Whereas he who has least to lose is often the most forward to offer, and the landlord is often tempted to accept the offer, without considering that a capital is necessary for paying the rent, and improving the land. Instances of ruin to the tenant, and loss to the landlord, from too high rents, are not unfrequent, especially on some of the smaller estates. Most of the farmers toil hard, live poorly; and for one who has a trifle for his pains, perhaps two give their pains for nothing. Many who have old leases obtained before the late rise in land, and in its produce, took place, are very well; as are also many of those who have sheep stocks; as their possessions are managed with less expense, and the value of some of them was not well known till they were tried under the sheep system. But even bad bargains are become good by the late rise on every article of produce; and most of those who have leases are at present at their ease."

It is added, that "the occupiers of land, whether in pasturage or tillage, ought certainly to be able, like labourers or tradesmen, to live by their occupation, and to support their families by their daily care and labour. The interest of the money invested in their stock, with the proper allowance for tear, wear, and risk, they should be able to save as a provision for their families, and for old age; as the money so invested would give this return, if laid out on interest, without any trouble whatever. It cannot be considered as any part of the produce of the ground; and therefore no part of it ought, in equity, to enter into the payment of the rent: and yet not one in ten, perhaps, he says, is able to save it; nor do they commonly advert that so much ought to be saved in justice. They are generally satisfied if they can keep their stock undiminished; so that the business, in general, returns much less to those engaged in it than almost any other. A happy predilection in favour of the occupation in which they were brought up, is, he thinks, what induces so many to follow it. Perhaps it may be also said, that there is implanted in the human mind, for wise purposes, a certain innate disposition, or instinct, which leads it to delight in rural occupations."

These observations should be attended to by the proprietors of farms, as their advantages as well as that of their tenants may be greatly promoted by such means.

RESERVOIR, a sort of bason formed in the farm yard, or in some place contiguous to it, for the reception of the urine or other liquid matters discharged from the sheds or stables where cattle or other animals are kept. They are of great use in collecting and preserving such useful substances for the purpose of manure, and should of course be formed in all farmyards. See *Farm-yard.*

RESOLVENTS, in *Farriery*, such medicines as loosen and open obstructions.

RESP, in *Farriery*, a disease in sheep the same as red-water. See *Red Water.*

RESTORATIVES, in *Farriery*, are such remedies as are suited to restore lost strength.

RESTY, in *Farriery*, a term used, in respect of a horse, when he will neither go backwards nor forwards; but resists the powers of his rider. It is sometimes written *Restive*.

RETAIN, in *Horsemanship*, is what is called *holding in*. It is said of mares that conceive, and hold after covering.

REY-*grass*, a hardy early sort of grass, much esteemed among farmers. See *Lolium perenne*, and *Ray-grass*.

REZZLE, a term provincially signifying the weezle.

RHEUMATISM, in *Farriery*, is a local affection of some part of an animal, mostly about some joint. According to a late writer it is termed "a chronic local cold," the seat of which "is among the integuments of the muscles, and, according to Dr. Darwin, it consists of inspissated mucus left upon the fascia, occasioning pain when they move, and rub against it, like any extraneous material. It is probable, he thinks, that the sciatica, or hip-gout in horses, is merely a rheumatism, at least there is no danger in confounding them, since their cure will be the same. He adds that "the grand difficulty lies in ascertaining this disease, which sometimes wanders in different parts of the body. The shoulders are often affected; but that confirmed species particularly designed here, is usually seated in and about the hip-joint and membranes adjacent. The horse goes lame, from no visible causes, but from a long continuance of the disease a wasting of the parts may ensue. The sight and touch must determine the case, distinguishing it from lameness in the foot, the tendon, the hock or stifle, or from the pains occasioned by incipient spavins, or curbs.

It is advised for "the cure, to bleed and rub the parts affected twice a day with camphorated spirits and oil, or ox gall, mixed; keeping on, if possible, a thick woollen bandage soaked in the same. After a mercurial purge, antimonials are advised to be continued three weeks or longer, and the horse kept constantly well cloathed, with walking exercise twice a-day in good weather. The warm bath, with strong friction of the parts, and afterwards swimming the animal in a river occasionally, are also mentioned. But the only cure to be depended upon, "is a month's run at the salt marshes in the spring, and being continued abroad in some shady place till autumn; giving afterwards some mercurial physic, and the best stable care."

The following embrocation is recommended:

Take of Lard, two ounces;
Camphor, two drachms;
Oil of turpentine, six drachms;
Spirits of sal ammoniac, two drachms;
Mix them well, and keep in a jar or pot stopped close. Shave off the hair, lather the part with soap, and when dry, anoint it twice a day.

The following turpentine drink may be given:

Take of Venice turpentine, half an ounce;
Three yolks of eggs;
Treacle, three ounces. Mix.
Give this cold in half a pint of white wine, and repeat it every third day for three turns. Cover the horse with thick blankets, and give him moderate walking exercise. Also,

Take of Guiacum, powdered, half an ounce;
Cinnabar of antimony, one ounce;
Cordial ball, half a pound.
Work these up with syrup, and form them into balls.

Blistering the part will sometimes succeed, and æther, both externally and internally, may be proper.

RHUBARB, a plant of the thick fleshy tap-rooted perennial kind, that may in some cases be probably cultivated in the field with advantage. There are two sorts, the *common* and the *palmated* or true kind. In the first the root strikes to a great depth, and is thick and branching, having roundish smooth heart-shaped leaves, and an upright strong stem three feet in height; while in the latter, the root is thick and fleshy, and the leaves large and palmated, having the stem five, six, or more feet in height.

Besides the use of the roots as a drug, parts of the young stalks of the plants as well as of the leaves may be made use of, when cut, peeled, and prepared in the spring season, as an article of food.

It is usually raised by sowing the well ripened seed in the autumn or early spring seasons, as about September, or in February, on beds of rich, deep, well manured earth, either in the drill or broadcast manner, the plants being afterwards kept clean from weeds and properly thinned. But the autumn is said to be the better, as the plants are more strong for planting in the spring. When the plants have attained four or five inches in growth they should be planted out on hills made at the distance of four feet, by digging out the earth to the depth of three feet, and filling in with well-rotten manure, and the mould taken out so as to raise the plants a little above the natural surface of the land.

Some however direct that a deep rich well prepared soil, that is neither too moist nor too dry, should be chosen for this sort of culture, the seeds being sown upon it in the early autumn, so as to remain without transplanting, as by this means the plants suffer no check in their growth, and the roots become larger and more fair. The plants in both modes being constantly kept clean and free from all sorts of weeds, and in the latter they should be set out in the different hoeings to the distance of six or eight inches at first, and afterwards to two or three feet or more. When the leaves and stems decay in the autumn the ground should be well cleaned, and in the spring, on the plants protruding, be dug well, or hoed between them. In the third year the roots will in most cases, be in a state to be taken up for use.

Another method has been suggested of raising these plants as being more easy, secure, and expeditious, which is by planting the off-sets, eyes or buds, separated from the upper parts of the roots with a small portion of the old root, having some root fibres to them; these may be taken from the old roots of three or four years growth. In this way a year is saved, and the plants less exposed to danger

from slugs, as well as more certain in growing less tender, and the size of the roots equal. In Mr. Hayward's practice in this mode, "the off-sets were slipped from the heads of large plants in the spring, and set by means of a dibble at the distance of about a foot. And on further experience, when he took up his roots in the spring or autumn, he divided the head into many parts, which he planted directly, at two feet distance, where intended for further removal, but if to remain for a crop, at four feet and an half."

In the culture of this root, a gentle declivity is the best situation, it should not be too much shaded either on the south or west. But it is essential that there be a great depth and richness of soil, which is best when of the light loamy kind, and perfectly free from any stagnation of moisture. Where the situation is flat, the land is best raised into ridges or beds, with deep furrows or trenches between them.

When the seed stems are removed in the autumn the crowns of the plants should be well covered over with mould, so as to form a sort of hillock, as by this means the moisture will be more effectually kept from the plants.

Where the transplanting method is practised, it is advised that great care should be taken that the nursery beds are well watered, and protected from insects, as the stronger the plants are here, the better they succeed afterwards. In forming plantations, and filling up vacancies in them, the finest and most healthy plants are always to be made use of. Where the chief bud is destroyed they never answer well.

The injuries to which these young plants are exposed are the attacks of slugs and insects, and too much exposure to frost in their more early growth; but afterwards they are sufficiently hardy.

The roots are proper for being taken up about the third or fourth year, or as soon as the plants have flowered perfectly. And the autumn is the best season for the purpose, when the stems decay, when they should be well dried, cleaned, and cut into thin pieces, stringing them upon packthread, and hanging them up to dry in a gradual manner.

It is observed by the writer of the Perthshire Agricultural Report, that it is "surprising that the culture of rhubarb has not claimed more attention, and been adopted on a more extensive scale, as it is calculated to bring large profit.

RIB, the small arched bones forming the chests of animals. Cattle should be full in the rib.

Ribs *of a Horse*, in *Horsemanship*, are the slender arched bones that form the chest or barrel, and which should be circular and full, taking their compass from the back bone.

RIB-*grass* a sort of grass much cultivated in some districts, and which is said to afford an herbage of which cattle are very fond. It is also asserted to be useful as a grass for milch cows, and also for fattening any sort of stock.

It is an indigenous plant in this country, which frequently abounds in pasture or meadow lands where the soil is rather inclined to moisture. See *Plantago*.

In cultivating it as a grass for cattle, food under the modern system of this husbandry, from four to six pounds of seed are stated by Mr. Donaldson to be sown upon the acre. It is a coarse sort of grass however that requires to be kept well fed down in order to render it valuable and prevent its running to seed.

RIBBLING, a term used in some districts to signify a mode of ploughing similar to that of slob-furrowing.

RICE, the name of a plant cultivated in many parts of the east, in South Carolina, in America, and also in Spain, Italy, and Piedmont. It is a plant that grows to the height of about two feet and a half, with a stalk not unlike that of wheat, but fuller of joints, and with leaves resembling that of the leek. It branches out into several stems, at the top of which the grain grows in clusters, and each of them is terminated with an ear or beard, and enclosed in a yellow rough husk. When stripped of this they appear to be of an oval shape, of a shining white colour, and almost transparent. It is probably a plant that cannot be cultivated in this climate, as the experiments said to be made by Sir Joseph Banks, and detailed as below by a writer in the tenth volume of the Agricultural Magazine seem to show. It is stated that "the dry or mountain rice, which he received last year from the Board of Agriculture, for trial, had been procured at a considerable expense by Sir John Murray, from the neighbourhood of Serinagar, a city in India, situated at the foot of Mount Imaus, where snow lies till late in the spring; and where the climate has been supposed to resemble that of England sufficiently to make it probable that the vegetable productions of the one would equally succeed in the other country; he therefore considers it as a duty owing to the patriotic exertions of Sir John to give the Board some account of the result of the trial of it, made at Spring-Grove, near Hounslow, in Middlesex." He adds that "it was not till near the end of May, when the samples, being of six sorts, were delivered out by the Board, and they were sown immediately, on the 21st day of that month, on six small beds in a garden, under the shelter of a pale, in a south exposure." And "the grains were sown very thin in order that the progress of their vegetation might be better noted; in a very few days they appeared above ground. The season being warm, with a moderate supply of rain, it was seldom necessary to water them; however, when they appeared to flap, which generally happened after three or four dry days had taken place, they were well sprinkled with a watering pot." He says, that "in less than a month, they had grown several inches high; each sort had acquired an appearance very different from the rest; some were pale green, and had broader blades; some were deeper coloured, and narrower in the blade; and one sort had a brown hue on the whole plant; and the bases of the leaves in this kind were nearly black."

He further states, that "during the month of August, they tillowed much more than he has observed any other corn to do; so much so, that although they had been sown very thin, they became

a dense, compact bed of plants: the blades in some of the kinds standing as close or closer to each other than the thickest sown barley ever does. At the close of the month the blades were from a foot to eighteen inches high; the plants continued to tillow, each root having by this time produced from ten to twenty off-sets, but no symptom of a rising stem was at all observable. In the middle of September they had still continued to tillow, and the blades to lengthen, so that some of them were at least two feet long. As the frosts of the autumn were now nearly approaching, it became an object of some importance to examine the state in which the plants really were, in order to ascertain the probability of their having produced ears, or possibility of their having ripened corn, if they had been sown a month or two earlier. The most careful inspection was therefore made by dissection, but no traces could be found of the rudiment of a joint beginning to form itself on the crown of the root, or of the embryo of the glumes of the ear, which in all kinds of corn are first discernible in that part." He says "that about this period he was taken ill, and obliged to desist from observing their future progress; but a frost soon after followed, which cut the blade down to the earth, and at once destroyed all hopes of these kinds of rice producing grain in our climate; the quantity of the blade was however so uncommonly great, that it is not impossible, he thinks, it might be advantageous to sow it as food for cattle, for a very large proportion of stock might certainly be maintained upon an acre of it." He concludes by observing "that before the frost set in he had ordered a tuft of each kind of the rice to be transplanted into a pot, and placed in a hot-house, in order, if possible, to ascertain the natural period of this grain; whether, like winter corn, it requires eight or nine months to come to perfection, or, like our Lent corn, arrives at the same period in five or six; but all of these died, notwithstanding great attention was paid to them: some seed, however, which he had given to Mr. Lambert, succeeded, he says, better; it was sown in his hot-house in the month of June, where it throve well, but did not produce ears till near Christmas, a period of seven months, from whence it is probable the grain would have ripened in less than two months from the time the ear appeared. It is easy to deduce, says he, that in the neighbourhood of Serinagar these kinds of rice are either sown as winter corn, or the climate there is far better suited to promote the quick progress of vegetation than ours is. It was, when it produced ears, about three feet and a half high, and some of the stems had five joints, including the radical one: had it been in a more suitable climate it would certainly have grown taller, for the flowers dropped off without producing seed."

It is however cultivated much in the East, as in China, as well as in the southern parts of America; the method of which is thus described by Mr. Duhamel. He observes that;

"1. To hasten the sprouting of the rice it is put into baskets, and soaked for some days in a standing water. 2. When their rice grounds are so soaked with water as to be quite like mud, they are ploughed with a buffalo yoked to a plough very simple in its make, having but one share, one handle, and no wheels. 3. After a gentle rain, they break the clods with a kind of a large hurdle, drawn by a buffalo; the driver sitting upon it to increase the weight. 4. The ground is cleared of all stones, and whatever roots are in it are pulled up by a strong harrow with great iron teeth. This instrument is drawn by a buffalo, and a man guides it with the help of two handles, like those of a plough, upon which he leans hard. The earth is like mud, and partly covered with water during all this operation. 5. The earth is afterwards smoothed with a harrow, which has several rows of teeth. A man guides this harrow by its two handles, whilst a buffalo draws it; and as fast as its teeth form little channels in the ground, the water runs in, and fills them up. 6. When the rice that was laid to soak has sprouted, the seed is known to be good; and it is then sown by hand, very thick, and as equally as possible. Only part of the ground is sown in this manner, to furnish plants for the rest. The day after it has been sown the points of the plants appear above the surface of the water: for the ground is overflowed all this time with just enough water to cover it. And it is added, that when the plants have acquired a little strength, they are sprinkled with lime-water, to destroy the insects, and some of the weeds that would hurt them. For this purpose a small basket is fastened to the end of a long handle, and dipt in the lime-water, which runs through it, and is conveyed over the plants. And the Chinese have, he says, a great veneration for the first inventor of this method, which answers to our custom of steeping wheat in lime-water, or manuring land with quick-lime.

And that "8. towards April, when the plants are grown strong enough to cover the whole field, and look very green and even, the greatest part of them is pulled up by handfuls, all the mud is carefully washed off their roots, and, being held all this time as even as possible with one another, they are planted in tufts, pretty far asunder, and in a quincunx form, in fields prepared on purpose for them. A serene day is chosen for this operation, which must be performed as quick as possible. This practice of the Chinese is, he thinks, with respect to the common culture of rice, what the new husbandry is with respect to the common culture of wheat.

He says that "9. the rice must be watered, which is always done in China, by overflowing it. To this end, the rice-grounds are always near a rivulet, pond, or great pool of water, from which they are separated only by a bank or causeway. If the water was higher than the rice-ground, a trench cut through the causeway would overflow it at once: but as it is generally lower, or on a level with the rice-ground, the necessary quantity is conveyed in pails, or buckets, which are worked chiefly by the help of ropes.

That "10. though a man cannot step in these rice grounds without being up to his knees, the Chinese weed them three times in a summer; and that with

such care, that they pull up even the roots of every weed."

And that "11. when the rice is ripe, which is known by its turning yellow like wheat, it is cut down with a sickle, made into sheaves, and carried to a barn, where it is threshed with flails pretty much like ours: the straw is removed with pitch-forks and shovels, and the outer husk of the grain is taken off by beating it with great wooden pestles, or a kind of mallet, after which it is sifted and winnowed: and, lastly, to get off the under husk, the grain is put between two mill-stones, which are worked by a lever fastened to the upper one." But, says he, "the two most remarkable circumstances of this culture are, 1. the care which the Chinese take not to let their plants be too close together, lest they should rob one another of their food. 2. Their weeding their rice grounds three times in a summer, which answers the end of the hoeings recommended for the alleys between the beds of other grain, cultivated according to the Horse-hoeing Husbandry.

This plant is said to have been lately cultivated with success near Dumfries; by Mr. Charters, notwithstanding the want of success in the above trial, as well as by others in Cambridgeshire. And it is not improbable, but that by degrees it may be so naturalized to the climate, as has been the case with many other plants, as to be cultivated without much trouble or difficulty, and thus contribute to the advantage of the country as an article of the grain kind. Rice forms an excellent kind of bread when incorporated with flour, as well as a good food for the feeding of different sorts of animals.

RICE-*balking*, a provincial word, applied to a method of ploughing, in which, according to Mr. Marshall, the "flag" is always turned up toward the unploughed ground, the edge of the coulter passing close to the edge of the flag last turned: whereas, in *slob-furrowing*, the flag is turned toward the ploughed ground, the coulter passing fifteen or sixteen inches from the last ploughed furrow;—into which, in this case, the edge of the flag hangs;—and, in both cases, a slip of unploughed soil, of a width nearly to that of the flag, is buried."

RICK, a term applied to a pile of corn, hay, straw, &c. regularly heaped up in the open air, and sheltered from wet by thatch. See *Stack*

Rick-*Yard*, a term sometimes given to that part of the farm yard in which the stacks are placed.

RICKETS, a disease affecting sheep and also some sorts of vegetable crops.

RICKETY-GRAIN, a sort of vegetable disorder that often attacks wheat crops. It is, according to Dr. Anderson, "a kind of disease which is totally different from that of *smut* or *rust*. The grain affected with this disease assumes, he says, a small shrivelled appearance, and irregular form; its colour is somewhat darker than good wheat of the same kind, but is different from that which is affected with either of the two other diseases. Water, when poured upon wheat of this kind, soon, he observes, moistens it, and brings to life a number of eel-shaped animals in various stages of their growth, which had taken up their residence there while the grain was yet in its succulent state, and thus occasioned the disease which produced the alteration in its form. As the grain ripens and dries, these animalcules are arrested in their progress, their life totally suspended, and their destructive operations upon the corn of course obstructed so long as it remained in this dry state. But no sooner does this grain become soft, in consequence of being moistened with water (whether after being sown in the ground or otherwise), than these creatures are, he says, restored to life and activity; they soon begin to feed upon the grain while it is moist, and, if not interrupted in their progress by another desiccation, quickly lay their eggs (for they are oviparous) and go through the ordinary evolutions of nature. The young, when hatched in the corn that was sowed, after living upon it for some time, begin, he asserts, to eat their way up the growing stalk, and establish themselves at length in the grain itself while it is advancing towards maturity, where they are arrested in their progress in the manner above described when it is fully ripened."

In respect to the nature of the animalcule that produces these effects, it is remarked, that it "can be preserved alive in a quiescent dried state, for twenty-eight years at least, as has been shown by experiment after the lapse of which period it was found to revive as readily as if its vital functions had been thus suspended only for one day." It is further stated as worthy of remark, "that the eggs of this creature cannot be preserved for a length of time in a dry state, and still retain their prolificacy, neither can those among them which are very young, or those which have attained their full size, be revived after they have been dried up. It is only those individuals that are in the full vigor of life, and in a state soon to produce young, that are endowed with this singular faculty. In this case, the obvious intention of nature is to preserve the species, by keeping them in life until the grain shall be sown, and thus, to have a proper food provided for their progeny, however long that may be."

RIDDLE, a sort of sieve used to separate dust and the seeds of plants from corn. They are made of different sizes for different uses.

RIDE, a term sometimes applied to a cluster of shoots of hazel or other underwood shooting out of the same root.

RIDGE, a piece of ground laid up between two furrows, having always considerable length, but different small breadths according to circumstances.

It is stated by the author of the Present State of Agriculture in Great Britain, that "in many of the more fertile and populous districts, the ridges are found remarkably crooked, unequal in breadth and made to rise towards the middle, or crown, to the height of several feet, above the furrows, on either side. And he supposes that these are formed in the worst manner, to answer the purposes which are now intended by dividing a field into ridges."

But "this, he thinks, could not have escaped the

notice of all the farmers of former periods; but that on the contrary, from the practice being so general, it is more than probable that such form, though now considered absurd, was formerly supposed an improvement, as in the case of many other practices of antiquity; as in many of the hilly situations in Scotland, where the soils are dry, and in a tolerably level state, and where cultivation had without doubt taken place at a very early period, although at present abandoned to the growth of heath, the ridges are found as straight as those in the best cultivated districts in the kingdom. The reasons which induced the cultivators of these times, to construct the ridges in such forms, may, he thinks, be explained in this way; that as the lands were mostly cultivated in the open field or run ridge state, the furrows of the ridges were for the most part the mark or boundary between one farmer and another. The portion of land belonging to a tenant in any one place being on this account so small as to prevent him from employing any other mode of drainage, than that of raising the ridge to such a height as to permit the water to discharge itself by the furrows, without injuring the crop." It is stated that "all the ridges that are broader at one end than the other will generally be discovered to be the narrowest at that end which is still the most wet and spouty. It is of course conceived that this form was purposely given them, as the only means by which lands in such a state could be drained. And that as the most crooked ridges are found on the steep and sloping grounds, it may be supposed that that form and position was adopted by the first cultivators as the best for preventing the soil from being washed away by sudden falls of rain, which must no doubt have been the case to a greater extent had the ridges been straight. Each furrow, by becoming a sort of small rivulet, without any thing to impede its course must have done more mischief to the soil than if it had been gradually taken off by the circuitous course of the crooked ridges.

"From the change in the nature of the possessing lands, proprietors and tenants have now, except in a few open field districts, the means of draining and forming the ridges in the most effectual manner, these old forms of ridges, which can only be useful in such cases as the above, are not only rendered useless, but operate strongly against the full improvement of the soil."

But "notwithstanding this, there is, it is conceived, no sort of business in which the farmer can be engaged that demands more judgment and caution than that of levelling and altering the direction of such sorts of ridges."

But before the mode of managing this in the cheapest and most effectual manner is explained, it may be proper to show the most suitable forms and directions of ridges in different sort of soils, and under different circumstances of the grounds.

In forming ridges great attention is necessary to the nature and quality of the soil, and the particular situation of it, as the size, height, and direction, must in a great measure, be governed by them. It has been observed by a late practical writer that "where the land is of such a nature as to be highly retentive of moisture, or from the peculiarity of its position liable to become too wet for the growth of useful crops, the ridges should in general be made narrower, and have a more rounded or convex form than in the contrary case, or where it is exposed to injury from becoming too dry. But in the first case they ought not, however, to be raised so very high as is sometimes the practice, as by such means much inconvenience is often sustained from the crowns becoming too dry, and the grain ripening in a slow and partial manner. Besides, narrow ridges, with but a little elevation, are, in general, much more effectual in taking away the water that may be injurious."

It has been remarked by the intelligent writer of the Perthshire Agricultural Report, in respect to the height of ridges in lands of the more dry descriptions, that as "the furrows, in general, produce less crop than any other part of the ground, the fewer furrows the better, provided the land can bear it. If the field be dry there is not only more produce, by fewer furrows, but the ridges are cloven by every ploughing (a thing that cannot be done in raised ridges with deep furrows), which keeps them in an uniform level surface, and greatly facilitates the labour of spring and harvest. Persons, says he, who are not accustomed to investigate the cause of what they daily see, are deterred from making their ridges nearly flat by the water that stagnate, in the strips of grass and sprits that lie between the ridges, which they have raised greatly in the middle: never considering that they are working against nature, because the more the ridges are rounded the deeper are the furrows, till they become like ditches, and the more readily do clods fall down, so that they are, he says, with their own hands producing the very evil which they wish to prevent. Whereas, were these strips of flags and other trumpery torn up, were the furrows less deep, and kept perfectly clean and open, to allow a free passage to the water, the whole would flow to the open drain at the extremity of the field; and the higher the furrows are in respect to this drain, their relative height would make the water flow the faster. Care should always be taken, he says, that the clods that fall back into the furrows and dam the water in such land, should be removed with the spade. The slovenliness of men in this particular circumstance, more frequently, says he, produces the stagnation complained of, and all its baneful consequences, than either ridges moderately raised or any other cause. This he considers as perfectly satisfactory in respect to laying out such lands into ridges in the first instance.

But, that in cases in which "neither the circumstances of the soil, nor the nature of its situation, require that the ridges should be formed in a particular manner, or of any certain breadth, that of making them about eighteen feet may be the most suitable, as they are found to answer well in the way of keeping the ground properly dry, and of the most convenient

dimensions for turning the teams at the ends in ploughing." And, that besides "the seed, where this method is pursued, can be easily sown by one cast up and another down; an operation which in other circumstances, would be attended with considerably more labour." That, in "the covering of the seed by means of harrowing," the work "is also accomplished with more facility and dispatch, as by employing double implements of this kind, one turn may wholly finish the business." And that in "the reaping, too, they have advantages, in allowing the number of reapers that are necessary to work with convenience, and without being in the way of each other." This, though a great advantage in some cases, is of less consequence since the mowing of grain is become more general.

But it is stated that "in wet, clayey, or any stiff and tenacious loamy soils, where the under stratum is clay, should be ploughed as much as possible into ridges of much less size, in order that they may be kept in a state of dryness, suitable to the growth of the crops that are to be put upon them. Three or four feet, according to the degree of tenacity and wetness, may, in such sorts of land, be fully sufficient." And it is added that in "the counties of Essex and Hertford, on this sort of wet soils, three feet are found to answer the purpose in a very effectual manner." And that it has been observed in the Middlesex Report, on the authority of much experience, that their superiority over ridges of greater breadths, for taking the water off without washing the land, is incontrovertible. That, in short, as there is much variation in lands of these kinds, the width and flatness of the ridges should be increased as they recede from the nature of clay or clayey loam, and approach that of sand, in order that a larger proportion of moisture may be preserved: while, on the contrary, as they are becoming more of a clayey quality, they ought to be narrower, and to have a more high and rounded form, that the discharge of injurious moisture may be more expeditious. In loamy soils they should be either broad and flat, or narrow and round, in some measure, according to the degree in which they approach the sandy or clayey soils." And that "in very wet, clayey soils, where they rest upon a subsoil of some porous kind, great advantage in the way of drainage may often be obtained by sinking the furrows so deep as to reach it." But some persons on these sorts of clayey soils suppose the best breadth to be ten or twelve feet, as where they are narrower there is much disadvantage, though they keep the land drier. Also "in lands of the marshy or fenny kinds, as mostly approaching in some degree to the nature of these, the ridges should be made narrow, and rather round in their forms."

But that "as the principal defect of lands of the sandy kind is that of parting with their moisture too readily, and of course becoming quickly in a state of too much dryness for the purpose of healthy vegetation, it is the most advisable to plough them into very broad ridges, or even in some cases quite flat, without the least degree of furrow being made, as in this way the moisture may be more effectually retained in such soils, to the great advantage of the crops which are grown upon them." But in the constructing of "ridges on such soils as are of the boggy or mossy kinds, some attention is necessary in respect to their depth, and the proportion of wetness that may be present; as where they are thin, and have but little injurious moisture, they may be more broad and flat than where they are deep of moss and more retentive of moisture: six or seven yards may, in general, be the best." It is observed, that "even in the deeper sorts, long experience has shown that in the first instance it is improper to make them too high or too narrow:" as in the former case "they throw the water off from their sides, without admitting it to penetrate their substance, the top of course gets too dry;" while in the latter, there is a loss of surface from too many division furrows: the breadths already mentioned are found to be the best: and when the improvement is completed the ridges appear like segments of wide circles, with a clean well-defined division furrow between each of them. The moisture is thus caused slowly to filtrate through the moss, rendered friable by lime, until it reaches the division furrows, and is discharged." And that as "the moss subsides for some time, and closes in towards the furrows, it is generally necessary to clean these out before winter, and at the time the crop is sown, until the moss acquires solidity." This has been fully shown in a paper, in the second volume of Communications to the Board of Agriculture.

It has been remarked, that "ridges in these soils are generally formed by the spade, the workman beginning nearly in the middle of the part which is to form the ridge, only leaving the space of about eighteen or twenty inches, upon which the materials raised from the trenches on each side are deposited, so as to constitute the crown; and in this way of digging up and turning over narrow spits on each side: the workman proceeds till he comes to the division furrows, which are cut out and laid on the sides." In which way "the ridge when completed, appearing as if done by the plough." And in the deeper mossy soils, especially of the more spongy kind, it is probable the breadth of the ridges may be increased with advantage, after they have collapsed and become sufficiently firm, as by such means they will be more suitable for being laid down to grass or sward for the purpose of pasturage.

In what respects the general disposition of ridges, where there is not a necessity of giving them any particular direction, either for the purpose of drainage, or other circumstances, they should be formed as much as possible in the direction of north and south, as by that means much advantage may be gained in the crops attaining maturity, and in becoming dry from their having the more full influence of the sun and wind. And it has been remarked, by Mr. Marshall, in his Midland Economy, that the shocks, after grain has been reaped, should be set in the same direction, and not have an east and west position, as in this case the sheaves on the north side are many

days later in being in a proper condition for being conveyed to the stack, than those of the south. From further experience he is also convinced of the bad effects of ridges having an east and west direction; it having been found that corn on the south sides of such as were not by any means high, shot into ear, and changed and ripened a week at least earlier than that on the north; and that at the time of reaping, the wheat on the south sides was, in some patches, too ripe; while that on the north sides was in many parts absolutely in a green state.

Where ridges are to be constructed in such lands as are hilly in their situation, or have much declivity, it is necessary that they be neither made too steep, nor have too much of a horizontal direction given them, being drawn in such a manner as that they may have that sort of easy sloping direction, by which the water may be taken off in a gradual easy manner; as in this way there will not only be great advantage in the saving of labour in ploughing, nearly one third less power in the team being sufficient; but the injury and inconvenience of heavy rains washing down the soil and manure, will be in a great measure obviated. It has been stated by the able author of "The Gentleman Farmer, that in a hanging field that had been carefully dressed with lime and dung for turnips, and in which the turnips were fairly above the ground, a heavy summer shower swept down the crop, together with the lime, dung, and a portion of the loose soil, leaving the land naked and exposed." Therefore in the forming of ridges in lands that have such situations, it has been well observed, by the author of the Agricultural Report of Perthshire, that "when the fields hang so much as to be accounted steep, the ridges ought neither to be drawn parallel to the bottom of them, nor at right angles, straight up and down; either of which would be inconvenient in the ploughing, and injurious to the soil; but they ought to be drawn diagonally. The great point, he says, is to understand in what direction this diagonal slope of the ridges ought to run. In this respect the tenants of Bulgowan in his district are perfectly correct; and it is his wish that their example were followed by all farmers whose land has a great declivity, of which there is a considerable proportion, not only in that, but in all hilly countries whatever. The form and direction of the ridges are, he thinks, contrived with such judgment, that the furrow (or as Lord Kaimes with more accuracy calls it the furrow slice) falls easily away from the mould-board, as well in ascending as in descending the field, which is the principal secret. There can, he says, be no more than two diagonal lines in any four-sided figure, which is generally the form of inclosures; and if you bring a sensible ploughman to each of the angles below, desiring him to look towards each of the opposite angles above, he will at once tell you, which of these diagonal directions is easiest for himself and his horses, and will accordingly fix on that line by which the furrow *in ascending* will fall most readily into its place, having his right hand and the mould-board of his plough with a side-aspect to the bottom of the field." But, with the view of rendering this more obvious, "suppose, says he, the field to have a steep descent and a southern aspect, the ridges are drawn from south-west to north-east; which is the case in the instance alluded to. Suppose again, the field to have a northern aspect, the ridges are drawn in the same direction, but with this difference in ploughing, that you *ascend* south-west in the last case, whereas you *descend* south-west in the first. If the field fronts the east, you ascend north-west; if the field fronts the west, you descend north-west; or invariably four points forward from the slope of the field in going up the hill." Besides the vast saving in respect to the power or strength of team in this way, and that of the soil being less liable to be carried away by rains, by the running of the water in the furrows; where the ridges are made parallel to the bottom of the field all the dexterity of a man and force of cattle that could be applied, would, he says, be insufficient to turn every second furrow up against the hill.

It is remarked, that "the expedient universally employed, according to the old system, in ploughing fields of this kind, was, either to plough with a double mould-board or, if the mould-board were single, to plough only one furrow in going twice the length of the ridge; but most frequently the last. Both are, he thinks, bad husbandry. In the former method you lose none of your time indeed, but one half of your labour is lost by the latter. His principal objection, he is of opinion, holds equally against both. All the soil is year after year rolling downward, and in process of time the upper part of the field will be peeled to the bone, and quite bare of soil, while a great bank is accumulating at the bottom, like a dunghill, composed of the richest land in the field: and withal, the furrows are laid so completely on their back, that little benefit is derived from the manure, excepting it be laid on the surface the first year."

And the same writer further states, that "where a hill is to be dressed, in order to be laid down to grass, it ought to receive the last furrow by going round in a spiral line, without ever turning the plough, beginning at the base, and ending at the top.

"This requires less labour, he says, and is more beautiful. In preparing the ground for this last furrow, it may be ploughed diagonally, to keep the soil from tumbling down hill, as has been mentioned above, in respect to declivities: for this purpose the surface of the hill may be divided into three or more sections." And it is remarked by a late practical writer, in addition, that "in this way no more strength of team is required in ploughing such elevations than in that of ploughing on a level, while, where the soil is of the gravelly or sandy kind, the great inconvenience of the moisture going off too quickly is guarded against by its being detained in the furrows." And "the spiral furrow is, according to the first writer, the neatest method of finishing off a lawn, even of flat land, near a gentleman's house, as it brings the whole surface to an uniform appearance,

and pleases the eye more than having the lawn striped with furrows."

With regard to such lands as are level, or have but little inequality of surface, the best general practice, it is observed by the author of a late work, "is, to form the ridges as straight and as regular in respect to breadth as possible, as by having them crooked, and of irregular breadths, the water is not only liable to stagnate and injure the soil, but the friction in ploughing is greatly increased, and the furrow slice is not so well laid over, being more disposed to fall back. And besides, many unnecessary turnings are requisite, on account of the inequalities of breadth, by which much time is lost, as well as much trouble given to the ploughman" in managing the plough while at work.

Levelling and Straightening old Ridges. In such lands as have been long in a cultivated state, high, crooked, and irregular ridges are frequently met with, that often become necessary to be altered, so as to be rendered more straight and level. This, though apparently simple, is a matter of more difficulty and trouble, and which demands more knowledge and care in its execution, than is commonly supposed, by persons unacquainted with the business. Various obstacles have been thrown in the way of this sort of improvement by farmers in different districts. By some the expense is considered as very great, while others oppose it on the ground of the injury done to the land for some years afterwards.

And according to the Agricultural Report of the county of Perth in Scotland, "the objection made by some farmers in the Carse of Gowrie is this: in the action of levelling ridges, that have been, time immemorial, raised high in the crown, much soil is brought up, which for ages had neither seen the sun nor smelled the air. This, like most other soils, which has been so long and so deep buried, is very unproductive at first, and blasts all their expectations. It is perfectly consonant to the process of nature, the writer says, that this should, in some measure, happen; and, as far as it has any weight, is an argument not only against levelling, but against straightening the ridges of such land. But was not, he asks, every particle of that soil, which is so much reprobated, on the surface of the ground before the ridges were so raised by the hand of man? Was not this very soil, at that time, as good as any soil in the field? Nay, was it not much more fertile before it was buried in the middle of the ridge, than the *new* soil, which the ploughman was digging up year after year, out of the sterile furrow, to assist in gradually raising his ridge higher? Every man must, he says, answer in the affirmative. If you therefore bring back your land nearly to the level in which the hand of nature left it, you will find the very soil which was then on the surface; the soil, which had been fertilized by the deciduous parts of plants, from the creation, until it came into cultivation; the soil which Providence intended for the production of grain for the use of man, this soil has not surely lost its fertility, although that fertility has lain long dormant by its being covered up in the bowels of the earth and removed from the benign influence of heaven. The fertility of a soil cannot, he thinks, be exhausted by any other mean, but by overcropping. It may be suspended, as in this instance, but not annihilated. Restore the soil to its native place, and to that influence of which it was deprived, and it will soon become equally productive as at first. It is not pretended that its fertility will be exerted all at once. Clay is a stubborn soil. It is neither so easily stimulated by manure, nor by the benignity of the atmosphere, as other soil. It requires time and labour and expense to set it in motion; but when moved it retains its powers longer and makes very ample returns."

But in addition to these observations, vast benefits must in many cases result from bringing ill-formed ridges into a proper situation for the advantageous culture of crops upon them.

In respect to the time or season for the execution of this sort of work, it has been remarked that the "most suitable period for accomplishing it where the plough is employed is when the land is undergoing a course of repeated ploughings, as in the case of a fallow; as under such circumstances the more elevated parts of the field may be ploughed over as often, and in such directions, as is most suitable for bringing them into a level state. Where the ridges are not raised to any very considerable height in their middles, but badly formed in other respects, they may sometimes be readily brought into proper order by being split, or cloven down occasionally; a mode which is performed by beginning at the furrows and terminating at the crown or middle of the ridge, so that the former furrows become the crowns, and the new furrows are made in the middle of the old ridges, which being filled by a furrow from each side, has the tendency of soon bringing them into a more equal and level form." But that in cases "where the soil is of the light, gravelly, or open and mellow kind, the plough may be conveniently employed in levelling the ridges, without producing any injury of consequence to the crops that may afterwards be put upon the land. It is proper, however, even in lands of these kinds, to use much caution in performing the operation, in order to avoid the injury that might be caused by too large a proportion of the under-soil being brought to the surface in different parts of the ground," and in that way rendering it less productive in crops.

It is contended, however, by Dr. Anderson, in the first volume of his Essays, that where this sort of work is done by such implements as are contrived for expeditiously bringing high ridges to this situation, as ploughs, harrows, drags, &c. the farmer "of necessity buries all the good mould that was on the top of the ridges in the old furrows; by which he greatly impoverishes one part of his field, while he too much enriches another; insomuch, that it is a matter of great difficulty, for many years thereafter, to get the field brought to an equal degree of fertility in different places: which makes it impossible for him to get an equal crop over the whole of his field by any management whatever: and he has the mortification fre-

quently, by this means, to see the one half of his crop rotted by an over luxuriance, while other parts of it are weak and sickly, or one part ripe and ready for reaping, while the other is not properly filled; so that it were, on many occasions, better for him to have his whole field reduced at once to the same degree of poorness as the poorest of it, than have it in this state. An almost impracticable degree of attention in spreading the manures, may indeed in some measure, he thinks, get the better of this disease; but it is so difficult to perform this properly, that he has frequently seen fields that had been thus levelled, in which, after thirty years of continued culture and repeated dressings, the marks of the old ridges could be distinctly traced when the corn was growing, although the surface was so level that no traces of them could be perceived when the corn was off the ground. But this, he remarks, is a degree of perfection in levelling that cannot be usually attained by following this mode of practice, and therefore it is but seldom seen; for all that can be expected to be done by any levelling machine is to render the *surface* perfectly smooth and *even* in every part at the time that the operation is performed: but as in this case the old hollows are suddenly filled up with loose mould to a great depth, while the earth below the surface, upon the heights of the old ridges, remains firm and compact, the new-raised earth after a short time, subsides very much, while the other parts of the field do not sink at all; so that in a short time the old furrows come to be again below the level of the other parts of the field, and the water, of course, is suffered in some degree to stagnate upon them, insomuch that in a few years it becomes necessary once more to repeat the same levelling process, and thus renew the damage that the farmer sustains by this pernicious operation." He therefore thinks that "on these accounts, if the farmer has not a long lease, it will be found in general, to be more for his interest to leave the ridges as he found them, than to attempt to alter their direction: and if he attends with due caution to moderate the height of these old ridges he may reap very good crops, although, perhaps, at a somewhat greater expense of labour than he would have been put to upon the same field, if it had been reduced to a proper level surface, and divided into straight and parallel ridges." However, says he, where a man is secure of possessing his ground for any considerable length of time, the advantage that he will reap from having level and well laid out fields are so considerable, as to be worth purchasing if it should even be at a considerable expense. But the loss that is sustained at the beginning by this mechanical mode of levelling ridges, if they are of considerable height, is so very great, that it is perhaps, doubtful if any future advantage can ever fully compensate it. On these grounds he rejects the use of machinery in these operations, and recommends the method described below as being more efficacious and successful.

There have however, of late been many valuable machines contrived for the purpose of accomplishing the work in an easy and cheap manner, and which have been found to answer in practice. An implement of this sort has been described under the head Machine. See *Land Levelling Machine.*

In lands of the clayey, loamy, or tenacious wet quality, there is much greater difficulty, as well as greater attention required, in levelling down and changing the forms of the ridges, as it frequently happens that in such soils, after the earth from the crowns has been removed in order to render them level, a coarse, unfriendly, stiff soil, is brought up, as has been seen above, that requires a great length of time and much amelioration to bring into a state capable of supporting good crops of any sort of grain. In these cases and sorts of soils, in the straightening and bringing down the ridges on the coarse lands in the northern parts of the island, the author of the Perth Report advises it as "proper to begin the operation by removing the made or ameliorated soil on the crown of the ridge, to one side, which may, he thinks, be done by two or three ploughings in one direction, turning the furrow always one way. This is easier than doing it with the spade. Then such a quantity of the buried soil may be cast with the spade from the crown of the ridge as will fill up the furrows at pleasure; and, lastly, the ameliorated soil may be spread over the surface of the whole. If it is not thought enough to save the ameliorated soil on the crown of the ridge alone, first one side, he says, of the ridge may be taken, and then the same process repeated on the other; by which means almost all the wrought soil may be kept on the surface. A good summer fallow, a hearty dose of lime, and the mixture of wrought mould, will reanimate the new soil, and restore its vegetative power to its primitive state; and a very few seasons will naturalize the whole soil, while the farmer has the advantage of straight ridges, moderately raised." Some, however, think that this business may be the best performed by the spade, though it is now obviously impossible in many situations from the vastly increased expense of labour. Where this mode is to be employed, it is advised by Dr. Anderson, in his Essays on Agriculture and Rural Affairs, to "let a number of men be collected, with spades, according to the extent of work, and then set a plough to draw a furrow directly across the ridges of the whole field intended to be levelled. Divide this furrow into as many parts as labourers, allotting to each a ridge or two, more or less, according to the number and height of the ridges, and other circumstances. Let each of the labourers have orders, as soon as the plough has passed that part assigned him, to begin to dig in the bottom of the furrow that the plough has *just* made, about the middle of the side of the old ridge, keeping his face towards the old furrow, working backward till he comes to the middle of the old ridge, going deeper as he advances, suitable to the height he has to bring down; then let him turn towards the other furrow, and repeat the same on the other side of the ridge, so as to leave the bottom of the trench he has thus made across the ridge, entirely level, or as nearly so as possible. When he has finished that part of the furrow allotted to him, which the plough has made in going, let him then go

and finish in the same manner his own portion of the furrow which the plough makes in returning.

"In this manner each man performs his own task through the whole field, gradually raising the old furrows as the old heights are depressed."

The old furrows ought, he says, to be raised to a greater height than the middle of the old ridges, so as to make allowance for the subsiding of that loose earth. And the operation, is thus finished at once. He recommends the making of these temporary or cross ridges 40 or 50 yards broad at least: "for although some time will be lost in turning at the ends of the broad ridges, the advantage that is reaped by having few open furrows is more than sufficient to counterbalance this loss: and in order to moderate the height that would be formed in the middle of each of these great ridges, it will always be proper to mark out the ridges, and draw the *furrow* that is to be the middle of each, some days before you collect your labourers to level the field, to prevent any hurry or loss of labour in the future operation of levelling. The field will thus be reduced at once to a proper level, and the rich earth that formed the surface of the old ridges will still be kept on the surface of the field to be formed into new ridges." And the same writer adds, that "the direction of the ridges, as noticed before, ought to be north and south, if the field will permit, by which means the east and west sides of the ridges, dividing the sun equally between them, will ripen at the same time." Also further, that "when the soil is so wet as to require the raising of the ridges, they ought to be made 12 feet wide and 20 inches high, and to be preserved always in the same form, by *casting*, that is, by ploughing two ridges together, beginning at the furrow that separates them, and ploughing round and round till the two ridges be finished. The separating furrow is indeed raised a little higher than the furrows that bound the two ridges, but at the next ploughing that inequality is corrected by reversing the operation, which is easily done."

In regard to the expense in the different methods, the following statements are given by the same writer, which, though far below the present price of labour, may furnish the means of calculation to the improver. "Supposing, says he, the price of labour in Scotland to vary in different places from sixpence to one shilling, and that the medium price be fixed at nine pence a day; and that the hire of a plough, with four horses and two servants (for so many, in general, will be requisite to labour properly ground in the condition that this is supposed to be in), varies in like manner from three to five shillings per yoking, and that the medium price of this be called four shillings; in this case, the comparative expense of levelling, by these two different modes, would, he says, be as follows:

Expense of levelling by spade.

	£.	s.	d.
For wages to eleven labourers one day, at nine pence each - -	0	8	3
For the hire of a plough $2\frac{1}{2}$ yokings, at four shillings each - -	0	10	0
Total expense of one day's work,	0	18	3

Expense of levelling by plough and harrows.

	£.	s.	d.
For 2 yokings and a half of a plough, as before - - - - -	0	1	0
For harrowing ditto, supposed at 1-4th of the ploughing - -	0	2	6
Total for once ploughing, &c. -	0	12	6
The same five times more repeated,	3	2	6
Total expense of levelling by plough and harrows - - -	3	15	0
Total expense of levelling by the spade - - - - - -	0	18	3
Difference	2	16	9

Another method practised by Mr. Paterson of Castlehuntley is, according to Dr. Robertson, "first to open up with the spade a trench of about 10 feet broad, from end to end of the field, in the same direction the ridges are to be made. The upper surface of this 10 feet trench is laid upon one side, to be removed afterwards. Then the under soil of this trench is levelled and dressed by spade and wheelbarrow, or carts, if necessary, at the same time giving the land a gentle fall at both ends, to enable the water to run off in the furrows towards the main drains. When this under soil has got its proper shape, he marks off another 10 feet trench, and with the spade throws the upper soil of the second trench on the new formed under soil of the first trench, so as to cover it completely and equally: and so on through the whole field. The upper soil of the first trench was carried round in carts and laid on the under soil of the last trench. The appearance of the field was then regular, rising in the middle and falling at both ends. He recommends ridges 18 feet wide. The whole expense is supposed to be £.8 an acre."

It is observed in the third volume of the Farmer's Magazine, that "ridges in enclosed lands are capable of being straightened with profit, or at least without loss, by wearing down the high ridges by the preceding crops, so as not to leave too much to the fallow, which is by turning one field at least into turnip or fallow every year until the whole is gone over. For as the land is ploughed and harrowed over and over in all directions, until it is brought to a close fine mould, the ridges may then be laid off just as the farmer pleases without any loss." But that "in straightening without this previous operation the loss cannot be calculated. The advantages are therefore obvious to every man."

And a writer in the fifth volume of the same work observes, that in wet clayey soils, where the operation is undoubtedly most difficult to execute, he has accomplished the business with facility in this way. On dry soils, very little judgment or skill is required to do it with safety to the ground and advantage to the occupier. He states, that "in 1794 he fallowed and straighted a field of about thirty acres, which had been oats the preceding year. The soil was a wet clay, and the ridges were very unequal in breadth, from ten to

thirty feet, intermixed with *butts* or *gussets*, which are always detrimental to such lands, as they occasion the ploughs, &c. to turn often upon the other ridges, by which means the prints or marks of the horses' feet are left unfilled up. The first operation consisted in cleaving down the ridges. The field was then ploughed across, and thoroughly harrowed; but before the broad ridges could be brought to a level several ploughings were necessary, which were accordingly given. The season, however, was far advanced before these necessary operations could be effected; and, as lime could not at this time be applied with advantage, he was under the necessity of laying it up in heaps in an adjacent grass field, so as it might be expeditiously laid on whenever the field was straighted. The next consideration was, to form the ridges in such a manner as to prevent water from stagnating upon the ground. With this view, he run them partly east and west, and partly north and south, as the level would admit. When the ridges were thus formed and gathered up, the lime was applied, and a good cross-harrowing given, in order to fill up the furrows." And it "being now the latter end of October, and the weather very wet, he thought it advantageous, in giving the seed-furrow, to yoke the horses in line, and not abreast, as is the usual practice. The whole field was sown on 6th and 7th of November, and the braird appeared about the beginning of December. The weather having been wet for some days after the wheat was sown, it appeared rather thin in March, but always retained a dark green colour. It improved much during the summer months; and at harvest, turned out as good a crop as ever he saw upon such poor wet soil, the produce per acre being from 32 to 34 Winchester bushels of good marketable grain. Next year he ploughed the field again, and sowed one half with oats, and the other half with peas, both which were as good crops as could be expected. Perhaps it may be thought that he should have sown grass seeds among the wheat; but it is his opinion, that when ridges have been altered, a second fallowing is necessary before the field can be profitably laid down in grass. Last year he straighted a field in the above-mentioned way, which has answered his expectations to the full. It was sown with grass seeds, which at present promise well."

He concludes by observing, that "the advantages resulting from the practice of straighting ridges are obviously many and great. More work is performed both by plough and harrows, and to better purpose, in a given space of time. Much seed too is saved; for when the ridges are at or below eighteen feet in breadth, which they ought never to exceed, two casts will suffice: whereas, in their former state, three or even four casts will be necessary in some parts, and in others one will be too much. Straighting ridges, and making them all of one size, also, he says, greatly furthers harvest work, as it is well known, that shearing is more expeditiously performed upon them, than upon those that are unequal with one another, or such as are broad at one end and narrow at the other. The last, though not the least advantage, which he shall notice at present, is that wheat is not so apt to canker upon straight as upon crooked ridges. He will not now inquire how this comes to be the case; but leave it to the consideration of those who delight in abstract philosophical researches:—it is sufficient for him to be assured from experience that it is so."

The business of straightening and levelling ridges, in many situations, certainly demands much more attention than it has hitherto met with by the farmer and land proprietor.

Besides these modes of ridging, which are necessary in the laying out lands for the purpose of tillage, there are others that become requisite in consequence of the growth of particular sorts of crops, and the particular methods of husbandry by which they are cultivated. Thus we have one, two, and three or more *bout* ridges according as the crops are grown to most advantage, on one or other of these sorts of small ridges, or as they suit the different sorts of tools by which they are put into the ground.

Ridging *up*, a term made use of to signify the practice of laying up the mould or soil to the rows of particular sorts of crops, as those of the pea, potato, turnip, cabbage, and other similar kinds. It also implies the laying up land or earth in such a manner as that it may receive the most full and perfect benefit and influence of the atmosphere, and in consequence become in a mellow and pulverized state.

Ridge-*Work*, that sort of tillage which is executed in the ridge method, or by raising the surface of the land into some kind of ridges.

Ridges, *in a Horse's Mouth*, are wrinkles or risings of flesh in the roof, running across from one side of the jaw to the other, with furrows between them. Horses are bled on the third or fourth ridge.

RIDGELING, the male of any beast that has been partially castrated.

RIDGIL, a male sheep, in which the testicles do not come properly down into the scrotum.

Ridgil *Lambs*, such as have none, or only one testicle in the scrotum or cod.

There is great trouble and danger in these sorts of animals being mixed with other sheep stock, as they not only tease the ewes, but frequently injure them. The lambs should of course always be cut while young as from six to ten or twelve weeks old, though the operation may be performed with safety at a much later period, and even when a year or more old. Mr. Marshall, in his Norfolk Economy, describes the manner of doing it in this way, where only one of the testicles had come down or entered the cod. Having cut off the end of the scrotum, bag, or cod, the testicle was drawn out in the usual manner of gelding. The other was then taken out at the side contrary to that on which the palpable testicle was placed.

In performing which, the lamb is laid flat on its side upon the ground, being held in that position by one man, keeping its neck and fore legs close down while another stretches it out by drawing the hind legs backwards, keeping them tight down, so

that the animal cannot stir. The operator then clips off a small patch of wood about the size and shape of a duck's egg, close below the loin and in the middle between the *huckle*, and the *short ribs;* after which he makes an incision, sufficiently wide to admit his fore-finger, with which he searches for the stone and brings it out, disengaging it from the tunic or coat in which it is enclosed, by a knife, drawing out the cord or string. The orifice after this is carefully sewed up, and the wounded parts anointed with elder or some other ointment.

It is stated as remarkable, that "the concealed testicles all laid on the same side, namely the right side; the contrary side to that on which females are cut, in the cases he had the operation performed in. And that in one the operation was rendered difficult by the testicle being very small, and braced up close to the vertebræ." It is likewise added that "the palpable testicle being priorly extracted, increases the difficulty of the operation, as the person who performs it does not know which side to cut on, and is sometimes obliged to cut on both before he finds the concealed testicle."

RIDGLET, a provincial word, used to signify a small ridge, especially when raised by baulking.

RIDING, the act of being carried by the horse or other animal.

RIE, a provincial term, applied to the operation of turning grain in a sieve, so as to bring the *capes* into an eddy on the top.

RIFTS, in *Farriery*, are small *Clefts*, or *Cracks*. See *Chops*, *Cracks*, &c.

RIG, a male sheep with none or one testicle only in the scrotum.

Rig, in *Farriery*, a name given a horse that has had one of his stones taken out, and yet has got a colt.

RIGG, a provincial word, used to signify the same as ridge.

RIGGEN, the ridge of the roof of a building.

Riggen-*Tree*, the piece of timber laid along the ridge of a roof to support the heads of the spars or rafters, which in modern buildings is found unnecessary.

RIGGIL, an imperfect male sheep having none or only one testicle in the scrotum. See *Rig*.

RILL, a small runlet of water, mostly rising on the sides of small hills or declivities. In many situations they may be converted to useful purposes in husbandry, such as the irrigation of pasture or meadow lands that lay below their levels; the supplying of grass grounds with water, for the purposes of live stock; and the affording it to towns and villages, in dry or other situations where it is scarce. See *Watering of Land*, and *Artificial Rills*.

Artificial Rills, such as have been formed or made by means of art.

It has been remarked, that the practice of constructing rivulets of this sort for supplying water is peculiar to a few districts, as Yorkshire and west Devonshire, in the latter of which they have been made use of time immemorial in bringing, what in the simple language of the district, is termed "pot-water" to the farm houses, and the hamlets of cottages in upland situations, an excellent expedient, which is supposed applicable in many other parts of the island, but which, except in the case of Yorkshire, has been confined to that extreme part of the country.

In forming these sorts of rills in their original district, it is observed by Mr. Marshall, that one which supplies the house with water, also a drinking pool near the yard, and in the natural course of it conveying it through a straw yard, a trough is placed across it for the use of the yard cattle; and which has, likewise, been for a vast length of time led over some grass land, which lies below the yards, on the principle of the float and drain. But says he, "although this rill is seldom if ever dried up—leading it along the sides of the valley, through upland inclosures, which are destitute of water for stock, and their value of course thereby much depreciated,—does not appear to have been thought of. In the course of last summer, 1792, being desirous to know if this rill could be carried through an intended suite of yards, on the side of the valley, he took the level, and found not only that object to be attainable, but also that it may be led with ease into two waterless fields, which lie above these yards; and, through them, into four or five more (equally in want of water for stock), situated beyond them." It is added that, in "ascertaining these facts, he made use of a mason's long level inverted: a plummet hole being previously cut in the head of the standard; the crown of which being set upon the ground, the arms of the level were steadied by rods in the horizontal position; and a carpenter's rule held across another rod, set up, at as great a distance as a clear sight would admit of, and at a height upon the staff, equal to the height of the level. Finding this a most simple and perfect instrument, but difficult to adjust, by reason of its instability, he has since had a *frame-level* made on the same principle; namely, with a straight edge, or top rail, answering to the base-board of the long level, with a broad piece falling down from the middle of it, answering to the standard; and with two end-pieces or legs, to supersede the use of the rods; together with a bottom rail, eight or nine inches from the ground, and with diagonal braces, to keep the whole firm, and prevent the middle or plumb-line from getting out of the square, with the straight edge of the top rail; which is seven or eight feet long, and the height about four feet. He thinks, that half a rod long, and a quarter of a rod high, are eligible dimensions when great accuracy is required. But a shorter length, as one third of a rod, is more handy. And, as an improvement of the rule and rod he has contrived a *cross-staff*; namely, a slip of thin deal, about five feet and a half long, with a cross-piece, about two feet long and three inches wide, fixed in the edge of it, at the exact height of the level; the top of the staff rising twelve or eighteen inches above the upper edge of the cross-piece, that the hand of the person who holds it up may not interfere with the view. This cross-piece should be of white wood, as deal, or be painted white,

that it may be the more distinctly seen at a distance. With this implement the flowing level may, he says, be well ascertained."

It is observed, that in order to "ascertain the proper fall of a rill of this intention, he previously took the running level of the ancient floating *leat* of the meadow, and finding its fall irregular, he took it in two places where the variations were greatest. In the first, the fall was twenty-seven inches in one hundred and ten feet; which is nearly one inch, or one foot of fall to fifty inches, or fifty feet, in length. In this part the current is in a degree rapid; the fall much too great for the general intention. The fall, in one hundred and ten feet of the other part is barely six inches; which is only one measure of perpendicular height to two hundred and twenty of horizontal length. But in this part the motion is too sluggish: the surface of the water is nearly smooth; barely dimpling; no ripple or agitation appears. The fall is evidently too little for a water-course, in which there is not a constant stream." He has therefore "fixed upon one measure in a hundred, as the proper fall of a water-course, into which water is occasionally thrown for the purposes of watering lands, filling drinking pools, cisterns, and other similar purposes."

And in order "to adjust the level to this descent he measured one hundred feet in length, and having nicely ascertained the *dead level*, he depressed the range of the top bar one foot below the upper edge of the cross-piece of the staff, and, while in that position, he marked the situation of the plumb-line on the face of the level; the plummet hole being made wide for this purpose; thus fixing the flowing level." And "with this descent, he has traced a line from an intended reservoir, and from point to point, through the fields of one side of the farm, and finds, that it reaches, even with this descent, within every field: and that three fourths, or a larger proportion, of the surface, are capable of being floated from this intended pool." With the view of "seeing the actual motion of water falling one in a hundred, he has had, he says, fifty yards of the upper end of the line opened, and finds the current fully sufficient; a lively rippling stream, more active perhaps than is necessary. But the leakage being the less the quicker the water moves," it may, he thinks, be safely concluded that one foot of fall in a hundred feet of length is nearly the proper degree that is required.

And in the same case, he has, by the same means, "also found that, from a similar reservoir formed near the source of the rill, water might be conveyed to every field, and almost every acre of the opposite side of the farm," which is a matter of great consequence. It is suggested, that "the uses of these reservoirs will be those of having in readiness, during the summer months, when the rill is weak, a body of water to throw into drinking pools, cisterns, &c.: a weak current turned into a dry trench is absorbed by its perforations and fissures, for some time, at least, after it is turned in: whereas a body of water, rushing quickly along it, not only in part escapes absorption, but tends to fill up the leaks: and, in winter, these reservoirs will be useful in scouring the trenches, and in hoarding up bodies of water for the purpose of irrigation," or other similar uses. In the setting out these rills, he has laid, he says, the head or upper end of each, from two to three feet below the intended surfaces of their respective reservoirs, when full.

Hence, by means of a portcullis floodgate, a body of water, two or three feet deep, and the whole extent of the surfaces of the basons, may be poured into the rills, faster or slower as may be requisite.

In a subsequent minute it is stated that difficulties were met with in conducting a rill through an open grove of trees, but which were overcome in the following manner:

"Having, says he, by means of the frame level and cross, ascertained the general descent, or flowing level, through the whole extent of the grove; and having, in this operation, gained a general idea of the requisite direction of the rill, by means of stakes placed at the several stations of the cross-staff, wherever clear views could be caught through the openings between the trees,—the intermediate spaces, between the stakes were traced by the eye, so as to endeavour to follow the natural level of the ground, without forming abrupt bends in the channel;—parrying between the two." And that "the supposed line being thus set out, the surface of the ground was cleared two or three feet wide on either side of it, from leaves and other incumbrances, and the top soil removed for manure; thus making a hollow pathway through the grove, four or five feet wide. The next operation was to level this pathway, which was likewise done by the eye, from stake to stake; paring off the protuberances, and casting or wheeling them into the hollows to fill them up."

Then in order, he says, to come at the true line, and to render the flowing level perfectly uniform, "a narrow pathlet, the width of the spade, was formed on the upper side of the broad pathway. This pathlet was formed, with the frame level in hand; sinking trenches in the still protuberating parts, and raising banklets in the hollows: thus fixing the exact flowing level at each level's length and, at the same time, forming the face, or lower side of it, in such manner as to ease the bends, and give a smooth flowing line to the rill or runlet of the water."

And further, "in order to bring the business of forming the bed of the rill to a certainty, and thereby to render any further superintendence unnecessary, yet to prevent error in the execution, he formed a *gauge* for the labourers to work by; which consists of a board, forming the segment of a circle; the chord or greatest length being three feet, the greatest depth twelve inches. This gives the dimensions of the bed of the rill. To keep the bottom of it exactly true to the flowing level, so that the current or stream may be perfectly uniform,—it is fixed under a mason's short level; the end of one of the arms projecting three or four inches beyond one end of the gauge. And the trench being sunk to nearly its proper depth, by the eye kept on the adjusted margin, the projecting end of the level is, he says, placed on the same marginal guide, and the plummet-line being brought to the perpendicular

(and the base of the level of course rendered horizontal), the bottom of the trench is finished, with certainty."

On having "the water turned into the upper part of the trench thus formed, by two common labourers, who never before, perhaps, took a level in their hands, the current was found not only desirable, as to descent, but perfectly uniform,—without alteration. And hence, says he, the practicability and certainty of this method of forming the channels of rills,—as well as the eligibility of one measure in a hundred, for the descent or fall,—are fully ascertained." It is observed that the above dimensions are the most proper for the part passing under trees, as being liable to fill up by leaves and small twigs, but in open land, liable to be trodden by cattle, four feet in width, and eight inches deep is better, the lower side being made broad and flatly convex to prevent treading in, being turfed over with the sods removed.

And in respect to the Yorkshire rills, the same writer remarks, that "the heights of the northern margin have neither springs nor rivulets (some very few instances excepted), nor any other natural waters than the brooks which wind at the bottom of the deep vallies that divide them, and the rivulets which generally run at the feet of the precipices that terminate them." That "formerly these brooks and rivulets were the only resources which the villages that are scattered on these heights had for water, both for the use of cattle and for domestic purposes." But that "in process of time wells were sunk; but they are of such a depth as to make the labour of raising the water little less than that of fetching it from a moderate distance." Of course that "this kind of natural necessity has led to an expedient, which, though not new in principle, is perhaps entirely so in simplicity of execution, and might be practised with great advantage in many similar situations." For as "the moorland mountains rise with generally an easy ascent, from the beds of the rivulets last mentioned, to a height much exceeding that of the hills to be watered, frequently abounding with springs almost to their highest swells, these springs are collected and conducted by a narrow channel down the slope of the mountain sides, and along the face of the precipice, until the summit be gained; the waters being thence conveyed to the place or places desired." It is stated that, "in planning an artificial rill, a level and some little knowledge of the country are, as has been seen, the requisite guides. The surveyor begins at the place to which water is reqnired to be brought; and ascertains the lowest part of the brink of the precipice from which water can be conducted. The face of the precipice is traced in like manner: and, if necessary, the ascent of the moorland hills, until springs, or their natural rills, can be commanded." And that "if his level bring him to the bottom of the steep soon enough to catch the rivulet which runs at its foot, the work is readily completed. If not, he goes above its highest bend, generally to the head or highest part of the valley (between the heights and the moorlands), and winds along the side of the opposite swell to some more elevated source." And "if, when he arrives on the moorland hills (or by an observation from the top of the precipice) he finds that nature does not furnish the requisite quantity of water high enough to give the necessary fall, the work is of course impracticable.

"In regard to the manner of executing an artificial rill, in this part, an opening shallow channel, of a width proportioned to the quantity of water to be conducted, is, he says, the main operation. In making stagnant pools, it has been found that much art is necessary to make them retentive; but in forming the bed of a rill no such art is, he says, requisite. It is the nature of running waters to render the surface on which they run firm and retentive. Sand is, he believes, the chief material used in forming the channels of these rills; and this only in places where an open rock or other porous stratum is crossed." But "much depends on the quantity of fall and the quantity of water. If the fall be but little, and the quantity of water at the source be such as not to admit of much waste, great care is requisite in forming the bed of the rill. The fall is therefore regulated in a great degree by the quality of the ground. On good ground the channel is nearly level. Over faulty ground the water runs with a current for the double purpose of getting quickly over it, and rendering its channel more retentive." The circumstances from which injuries are produced in these rills are "leaves in autumn and snows in winter. To remove the obstructions which these not unfrequently cause, and to repair such breaches as time will always make in the works of art, a superintendent is necessary to every artificial rill."

It is observed that "the rill of Kirbymoorside is, he believes the largest, and was the first which was brought upon these heights. This rill was brought to the villages of Gillimore and Fadmore near forty years ago; and has been extended to Kirby about thirty years, by Joseph Ford, a self-taught engineer, of great ingenuity and some judgment; a man to whom the county owes much. Since the introduction of this, several others have been raised; and some few unsuccessful attempts have been made: the channel was in one instance (that of Newton) extended a considerable way before the impracticability of completing it was discovered; a piece of misconduct which nothing but a want of accuracy in the use of the level can, he says, lead to. The miscarriage in this case was not owing to a want of elevation in the source, but to a depression of the channel at the foot of the steep; the head of the valley (if such it may be called) being lower than the top of the precipice at the given point. This shows, he says, the necessity of tracing the entire channel with sufficient accuracy before any other expense is incurred." The mode of doing which has been shown above.

It is further stated, that "in the case of Kirby the channel is raised somewhat by a bridge-like mound of earth thrown across the crown of the valley." And that "the same mound serves the purpose of conducting another rill across the same difficult pass; from whence the Kirby rill takes an eastward, the

rill of Welburn (applied principally to the watering of pasture grounds) a westward direction."

In regard to the expense, it is stated that "the first cost of the Kirby rill was not altogether one hundred pounds. The distance about ten miles, watering (besides the town of Kirby) two villages and a line of cultivated waterless upland country about four miles in length. Besides the first cost, which was raised by subscription, a superintendent has ten pounds a-year for keeping it in repair and free from obstructions; which yearly salary is paid by the contributions of the persons benefited; each being rated agreeably to the estimated benefit received."

From the vast advantages that have been derived from the construction of these sorts of rivulets, in these few cases of upland dry situations, the attention of the land proprietor and farmer in other districts where there is a prevalent scarcity of water, either for domestic purposes, or the use of cattle stock, should be directed to the execution of them, on such cheap and beneficial plans as may be the most convenient in the particular situation. See *Drinking-Pools* and *Ponds*.

RIME, a sort of hoary or white frosty appearance, sometimes on the ground in the autumnal winter and early spring mornings.

RIMS, the steps, staves, or rounds of a ladder.

RIN, a provincial word used to signify brine.

RING, a sort of hoop made of iron, which is used for various purposes, as for fastening horses and cattle by in the stalls. In these cases they should be made large and strong.

Rings *in Timber*, the concentric layers, by which the wood is formed. These rings are, according to Dr. Darwin, annually produced from the alburnum, and are supposed to be thicker on that side of the trunk of the tree which has a southern aspect than on the contrary, and thicker in those summers most favourable to vegetation than in others. It is added, that "these rings, as they lose their vegetable life, and at the same time a part of their moisture, by evaporation or absorption, gradually become harder and of a darker colour, in so much, that by counting their number, it is said, that not only the age of the tree, but that the mildness or moisture of each summer, during the time of its growth, may be estimated by the respective thickness of the rings of timber."

RING-BONE, in *Farriery*, a hard swelling on the lower part of the pastern of a horse, generally reaching half way round the fore part. It has its name from the resemblance to a ring.

It has an affinity to a bone-spavin; and, for the most part, proceeds from the same cause. The external cause of a ring-bone is often a strain in the pastern from hard riding on dry roads; or owing to the pastern having been wrung in deep clayey roads, either in travelling or at grass. Yet some horses are naturally subject to ring-bones, especially those that are large and bony about the pastern. When a ring-bone appears upon a clean limbed horse it is seldom so dangerous as when it happens to horses that have large bones, and are fleshy in those parts; for when the swelling is removed the stiffness often remains for a long time.

This disease is always found easier to cure when it appears distinct round the pastern than when it spreads downward towards the coronet; for then it is apt to affect the coffin-joint, if it does not derive its origin from some strain or defect in that joint originally; in which case the cure will be uncertain, and sometimes impracticable, especially when a callosity is produced under the round ligament that covers that joint, and even when it happens more externally: it proves also dangerous when it unites with or spreads to the ligamentous substance that joins the hoof to the flesh; as it is apt to turn to a quittor, and in the end to form an ulcer under the hoof. A ring-bone that rises on the pastern is easily cured when it does not run down towards the coronet.

It is remarked by Gibson, that the ring-bones that appear on colts and young horses will often insensibly wear off of themselves, without the help of any application: but when the substance remains there needs no other remedy besides blistering, unless when, by long continuance, it is grown to an obstinate hardness, and then it may require both blistering and firing. The swelling may proceed only from the tendons, which sometimes is not easy to be distinguished from a true ring-bone, except only that a true ring-bone is less painful, unless it proceed from the coffin-joint. In this case, blistering alone generally proves successful; and it is to be renewed two or three times, according to the urgency of the symptoms. But in a true ring-bone, where the substance is hard, like a piece of flint, and altogether insensible, and without pain, firing is the only thing to remove it. And in order to fire a ring-bone successfully, he advises the operation to be performed with a thinner instrument than the common one; and that the lines or razes be made not above a quarter of an inch distant, crossing them obliquely somewhat like a chain. He directs us to apply a mild blister over all, and when quite dried up, and before the hair is grown, to lay on a charge of yellow rosin and bees-wax, &c. melted together, and spread over the pastern joint, covering the whole with flokes, or with the stuffings of an old saddle. As soon as the horse has rested two or three days in the house he advises us to turn him out to grass in some dry smooth pasture. The same method, he says, is to be followed when the ring-bone rises towards the coronet, or the coffin joint of the animal.

RIPENERS, in *Farriery*, are sometimes vulgarly termed drawers, they are such medicines externally applied as by their stimulus and warmth promote the formation of matter in an abscess; such as camphorated ointment, turpentine, poultices composed of active ingredients, and liniments of some kind.

RINGES, a provincial term signifying rows of hay, quicks, &c.

RIPPLE, a slight scratch or tear, sometimes applied to very slight ploughings.

Ripple, an implement of the comb kind, constructed with several upright triangular prongs, set, near to-

gether in a strong piece of wood, for the purpose of rippling flax and hemp.

Rippling *of flax*, the operation of taking off the seed from the flax by drawing it through a ripple or large comb. See *Flax*.

RISING, a term sometimes applied to yeast, or barm.

RIVER, a current, or stream of fresh water, flowing in a bed or channel, from its source into the sea.

In many situations rivers may be converted to various useful purposes in agriculture, such as those of improving the meadow and other grass-lands which lie below the sources of them, by having their waters in particular seasons turned over them. By proper attention in these respects, vast benefits might, in a variety of cases, where it has never been even so much as suspected, be derived, and thereby immense savings in manure be made for the amelioration of the less favourably situated lands.

But besides this vast source of advantage, rivers may often be converted with little trouble or expense to other useful purposes, such as the supplying live stock with water, the turning of different kinds of farming machinery, the conveying of cattle food, and manures of various descriptions, as well as different sorts of farm produce, and a great number of other uses, which can only be discovered by the particular circumstances of them, and those of their situations.

But though in these views they may be justly considered as of much advantage, in others they are often dangerous, troublesome, and highly detrimental to the farmer, as where they are much accustomed to overflow their banks, injure the crops, sweep away the live stock, and carry down much of the lands on their borders.

Where they are apt to prove hurtful by thus overflowing their banks, the best modes of confining them in particular cases have been pointed out in speaking of the nature of embankments, and hough land. See *Embankment* and *Hough Land*.

But there are other cases that deserve to be considered in this place, such as the directing and altering the courses of torrents coming from mountains, changing the course of rivers, securing the banks of rivers in vallies, and straightening the narrow, crooked windings of small rivers in the same situations and other hollow parts of lands.

By the first of which much advantage may in different circumstances be procured, and great security be attained for the valuable lands below. By the second, extensive tracts of the most valuable kinds of land may be obtained, while the whole is rendered more safe and proper for the purposes of pasturage or those of tillage. By the third much useful land may be secured as well as much mischief from high floods be guarded against. And as by the last much ground is often lost or rendered of but trifling value to the farmer, by proper means these inconveniences may be obviated, and the land rendered of much greater utility. Besides these, the methods of securing the banks in other instances where they are liable to be carried away by large floods may also prove a vast benefit and improvement.

In the former of these cases, the remedies are in general those of rendering their courses more *free*, *open*, *straight*, and *regular*, by which they must obviously suffer less obstruction, and of course be less apt to overflow their banks, and prove injurious to the grounds below or on the sides of them.

It is however remarked by an able writer that this is a sort of work that ought to be maturely considered in all cases before it is attempted; but that in such upland situations the business may often be performed with facility by small cuts made along the flat bases of such elevations, while it is very different in those of straightening vale rivers, as much larger openings are requisite. Besides shallows for piers and stops are mostly found there, while in these cases they are in general wholly wanting.

In all cases, and in every point of view, the business is evidently of the greatest interest to the proprietors of land, as the destruction produced in this way is not only often committed on the most valuable sorts of land, but is frequently the cause of disputes between neighbouring proprietors; this sort of work has however been little attended to, and is in common very imperfectly understood. In many instances a great deal may be effected by proper accommodation between the different proprietors, whose interests are affected.

In undertaking works of this nature, there are different circumstances that require to be particularly considered. The peculiar site or place of improvement should, Mr. Marshall says, be well studied, in order to fix upon the best method of executing the work.

And when this has been done, that accurate plans and estimates of the expense that may be incurred, as well as of the gross profits that may result from it, be made out with care. And it is advised that where the business is extensive, and the person who has the management not perfectly acquainted with the nature of it, to contract with proper experienced labourers, or a responsible undertaker for the execution of the whole, binding the party who is to perform the work to uphold it for a certain number of years after it is finished. It is remarked, that "for the want of these precautions, sums of money, and quantities of timber, are annually expended, and in great part thrown away, so as to become, in some instances, a heavy tax upon estates,—and a serious defalcation of timber." It does not follow, it is contended, that, because a few square yards of land are annually carried away, an expensive work should be erected, and upheld at ten times the value of the ground it will protect: nor that, because one side of a river is slightly injured, an oversized work should be raised, to the greater injury of the opposite banks. It will be found, it is observed, that in ordinary cases, opposite proprietors have one and the same interest; and that small injuries may generally be remedied by simple means, and at a small cost. What the writer is solicitous to inculcate is, that the remedy ought to be proportionate to the disease; and that it should be applied in such a manner as not to injure another: consequently, that it behoves a proprietor to see that no one about him has an inte-

rest in erecting expensive and abortive works, or any prospect of advantage from the annoyance of his neighbour in any respect from such works. It is added that every person "has an undoubted right to defend his property. It is often his duty, as well as his interest, to do it." And that "there are cases, on which even large sums of money may be prudently laid out, and ought to be expended" in order to accomplish the work, as by neglect great injury may be sustained, which at first might have been remedied at a very trifling cost.

Securing River-Banks, the means of guarding and protecting them from the encroachment and injury of the streams when in flood or otherwise. It is a work of much difficulty and labour in many cases, and that r quires the careful management of an experienced director.

And it is remarked by the able author of the Treatise on Landed Property, in speaking of the nature of this business, that "suppose the uniform, and evenly-poized, current of a reach or straight part of a river, as *a a*, *fig.* 1, Plate XXIV, to be disturbed by the body or large root of a tree, brought down and lodged, by a flood, as seen at *b*, which in brooks and narrow rivers is an ordinary cause of mischief," it it found that "through this apparently trifling incident the current may be said to lose its balance. For, when the flood falls to the level of the obstruction, the water becomes confined in that part; its height, above the obstruction, is consequently, he says, increased; and its current opposite and below it, not only accelerated, but gently turned from its direct course toward the opposite bank of its natural channel; which, if it be of an earthy crumbling nature, becomes undermined: the land, or upper parts of the bank, consequently shoots down, and is carried away by succeeding floods." And what "tends to increase the evil is the circumstance of the channel, immediately below the obstruction, as at *c*, becoming occupied, even in minor floods, with comparatively stagnant water. It is in consequence, he says, warped up with the sediment there deposited; and, by this mean, an additional weight of water is thrown against the opposite bank; which, if the growing cause of mischief be not speedily removed, will in a short time be much torn away, and in a course of years a bend or bay *d*, be formed in the adjoining ground of the proprietor A, with a corresponding bank of sand or gravel united with and becoming part of the lands of B.

"But, says he, if the grounds of B are equally vulnerable as those of his opposite neighbour, he has no cause of exultation in his increase of territory. For while the current is leaving him, perhaps, a worthless sand bank *c*, it is, by a natural law of river currents, scooping out a bay at *e*, and giving to his neighbour an increasing territory at *f*." And "thus," says he, "a mutual loss of valuable lands is incurred; and the evil (in this case) continually increasing; until the banks are securely defended, or the current is restrained, and directed into its former channel."

The remedies in this case are, he says, two, first, "to sheath the injured banks of the bays *d* and *e* with such materials as will resist the circuitous current, and let the river remain in its crooked state." And, secondly, "to erect a pier, as at the point *g fig.* 2, to parry off the force of the current from the bank *d*, and direct it forward;—with the two-fold intention of preventing further mischief, and of bringing back the course of the river to its former state of straightness," as much as possible.

It is stated that "the operation of guarding the immediate bank of a sharp river bend against a heavy current meeting with great resistance, is generally a work of much difficulty and expense; even where materials can be easily procured: while that of diverting the current may frequently be accomplished at a comparatively small cost; and its effect be rendered infinitely more salutary and permanent." As it is evident "that if the accidental obstruction, mentioned, had been timely removed, no bad effect would have ensued: the river would have continued its direct course. Or if, through neglect, it had been suffered to remain awhile, until its mischief was discoverable, even then, if it had been moved from its station to the opposite side of the river, and placed in the part affected, this small counterpoise might have recovered the balance of the current, and directed it into its wonted channel. And in almost any case, he thinks, by judiciously placing, in a similar manner, an obstruction proportioned to the magnitude of the power to be counteracted, the like effect may be produced." As for instance, says he, "if in the case supposed the pier or river-guide, above mentioned, were to be erected by the proprietor A, and to be inclined towards the stream, or direct course of the river, in a degree proportioned to the strength of its current (a rapid current requiring less bias than a slow one,) and of a size in like proportion,—not only the banks *h h* would be defended, in a great degree, from the action of floods, but the sand bed *c*, *fig.* 1. would be worn away, and its materials deposited in the bay *d*; which, also, being rendered stagnant, comparatively with the current of the river, would receive the deposits of foul waters in times of floods; and thus, in a two-fold manner, be refilled, and brought back toward its former state. And further, that if when the gravel bank *c* is sufficiently removed the proprietor B were to erect a similar pier at the point *i*, *fig.* 2, the sand or gravel bank *f*, *fig.* 1, would in like manner be worn away, the bay *e* be returned to its original proprietor, and the straight course of the river be regained:—then the piers ought to be removed;—whether they belong to one or to two proprietors;—the latter having, generally, a mutual interest in directing the river which separates their properties into a straight course," as much as can be done."

It is stated by the same author, that in the construction of a river-guide for this purpose "there are certain principles and particulars of practice, to be observed." It is suggested that "its position should be such as to produce the required effect, with the least degree of resistance. For the current of a river, as the waves of the sea, ought, he thinks, to be subdued by stratagem rather than by force.

Resistance serves but to increase their fury. A wave falling on a flat shore, seems, says he, to die without a struggle; while one that is stemmed by an abrupt rock strikes with tenfold force. And, in like manner, a rapid river will glide smoothly along the side of an even bank, though it may somewhat deviate from the direct course; without perceptibly disturbing the current, or injuring the bank that directs it, even though merely of turf. But when a strong current meets with an abrupt projection, or a sharp bend in its channel, its fury is roused. There, rock is sometimes barely sufficient to resist its force." On these principles he therefore conceives, that "in erecting a pier of this intention it ought to be made to unite evenly with the natural bank of the river above it, and, where the required deviation from a straight line is considerable, the face of the pier ought to pass off from the natural bank with a smooth hollow curve, that the force of the current may not be checked. But its outer or lower end should be straight, or nearly so, and be directed, as a piece of ordnance, to the object it is intended to destroy—to the obstruction it is intended to remove; —and, it may be observed, that the nearer it approaches this, the greater will be the action of the current upon it, in times of flood; and the less liable the stream will be, at low water, to turn back into its former channel. For, in cases of this kind, the current of a flood, and that of low water,(if not better directed) take different courses, according to their heights and strengths. The one, he says, rushes forward in the direction desired; the other, unable to surmount the obstruction, and flagging for want of strength, at the point of the pier, doubles it; and falls back into the bay, with an accelerated current; directed, perhaps, straight to the injured bank; and may thus increase, perhaps, rather than prevent, the injury." But in order "to remedy this evil effect, and to direct the current, at every height, into the same channel, it will generally be found right, he thinks, where it can be done, and at a reasonable expense, to cut a channel through the obstructing bank; large enough to admit the stream at low water; depositing the materials which are raised in doing it at the point of the pier, and against the foot of the injured bank: by these means not only preventing further injury to the lands of A, but greatly assisting the action of the flood currents to force their way through the channel, enlarge it; and, in a short time, lay open the required course. For although, by this procedure, the bay *d*, *fig.* 1, might not be so readily and completely filled up, as it would by suffering the current to throw back the obstruction, by degrees, in the manner above represented, yet the advantage of putting an immediate stop to the ravages both of floods and of low water, might counterbalance that defect; even though the pier were thereby rendered necessary to be kept up in perpetuity. The expense of the cut may generally be saved in the required *length* of the pier; whose use, in this case, is, merely, he thinks, that of giving an easy bend to the current; so as to enable it to find its own way to the channel prepared for it." And the "*strength* required, depends, he says, on the weight of water, the force of the current, and the angle of deviation from the given direction of the current immediately above. If the required direction of the pier be nearly the same as that of the current above it, as in *fig.* 2, *Pl.* XXIV, it has, he contends, little more than the weight of the water to sustain. Whereas a jutment run out, abruptly, into the natural course of the current (as is commonly seen) has not only, he asserts, the weight, but the force, of the water to withstand; and requires threefold, or tenfold, the strength of structure" that is necessary in the other case.

And he says that another circumstance to be particularly regarded in this sort of business is the height of the conductor. Where it is "run out from the bank into the channel of the river, as represented in *fig.* 2, and if it be not raised high enough to prevent the waters of floods from making their way over it, its foundation may be endangered;—especially in a place where the general fall of the river is considerable. For an overfall of water, unless it have a firm basis to act upon, naturally, he says, scoops out a pit at the foot of the fall, and undermines the precipice it tumbles over; seldom failing to let down" such as are constructed by art.

In respect to the means of obviating this effect, they are, he says, three: one of which "is to raise the pier high enough to prevent the overfall; an expedient, however, which cannot always be practised with propriety. Another is to form the lower side, or back part of the pier, with a shelving or flatly inclining surface, to break or elude the fall. And the other, to prepare a convex floor, behind the pier, for the waters to fall upon." This last has, he says, been found successful in his own practice.

There is likewise another point that demands particular care in the operator, which "is that of securing the point or outer end of the pier, not only at the foundation, but in the superstructure. For although the main current cannot, if the pier is judiciously placed, exercise its strength upon this part; yet, by reason of the weight of water there losing its support, and part of it, consequently, rushing precipitately into the unguarded bay, the lower end of the pier is peculiarly exposed to danger" in that way. He supposes it "scarcely necessary to add, that the *upper* end of the pier ought to be deeply inserted in the firm bank of the river, to prevent the current from insinuating itself behind the facing; or that the face of the pier should be carried up with a sufficient batter, to give it firmness; or that the *foundation* ought to be securely laid, and to be kept sedulously guarded in front, to prevent its being undermined by the current. Rough stones, thrown down, loose, and with a flat shelving surface, against the foot of the pier, are, he thinks, in most cases, the best guard," let its materials be of what sort they may.

He advises, that the materials for this use should "be suited to its occasion, where a choice is to be

had. If a low defence, only, is wanted, in a district where large rough stones are plentiful, a long pile of loose stones, laid flatly sloping against the bank of the river, or a flat ridge run out from it, may, he says, form a cheap and durable barrier. For should they be disturbed by an extraordinary flood, they may be readily replaced when the water subsides. Where "a tall pier is required to direct a large and rapid river, in a place where stones and strong cement may be procured at a moderate expense, masonry may, he says, be eligible. But in exposed situations, at least, it ought to be guarded with timber, especially at the top and the outer end (as the piers of sea-ports, and the quays of navigable rivers, are guarded) to defend those parts from injury by ice, timber, or other large floating bodies, driven against them in times of flood." And that "where masonry cannot be used, but at a great expense, a *cassoon*, formed with posts and planks of adequate dimensions, and filled with pebbles, gravel, or other indissoluble materials, to give stability to the fabric, may be found to last as long as its services may be wanted; and, in some cases, may be removed, he says, while its materials may yet be valuable." And it is here well observed, by the able writer, that though it has been stated that in this case A "has two methods of defending his property, namely, that detailed above, and that of sheathing the entire bank of the bay *d*, *fig.* 3, Plate XXIV, to prevent any further depredations.

But this, though the prevalent method, is merely palliative, and demands frequent repairs: it does not, he says, cure the evil, or bring back the lost property to the owner who has a right to it. "Nor is it, says he, in such a case beneficial to a rival owner. for the current, as has been shown, sweeping circuituously along the banks of the bay, is thereby led to direct its force against the lands of B, who cannot under these circumstances defend them by the above means; but who must either secure them by a lengthened land-guard, or leave them at the mercy of a sweeping current." It is therefore concluded, that "in a case of this kind it is evidently the best interest of an opposite proprietor to suffer his sand bank, or gravel bed, to be cut through, in the manner suggested; and he ought, he says, to assist in the operation; as he will thereby, not only get rid of the circuitous current, but, by the action of floods, in the straightened course, his bay *e*, *fig.* 3, *Pl.* XXIV. will, he says, scarcely fail to be filled up with the scattered materials that may be removed.

There is another case, the same author observes, in which this sort of pier or river guide may be made use of with success; which is that "where a stream of the above description falls down a crooked valley, and necessarily takes, at certain points, a winding course; as shown at *fig.* 3.

In this case, where "the quantity of water is considerable, its fall rapid, and especially where it is conducted to the bend *a*, down a straight, unobstructed reach, scarcely any thing, he thinks, but natural rock can resist its force, in that part." In such situations, he says, "it is not unusual to see earth banks scooped out and undermined, until a perpendicular cliff of twenty or thirty feet high be formed. But that if a pier be erected at *b*, *fig.* 3, with an easy curve from the natural course above, so as to *bend* the current without *breaking* it, and direct it into its natural channel, in the valley below, it will have nothing to contend with but the loose gravel beds *c* and *d*, which, if cut through, as in the former case, will presently, he thinks, be torn away, and a principal part of their materials be deposited in the bays *e* and *f*, but especially in the latter: so that in this as well as in that case. both sides of the river may be benefited by the alteration" which is thus produced.

It is however stated, that "there are cases in which nothing but an immediate sheath, or *land-guard* applied to the injured part, can be properly used to prevent further depredations. As, first, where the river is confined in the part where it is required to be bent, by rocks or otherwise, to an unaltered channel;—as it frequently is, he says, in sub-alpine situations. And, secondly, where a deep pool occurs in that part at low water, so as to render it difficult to get a proper foundation for a pier." He observes that, in the former situation, stones are generally plentiful; and they require to be applied, according to the circumstances of the particular case. "Where the foot of the injured bank is covered with a pool, at low water, it is advised to shelve off the brink of the bank, and shoot down loose stones from the top of it: suffering them to form their own slope, in the action of falling, and by the operation of succeeding floods; continuing to pour them down, until the bank be secured, at least from minor floods; and then to slope back the upper part, to give freedom to floods of higher magnitude." But that where it is "in the face of an impetuous torrent, and at some little distance from it, a gravel bed is thrown up, so as to lie dry during low water, yet where lands, behind, are liable to the ravages of floods, as is often the case, and especially where stones are not plentiful, a more frugal arrangement of them may, he says, be made, by using them merely to ease the exposed bank, so as to prevent the currents of floods from laying easy hold of it, and tearing away the land." However, in this case "much, he says, depends on the plan and construction of a safeguard of this kind. It ought, he says, to be every way convex; so that the strength of the current and the weight of the water may act upon it, as superincumbent pressure acts upon an arch. It should, he thinks, bulge out, horizontally, towards the known current of floods (without regard to the course of the stream at low water), and the face of the wall ought to take the barrel form. A cross section of the stonework should resemble a semi-arch, or, in dangerous situations, it ought, he conceives, to fall back flatter than the quadrant pitch. For, in general, says he, the flatter it is made to lie the more secure it will become; but the steeper it is carried up, the fewer materials and the less labour it will require." And in forming a work of this nature "the *foundation* should, he says, be laid pretty deep,

to guard against any accidental scoopings of the floods. The wall ought to be carried up dry, or without mortar, the stones being laid with their ends outward, their inner ends pointing to the same centre, like those of an arch, and to be backed with gravel or earth, rammed in firmly, behind, as the facing is carried up. The *coping*, or uppermost course of the stones, should be securely bound, with thick tough sods (8 or 10 inches deep), whose surfaces, when beaten down, ought to lie even with that of the stonework; and similar sods require, he says, to be laid, with a gently rising slope, until they unite smoothly with the natural turf of the land to be defended: so that the waters of floods, when they rise above the stonework, may have no abruptnesses to lay hold of; but may pass away, smoothly, over the surface of the land, as they commonly do over smooth greensward, without injury." And lastly that "the stones are to be beaten forcibly into the bank, with a rammer, a mallet, or a small battering-ram adapted to the purpose; thus rendering the whole conpact and firm to resist the current. Where vacancies or fissures still appear, long splinters of stone are to be driven in, as wedges, to increase the firmness, and prevent the current from tearing out an unguarded stone. It follows, in course, he says, that the largest and longest of the stones ought to be used where the greatest resistance is known to be necessary," in order that the greater security may be attained.

It is remarked that this sort of defence, like that of every other species of the river kind, "requires to be attended to from time to time, especially after great floods. If the foundation be laid bare, it requires to be re-covered with rough gravel, or with stones thrown loosely against it. If any of the facing stones be displaced, or loosened, they are to be replaced with others, or to be wedged in afresh. Or, if the turf which binds them at the top be disturbed, the torn part should be cut out, square, and be firmly and completely filled up, with fresh turves." It is added, that this method of defence against rapid rivers originated in the ingenious writer's own experience and practice; and that when compared with a wooden guard it is cheap, sightly, and durable.

It is noticed by the same writer, that there are cases of other kinds, as those which are found in the skirts or margins in the vallies of mountainous situations, through the plains of which "the rivers are found winding with devious courses, or tracing the margins at the feet of the containing heights. In some instances, they are, he says, confined in deep sunk channels, whose banks they seldom overflow; but, much oftener, their channels are sunk a few feet, only, beneath the general surfaces of the lands they pass through. Hence, in high floods, they may, he says, be said to be let loose over the plains, to ravage them at pleasure. Their immediate banks, however, are generally the victims of their rage. These they tear away, and ransack off their better parts; substituting beds of stones and gravel, or perhaps their own channels, in the stead of what were, a few hours before, valuable lands."

And he adds "that there are instances of mountain torrents, on rushing out of their confined channels into flat vale districts, ravaging many acres during a single flood." And to confine or direct these, is, he observes often a business of vast difficulty and trouble.

In these cases the "best endeavour of the artist is generally, according to Mr. Marshall, to give the river a direct or straight-forward course on its quitting its restraining channel, at its first entrance into the area of the plain; and, if no obstruction lies in the way, to continue the straight line to another restraining channel, at the lower end of the area to be improved." But that where "the area is winding, or some obstruction rises within it, so that a straight line cannot be drawn from the entrance to the outfal, an insuperable difficulty may, he says, seem to frustrate this mode of improvement; as the current requires to be bent, not only after it has entered the plain, but after it has acquired an increase of velocity by moving in a straight course." By actual practice and experience, he says, he "was led by another circumstance belonging to it, to what may, perhaps, be considered as a principle, in conducting improvements of this nature. A straight cut, from *a* to *b*, *fig.* 4, Plate XXIV. was desirable. But the point of rising ground *c* rendered it impracticable. Near the centre of the flat, a large insulated fragment or islet of rock *d*, rose ten or more feet above the level of the area; and at the lower end of it, near the natural outlet of the river, a bank of rock *e*, had formerly been washed by it." It was easy, he says, "to perceive, that the insulated rock, which commanded both the extreme points of the area might be employed in uniting them; and that, by the use of the rock *e* the work might be rendered complete. For, by opening a straight course from *a* to *d*, and another from thence to *e*, the current would be directed, in another straight line, to *b*, and the site of improvement be entirely freed from its injurious effects." He remarks, that in few instances "prominent rocks, firm enough to resist the current of an impetuous river, rise in the areas of river-worn plains. But, that, on the sides of mountain vallies, rocks are common; and, may doubtless, in many instances be employed, he says, to throw the river, from side to side of a crooked valley, in straight reaches; as rays of light may be reflected in continuation by well-placed mirrors. Even where natural rock is not present, either in the area, or on the sides, of such a plain, or flat-based valley, rising grounds may frequently be found within the former, and are never wanting on the sides of the latter. And, against these, artificial butments, of sufficient strength, may not unfrequently be formed, in alpine situations where stones are generally plentiful," without any very great expense.

It is observed in respect to the *altering* the *course* of a *river* or brook, that the difficulties and expense "depend on the particular circumstances belonging to

it. In a simple case, in which one straight cut, only, is required, the principal difficulty, and that which requires the best skill of the artist, lies in directing the current of the first flood, out of the old into the new channel. But if a bend of the old channel, like that at *a*, in the above case, can be made use of, this difficulty may be said to vanish. The mouth of the new cut receives the current with a straight course; consequently, if it be made of sufficient capacity, the river in a *flood* can have no propensity left towards its old channel; and the loose materials which rise in forming the mouth of the new cut will generally be sufficient to turn the stream, at low water, into it. But if a suitable bend cannot be approached, by the new cut, a directing pier, like that at *fig.* 3, will be required to bend the flood-current, and give it a straight forward course into the new channel; a water-tight dam being formed between the point of the pier and the firm bank of the new channel; to prevent the water from regaining its former course or direction."

In regard to "the cutting of the new channel, it is merely, he says, a work of manual labour; being attended with no other difficulty than what may arise from the expense; which will depend on the size of the river, the nature of the ground to be cut through, and the value of labour in the given district. It is mostly to be ascertained, with sufficient accuracy, by previous calculations." And it is added "that the required *size* of the *new cut* is small compared with that of the old channel. For the currents of floods, by carrying off the earthy particles with which they come in contact, will soon enlarge it. It is nevertheless, he thinks, right to give ample room in the new channel, lest the first flood should prove high, and, by bursting its bounds, force its way back to its former course." Therefore, in order to give the required capacity to the new channel, and "to allow for its widening, the materials which arise in making it, ought, he says, to be formed into regular embankments on either side of it, and at sufficient distances from its brink, to obtain the above purposes; and, moreover, to protect the adjacent lands from the injurious effects of unrestrained floods." And it is further suggested "that a new river course requires to be carefully attended to, during a few years after it is opened,—to see that its channel preserves its straightness, and that no breaches are made or threatened in its banks." And he thinks that "considering the uncertainty of extraordinary floods, it cannot be said to be out of danger in less than three years." Of course, in contracts for these works, in these cases they should be upheld for that time, and then delivered up in the state fixed upon in the agreement.

There are still other cases of rivers in low-land situations, where the "currents of rivers are generally sluggish, and their beds deep sunk and narrow, with few shoals or firm bases on which to found piers or bulwarks, and few stones with which to raise them; and even if erected, the sluggishness of the current may render them ineffective. In these cases the banks are steep, and often of the tenderest earths, liable to the slightest attacks of agitated water, especially near their feet, where they are naked of vegetable covering. Hence, it is from the frettings of minor floods, or the waves of the dead water which occupies the channel of a river of this description, that its banks are worn away; especially at a bend which faces a length of reach, in which the waves have room to rise. These, fretting against the foot of the bank, undermine it. The face of the bank, in consequence, shoots down; and the prostrated soil is dispersed by the next flood." It is consequently observed that the most essential work, in a case of this kind, is to guard the foot of the bank up to the level and somewhat above the level, of low water. And, this done, to slope back, smoothly, the upper part of the bank, to enable it the better to support a vegetable covering, and withstand the attacks of higher floods, as well as to render it less dangerous to pasturing stock, and enlarge their field of pasturage." And that when with the increase of capacity the channel is still unable to contain the waters of great floods, lines of embankment may be raised on either side of it, with the soil removed in forming the slopes; and thus restrain them within due bounds. Likewise in particular parts, as at sharp bends, when ordinary sward, or pasturable turf, is not able to prevent the current, in this trying situation, from breaking up the soil, it should be bound more securely together, by stronger rooted plants. Of which the osier is said to be profitable to be planted, upon the top of a rich river bank; but it is altogether unfit to occupy its face, for the purpose here required (though commonly used); as it tends to counteract one of the intentions proposed, in sloping back the face of the bank; by filling up the space thereby prepared for the waters of high floods to spread in; and thus increases the current at the foot of the bank. A much more eligible and effectual guard presents itself, Mr. Marshall says, in the furze,—whose roots not only form a mat of strong fibres in the soil, but bind it down to the substratum in a singular manner. Yet even the furze, if suffered to run up to its greatest height, may frustrate the intention of propagating it. It ought, therefore, he thinks, to be cut down, from time to time, as fuel; or to be kept close mown, so as to form an invulnerable shield to the face of the slope." But it is observed that "if we examine into nature's practice in guarding the soil of river banks, we shall find it carried on with the best effect by the butter bur (*tussilago petasites*)."

But in these cases of securing the banks of rivers Dr. Anderson has long since given more full and ample directions.

He remarks, that "when a river runs in a bed of rich vegetable mould the least accident that may chance to direct the stream towards any particular part of the bank causes it to sweep away large tracts of fine ground to the very great detriment of the proprietor, as well as the public, as this fine mould is usually carried to the sea, and the materials that the water leaves to occupy the new bed that it thus forms for itself is generally of a much worse quality, consisting chiefly of stones, sand and gravel. And

that where the whole force of the current is quite close to the bank, and the materials necessary for fencing it are not to be there found, it may, perhaps, be impossible, or very difficult, totally to prevent this evil; but for the most part it admits of a cure that can be obtained at a pretty moderate expense. For if you carefully observe the banks of rivers you will readily remark that these ravages are always most considerable at those places where the bank rises perpendicularly to a pretty considerable height above the ordinary surface of the water, and never at those places where the banks shelve down gradually toward the water's edge; for when the river is swelled to a great height by rains, and runs with a greater force and rapidity than usual, it strikes violently against these perpendicular banks that directly oppose its course; and as they are composed of earth quite bare and uncovered, they are easily softened by the water and quickly washed away, so that the upper part of the bank being thus undermined falls by its own weight into the river, and is carried off in prodigious quantities. But when the river rises to any considerable height, it gently glides along the surface of those parts of the bank which shelve gradually downwards to the water's edge, which being defended by the matted roots of the grass with which it is covered, scarcely sustains any damage at all, and is nearly the same after the water has retired within its banks, as before the inundation took place. He thinks that these are facts, which no one, who has bestowed the least attention to this subject, can fail to have observed; and they clearly point out that the first and most necessary step towards a cure is to level down the edge of the bank that is next the water, so as to make it slope gradually down towards the river. And that where the bank is very high, and you have no other particular use for the earth that must be taken from it; the easiest method of disposing of it will be to throw it into the river: but in whatever manner you dispose of the earth the slope of the bank must be continued until the inner edge of it is as low as the surface of the water at the driest time of the year, and be made to ascend gradually upward from the water with an easy slope, till it comes to the level of the ground, or at least rises to such a height as the water never exceeds. And the work ought to be performed as early in the summer as possible, and the slope should be either immediately covered with turf pared from the surface of some field that has a very strong sward upon it, taking care to lay their ends in such a manner as to be in as little danger as possible of being washed away by any accidental flood that might happen before they are grown together; or if turf of this kind cannot be had it should be sown very thick with the seeds of some small mat-rooted grass that should be kept in readiness for that purpose, such as the creeping meadow grass: if the stream has not been extremely rapid at the foot of the bank some of the earth that was thrown into the water will be allowed to subside to the bottom, and will there form a bed of loose soft earth, which will be of very great use afterward in preventing the face of the bank under water from being washed away; but, in order to secure this bulwark effectually for the future, the surface of this soft earth ought to be instantly stuck full of the roots of bog-reeds, flags, water-spiderwort, rushes, and other mat-rooted aquatic plants, which, if allowed to remain till they have once struck root, will afterward form a barrier that nothing will ever be able to destroy, as at *fig.* 5, Pl. XXIV, which represents a river with a high bank, and at *fig.* 6, the same bank cut into a slope and part of it thrown into the river and aquatic plants growing upon it. It is added, however, that if the stream be too rapid to admit of this, and the bank of soft earth much deeper than the surface of the water, as at *fig.* 7, it will be, he says, of great use to fill up the breast of the bank with small loose stones, with a little earth intermixed among them carelessly thrown in till they rise near the surface of the water, which would most effectually secure it against any future encroachments if the bank is sloped away above as shown at *fig.* 8. It is further stated, that in case it should so happen that stones cannot be easily got for this purpose, the only resource is to dig the bank so low as that at the undermost edge it may be always below the surface of the water, and carry it out in this way for a considerable distance, and then stick the whole surface that is below the water, full of mat-rooted aquatic plants, strewing it over if possible with a thin bed of small gravel or sand, as convenient, which will in a great measure, if not entirely, defend it from any future encroachments. And this bank ought to continue to shelve downwards, even where it is below water, as shown at *fig.* 9, and those aquatics that will grow in the greatest depth of water be planted on the innermost bank, and the others behind them. The water-spiderwort will grow in four feet depth of water, and the roots of the common yellow-flowered water iris forms such a strong and compact covering upon the surface of the soil on which it grows, as would defend that soil from being affected by the water almost as well as if it were a rock. It is likewise, he adds, an advantage attending this plant, that it grows upon a firm bottom, and chiefly delights in running water. But where the stratum of soft earth is not so deep as to reach to the surface of the water, and lies upon a stratum of rock or hard gravel, there will be, he says, no occasion for throwing in stones of any kind. But as it is difficult to unite the vegetable mould to any of these stratums, there will always be some danger of its separating from them in violent inundations, and if the water once gets an entry the breach will not fail to grow larger and larger by every inundation. To prevent this inconvenience it will be necessary, after you have sloped the earth away till you reach the gravel or rock, to cover the place where the edge of the earth joins the inferior stratum, with a good many small stones, if they can be found, sowing between them the seeds of any kind of plants that you think are most likely to thrive, which have strong matted roots, with as small and flexible tops as possible. But where the object is of great importance, it will be still more effectually secured if the face of the rock be dug entirely away for

some distance backward, and the place which that rock originally occupied be then filled up with earth, and sloped back in the same manner as if it had been an earthen bank in which no rock was to be found. In all operations of this sort great care should be taken that no stones should be mixed with the mould, for every thing that makes an inequality on the surface, or a difference in the firmness of particular parts, is extremely pernicious. It is evident, he says, that from the impossibility of ever making earth adhere firmly to stone of any kind, it must always be an improper practice to face the banks of a river to a certain height with stone which is capped at top with earth: as it must always be liable to be removed. This method has been since found to answer perfectly in actual trials in such cases.

There is, the same able author observes, another mischief produced by the swelling of rivers, from the water overflowing the rich flat ground, that is frequently met with on the sides of them, which sometimes prevent them from being got laboured at the proper season, sometimes sweeps off at once the whole crop, and sometimes destroys it by covering the whole surface with stones and gravel, to the unspeakable detriment of the possessors of such ground. And as these lands, sometimes termed *haughs*, are, he says, generally very rich and fertile, and sometimes of great extent, the damage that is done by not getting them properly cultivated is very considerable. In respect to the mode of removing this sort of inconvenience it is remarked, that these haughs are seldom of great extent excepting on level tracks where the water runs with no impetuous current, and therefore they may in general be preserved by means of a sloping bank raised all along the side of the river as far as the haugh extends, which if formed by the same plan as those described above, will easily confine the water within their boundaries till it rises so high as to overflow the top of the bank; so that if these are raised to a sufficient height towards the back part, in such a manner as to be capable of containing the whole of the water that at any time flows down the river, the fields on each side will be effectually secured. He says, that where the surface of the ground in the haugh is at any considerable height above the water in the river, as at A B, *fig.* 10, the bank may perhaps be raised to the necessary height by throwing the earth that is taken from the brink of the river at A, *fig.* 11, to the other side of the bank at B, so as to form the new surface of the bank on the direction E, instead of the old surface A B. But if the surface of the ground is level, as at E F, *fig.* 10, on the opposite side of the river, the earth that is taken from the triangle F G H, *fig.* 11, will not in that case be sufficient to fill up the whole triangle G I K, and raise the bank to a proper height, to make which deficiency it will be necessary to dig a ditch K L E, at the back of the bank, throwing the earth into the higher part of the bank I K L, and facing up the line E K L with stones or turf, so as to make it become a fence to one side of the field that it preserves from inundations. However, where the surface of the ground is extremely low, so as to be but little above the level of the water, as at L M, *figs.* 12 and 13, then instead of raising the bank on each side to the height of A B, *fig* 13, it will be more advisable, he says, to raise them only to the height of the line E F, as in that case it would be very difficult to find so much earth as would form the banks at A K D, and E G B, although there will be no difficulty in forming the smaller one K L and G E M, and as the area E F G C D K is equal to A B C K, these lower banks will contain an equal quantity of water within them, as the higher ones would have done; the greater width between them making up for their want of height. And it is conceived, that in this way it will be in the power of any man so to proportion his banks to the circumstances in which he finds himself placed, as in the easiest manner to accomplish his design; for if he has plenty of materials at hand he may rear his banks to a greater height, and confine the river to a narrower course, and if he finds a deficiency in that respect he may make them of a smaller height, and allow the river to spread to a greater breadth. It is added by the writer, in concluding his account, that this method has been found to answer well in actual practice. But that in some cases it was found that while the bank was new raised, and before the surface was grown together, some parts of that surface were broke a little when the water rose to a great height; in this case the bank consisted entirely of loose sand, which is the worst material it could be formed of; but this was easily repaired at a very small expense, when the water subsided. If these small breaches, however, had been neglected, there is no doubt, he says, but the whole would quickly have been destroyed. It was found, he adds, that a few small stones laid upon the surface of the sward, near the edge of the water, proved in this case a very useful addition. In cases where the sward is firm this caution would have been unnecessary. Whoever attempts this mode of fencing should, he says, take care to provide themselves with a sufficient quantity of the seed of the plant usually called *sprots*, to sow near the edges of the water, for these other kinds of grasses are shelled, and without this precaution the surface remains bare, and is therefore liable to be washed away with the water during the time of floods.

There are other cases in which attention is sometimes necessary to rivers, which are in those of the vale kinds, which run in very serpentine or crooked directions. In these cases it is sometimes proper to straighten them, though it is in but few instances, Mr. Marshall thinks, that this can be done with propriety and advantage, in respect to profit. And though the principles and management are the same in the execution, there is much difference from the want of suitable materials, &c.

The instances in which the courses of rivers that have their beds greatly sunk below the general level of the surface of the lands, as five or six yards, may be straightened in a profitable manner, are, it is observed, where two reaches or straight parts run in a

line with each other; but are separated by a narrow neck of an extensive tract, somewhat in the manner as seen at *fig.* 14.

As in this case nothing more is required than that the earth which is taken out of the cut at *E* should be thrown into the ends of the old bed as at *D D*, by which the stream both at low water and in time of flood must possess a straight unimpeded course. And by this means the proprietor *a* not only obtains an acquisition of ground in the old river bed for different purposes, but on his own side the river gains a length of straight ground for the plough or scythe. But at the time this proprietor is thus benefited, the property of *b* may be injured; as by shortening the length, and that of straightening the direction of the river, the force of its stream or current at the bend *C* may be considerably increased, and the land there greatly endangered. Hence Mr. Marshall thinks, that this obvious alteration should not be undertaken, except under the sanction of a commission of drainage, or till the proprietor below be indemnified for the injury that may be sustained. It is suggested, that in the above instance, half of the bed of the old river might be a sufficient indemnification.

There are however, a great variety of small streams and rivulets in the bottoms of steep declivities, that have such winding and serpentine courses, that they might be straightened with not only profit, but vast advantages to the lands on the different sides. In many situations it is disgraceful to see the destruction and injury that is caused by these little winding streams in the time of floods.

River *Guards*, such piers, mounds, or other solid embankments, that are carried out for the purpose of altering, directing, or confining the courses of rivers. They are distinguished into common, and what are termed *dwarf* guards; the former being those employed for large rivers, and the latter, such as are made use of where the force of the currents are less violent.

The substances that are most commonly made use of in this intention, are all sorts of hard weighty materials, such as rough coarse stones of different kinds, large pebbles, heavy pieces of timber secured by piles firmly driven into the ground, and supported behind by coarse gravel stones, or other similar materials, the roots of trees with the earth about them, posts firmly driven in with planks nailed to them, and well banked with strong substances, piles driven in and wattled, with sods being well banked with the same substances. Various other materials are presented to the attention of the workmen in different situations and circumstances.

River *Weeds*, such sorts of plants as grow on the sides and other parts of rivers. When collected in large quantities they are highly valuable for the purpose of manure. And in compost with other substances they have been found of much utility in the practice of several writers in the Transactions of the Bath Society. And Mr. Crowe, of Lakenham, in Norfolk, according to Mr. Young's Survey of that district, "manures four acres annually for turnips, with the weeds of a river that runs by his farm; the plants are chiefly the *philandrium aquaticum* and *sium nodiflorum*, the water hemlock and water parsnip." It is stated that, "he lays twenty loads of thirty bushels per acre, and ploughs in directly: are as good on sand and mixed loam as the best dung; but not equal on stiff soils." And it is added, that "Mr. Bloomfield of Billingfold, has been in the habit of manuring his turnip lands with weeds fresh from the river, and ploughed in quickly: they have answered as well as yard muck."

Where these sorts of materials are made use of for the purpose of manure, the plants should be removed while in their most succulent green states, and be turned into the soil as quickly as possible afterwards. In the making them up into composts, a great loss is probably sustained in the extrication and dissipation of the more fluid parts.

It is obvious that as a manure they must be the most useful when applied to the light friable descriptions of soils, as in these they run more rapidly into a state of putrefaction. It is probable they cannot be used with advantage on the stiff heavy soils in their green state. See *Weeds.*

RIVET, in *Farriery*, the extremity of the nail that rests on the horn in shoeing a horse. See *Shoe, Nail, &c.*

RIVETS, a term sometimes applied to a sort of bearded wheat. See *Wheat.*

ROAD, a track constructed with some sort of hard materials for the purpose of travelling upon, with carriages, horses, and other animals. Roads are of different kinds, as public, and private or parochial. And the first sort may be sub-divided into toll and free roads and the latter into lanes or bye roads; there are likewise other sorts of roads as carriage and horse tracts. It has been remarked by an able writer, in the first Volume of Communications to the Board of Agriculture, that the conveniencies and beneficial consequences which result from a free and easy communication between different parts of a country and district are so various, and the advantages of them so generally and extensively felt, by every description of individuals from the highest to the lowest, that no labour or expense should be spared in providing them; as without such ready means of intercourse, all sorts internal commerce and improvement are either much embarrassed or wholly at a stand.

It is indeed well added that "roads and canals, or navigable rivers, may justly be considered as the veins and arteries through which all improvements flow. To internal commerce and agriculture, they are as the veins and arteries to the human body. Through these the blood circulates in every direction, and thus keeps alive the animal system; but, if this circulation is by any means checked or obtructed even in the remotest part, that part soon becomes useless, and sinks into decay, and in some degree is felt throughout the whole body. So it is with respect to the commercial and agricultural systems. Without a free and uninterrupted intercourse, it is impossible they can exist, or at least produce, to the community at large, so many important benefits as they otherwise might have done. How many, for example, are the places in almost every country, that might be rendered doubly valuable, was the access practicable and easy. How immense the quan-

ilies of tthe fines timber, perhaps growing in inaccessible woods, which on that account alone are lost to society. How many the valuable *strata* of the richest metals and minerals, which, from the same cause, lie buried and undisturbed in the bowels of the earth; and how many thousands of acres of the most fertile soil, that might be improved and cultivated to the highest degree of perfection, and thus very largely contribute to increase the food and the comforts of man, were the ingress and egress rendered practicable and free." And the "value of a farm, consequently the riches, perhaps the strength of a country, greatly depend on an easy and uninterrupted communication."

The able author of the "Wealth of Nations," has also well suggested that "good roads, canals, and navigable rivers, by diminishing the expense of carriage, put the remote parts of the country more nearly upon a level with those in the neigbourhood of the town. They are upon that account the greatest of all improvements. They encourage the cultivation of the remote, which must always be the most extensive circle of the country. They are advantageous even to that part of the country. Though they introduce some rival commodities into the old markets, they open many new markets to its produce."

It is further observed, that "the Romans were so sensible of this, that we are told the first writer says that they did not think it beneath the dignity of the commonwealth, to attend to the conveniences arising from good roads. That great and wise people, it is said, carried on, at an immense expense, roads whose remains are to this day the admiration of the curious, from the centre of the empire to many of the remoter provinces. The readier march of their armies was, perhaps, he thinks, their first motive, but the easier intercourse of the several parts of that great empire was another, which they had too much prudence and too much wisdom to overlook. We are also told by Diodorus, Strabo, and other historians, he says, that the famous Semiramis being so fully convinced of the importance of an easy and general intercourse, applied herself to render the roads practicable throughout the whole extent of her empire."

And Mr. Donaldson states, that "in an agricultural view, the benefits derived from good roads are incalculable. Before the establishment of turnpike roads in England, many parts of that kingdom, like the highlands of Scotland, were, he says, scarcely accessible. Coal, manure, grain, &c. as is still the case in many parts of Cornwall, were carried on horses' backs. Where waggons were used, seven or eight horses were necessary to draw about two tons, and seldom were able to proceed above twenty miles in a day. Now, where turnpikes are established, or other means used for keeping the the roads in a proper state of repair, the same number of horses will draw at least five tons, and travel nearly double the distance with much more ease. How absurd then, continues he, for any person to scruple the payment of an inconsiderable toll, when the saving is so great and so evident; where the tear and wear in the one case is not one twentieth part of what it is in the other!"

It is contended by Mr. Bentson! in respect to the turnpike laws in this country, that they "are liable to many exceptions; for although immense sums of money are annually levied for the purpose of making and repairing the highways, yet either from bad management, from party influence, or from the chicanery and ignorance of surveyors and contractors, the roads in many places, are not only laid out in the most absurd direction, but are so badly constructed, and kept in so wretched a state of repair, that they are almost impassable. It is surprising, says he, that in so enlightened a country, and where the turnpike laws have so much engaged the attention of many very ingenious men, those laws should still remain so very defective; more especially as there is hardly a country gentleman who attends a turnpike meeting, but considers himself completely master of the whole business and management, as well as of the making of roads; at least, if we may judge from the violent disputations and bickerings that frequently happen at these meetings, where a proposed new line of road, or perhaps the repair of an old one, will sometimes be contested with as great keenness and vehemence, as if the parties were contending whether Great Britain shall be a monarchy or a republic." And it is contended that "it too often happens, that party influence rules the proceedings at such meetings, and that those who are entrusted with the management of this business, delegate their powers, and trust the inspection and whole management and direction of the roads, to some ignorant or pretended surveyor; who, almost to a certainty, will impose upon them, especially if he is empowered to settle with contractors; and thus the business of the public, in one of its most important concerns, is either altogether neglected, or terminated according to the convenience of the strongest party, without any regard to the interests of the community at large. In support of this assertion he has, he says, only to refer to many parts of the principal thoroughfares in Britain. In some, it will be observed, the roads are directed in the most irregular zig zag manner, through a level part of the country, where they ought evidently to have gone straight forward. In other places, the traveller and the public, and the poor overloaded horse, are obliged to submit to all the inconvenience, the labour, and the fatigue of ascending and descending the steepest hills, when they might have gone, with the greatest ease and comfort, on a level road," by proper attention in the first making and laying them out.

"He is however, he says, "far from thinking it would either be just or proper, to force a road, unnecessarily through any part of a gentleman's property, without his consent, unless for very powerful reasons indeed.

"If to avoid a steep ascent, or to shorten the distance considerably, and that there is no other way to do so, in that case there should be no hesitation; but if the advantages to the public are not very material, and that another line can be adopted, nearly as good,

which will do less injury to an individual, the latter line should unquestionably be preferred" in all such cases.

"It should be a general maxim, he thinks, that private considerations ought, in all cases, to give way to public convenience and advantage. Society, says he, is formed for the mutual and general benefit of the whole, and it would be a very unjust measure to incommode the whole, merely for the convenience, or perhaps to gratify the whim or caprice of an individual. However, the property of an individual ought by no means to be taken to serve the public, without allowing him, not only the full value, but more than the value, proportioned to the inconvenience or injury he may sustain" by the measure.

But he contends that "while the present turnpike laws remain in force, and the common mode is practised of choosing surveyors annually, or by rotation, without the smallest regard to abilities or experience, it cannot be expected the public convenience will be so much attended to as it ought to be; neither is it to be expected, that the generality of surveyors, so chosen, can know the proper directions to give, in making or repairing roads, nor the proper manner of making estimates, so as either to conclude an agreement with an artful contractor, or to form a correct judgment of such proposals as may be made. From these disadvantages, it is, he says, inconceivable the loss that may be occasioned, or the mischief that may be done, by an ignorant and inexperienced surveyor." For he is decidedly of opinion, that "a surveyor of roads, should be a man of considerable abilities, and of the strictest honour and integrity. A man not apt to be swayed by party influence, or by private or personal considerations; for if he once allows himself to be led away or biassed by these, or to act in any manner inconsistent with the public interest, he is unfit for that office. He ought not to be a man, who has all his lifetime been confined to the narrow limits of a single district or county, or who has suddenly, or by a slender recommendation, been brought forward, as a person fully qualified for so arduous an undertaking. He ought to have seen, in various places, the different systems adopted in the management and construction of roads, and to have made it a particular object of his attention, the judging of the best and most advantageous practices," under the particular circumstances of different cases.

Besides these there is, he says, "another probable reason why under the present system, the public roads cannot be so impartially managed and conducted as they ought to be, in the unlimited power given to country gentlemen, over the roads in the county or district in which they live. Many of those gentlemen, for their benevolence and liberality, are, he says, truly deserving of every praise that can be bestowed upon them; but, however honourable and respectable they may be, and however desirous to promote the public good, it would be doing an injustice to human nature to suppose, they can view, with impartial eyes, the fine plantations, the beautiful inclosures, and other improvements, they have made on their estates. We may, says he, as well imagine, that a doting mother, can coolly and deliberately see an incision made in the skin of a darling child, however much it may be benefited by the operation, as that a country gentleman can with indifference behold a turnpike road carried through an inclosure, which he himself has been at the pains and the expense of adorning." He adds, that "so situated, it is natural to believe this gentleman would wish that road to go in any other direction, even though it should not be quite so convenient to the public. He will not only use his own persuasion and endeavours to point out arguments against its coming that way, but he will even endeavour to prevail on his friends to exert themselves also, and thus a party is often formed in opposition to the public interest; and if he is a man of opulence and power, and generally respected, it is more than probable, he says, his influence will prevail," in the business.

It consequently appears to him necessary in order to obviate these abuses and inconveniences, that "there should be a controlling power over the measures proposed by country gentlemen respecting turnpike roads: for to allow those gentlemen to decide ultimately on the laying out a new road through their own lands, or even on the distribution of the money to be expended in repairing old roads, is in fact, he thinks, making them judges in their own cause. In short, it is an object so truly important to the interests of the community at large, and of the kingdom in general, to procure the most easy, safe, and expeditious, and the least expensive intercourse with every part, by means of the best roads, that it is a measure, he presumes, highly deserving the attention of the legislature;" and which from the great extent of business would probably require a Board with proper surveyors appointed by it for the purpose.

If some plan of this nature "were adopted, we should then, he thinks, hear no more of those numerous complaints that are so often made respecting the abuses committed in the management of turnpike roads, and of the money levied at the toll-bars, at many of which, it is said," by the author of the "Wealth of Nations," "the money levied is more than double of what is necessary for executing in the completest manner, the work which is often executed in a very slovenly manner, and sometimes not executed at all."

In respect to the improvement of both the public and private roads, the following hints have been thrown out in the able Survey of Shropshire: "In lieu of surveyors in each parish (who are generally chosen in turn, and consequently have neither time nor experience sufficient to act properly, and are generally not inclined to exert themselves by enforcing the duty, &c.) the writer would propose for the magistrates to have power to appoint a proper surveyor with a salary, who should act under their direction, and be amenable to them for his conduct; such surveyor to undertake the arrangement of a certain district (say 10 miles square) whose duty it should be to employ deputies, to call in and see the statute duty done under his direction: by this means the forming of the roads, which is the first principle, would be done in the most approved method, and

the statute duty regularly called out. There may be an inspector, an inhabitant in each parish, appointed, and chosen yearly, whose interest it would be as well as his duty, to act as a check upon the general surveyor and his deputy; this office being easy, might be filled by one of the most liberal persons in the parish. He apprehends that an arrangement of this sort would very soon insure good private roads. And something like the following would, he thinks, procure good turnpike roads also, namely, the trustees of all the turnpike roads throughout England, to be obliged to erect weighing engines, at all their gates or bars at which tolls are received, on or before the 24th of day of June next, the expense of such erections to be repaid to them, by their being empowered to add to their present respective tolls, any sum to be paid by such carriage to be weighed, not exceeding so much as has been heretofore paid within one year last for the tolls; such sums to be paid, until all expense of erecting the said engines shall be fully repaid. The account of such repayment to be made out and settled by the clerks and gatekeepers belonging to the respective roads, and to be attested upon oath before two justices of the peace. And from and after the said 24th day of June next, it may be lawful for all carriages to be drawn with any number of horses along any turnpike road.

"But to prevent the injuries done to the roads, by the great burdens too frequently drawn along them, it should be enacted, that from and after the said 24th day of June, it should be lawful for all trustees appointed by any act or acts of parliament, for the repair of any turnpike road, or any five or more of them, and they should be required at a public meeting, to be held for that purpose on or before the 24th day of April next, to order to be erected at all the gates and bars which they have erected or shall erect, for the receiving of tolls, or upon any part of the road within their respective jurisdictions, and at such a distance from any turnpike, bar, or toll-gate, as they shall think requisite and expedient to order and cause to be erected, a crane, machine, or engine, proper for the weighing of carts, waggons, or carriages conveying any goods or merchandize whatever; and by a writing signed by them, or any five or more of them, to order all and every such carriage or carriages which shall pass loaded through any such gate or bar, to be weighed, together with the loading thereof, and for them, or any five or more of them, or for any person or persons empowered by any five or more of them, to receive and take, over and above the tolls already granted, or hereafter to be granted, the sum of 10s. for every hundred weight of 112lb. to the hundred, which every waggon or cart hereafter described, together with the loading thereof, shall weigh over and above the weights hereafter allowed to each of them respectively; (that is to say) to every waggon or four wheel carriage, having the fellies or rollers of the wheels of the breadth of 16 inches, 8 tons in summer, and 7 in winter; to every waggon or wain, having the axletrees thereof of such different lengths that the distance from wheel to wheel of the nearer pair of the said wheels be not more than 4 feet 2 inches, to be measured at the ground, and that the distance from wheel to wheel, of the other pair thereof be such, that the fore and hind wheels of such waggons and wains shall roll only one single surface or path of 16 inches wide at the least, on each side of the said waggons or wains, and having the fellies thereof of the breadth of 9 inches from side to side at the bottom or sole thereof, 6 tons 10 cwt. in summer, and 6 tons in winter; to every waggon or four wheel-carriage having the sole or bottom of the fellies of the wheels of the breadth of 9 inches, 6 tons in summer, and 5 tons 10 cwt. in winter; to every cart having the fellies of the same dimensions, 3 tons in summer, and 2 tons 15 cwt. in winter; to every waggon having the sole or bottom of the fellies of the wheels of the breadth of 6 inches, 4 tons 5 cwt. in summer, and 3 tons 15 cwt. in winter; and to every such waggon so constructed as to roll and actually rolling a surface of 11 inches by the wheels thereof, 5 tons 10 cwt. in summer, and 5 tons in winter; to every cart having the fellies of the wheels of the same dimensions, 2 tons 12 cwt. in summer, and 2 tons 7 cwt. in winter; to every waggon having the sole or bottom of the fellies of the wheels of less breadth than 6 inches, 3 tons 15 cwt. in summer, and 3 tons 12 cwt. in winter; and to every cart having the fellies of the wheels of the same dimensions, 1 ton 15 cwt. in summer, and 1 ton to 12 cwt. in winter. And if such trustees as aforesaid shall neglect to erect such engine at their respective gates by the said 24th day of June, then it shall and may be lawful for any mortgagee or mortgagees of the said gate or gates to erect such engine or engines, and to take upon them the same power as the said trustees were by the act invested with, and under the same regulations, on or before the 29th day of September next; and if the said trustees and mortgagees, shall neglect to erect such engine or engines by the respective times hereinbefore stipulated for erecting the same, then it shall and may be lawful for all horses, carts, and other carriages, from and after the said 29th day of September next, to go through and pass along such road or roads without any obstruction or payment for tolls whatsoever, until such trustees or mortgagees shall erect such weighing engine or engines as aforesaid, and occasion the same to be regularly used; any thing contained within the respective acts for turnpike roads, to the contrary notwithstanding."

It is usefully remarked in respect to the effects of these regulations, that "First, the weighing engines will sufficiently prevent carriages of all sorts being overloaded, which will be a preservation of the road, whereas, the restraint upon the number of horses does not answer the purpose; for a short and overpowered team does more damage to the roads, than a greater number of horses which draw easy, and consequently pass along much quicker. That disagreeable restraint will be thereby made unnecessary, which empowers and encourages some

poor indolent wretches to wander about the country with their ready printed notices, to catch a prey, which when got is lavished away in drunkenness, debauchery, and disorder; and if they fail in their lawful attempt, which is often the case, and perhaps distressed to the greatest degree, being despised by persons of all denominations, pursue poaching and fowl stealing, which lead to greater acts of thievery, of which there are many instances; for all the convictions are grounded upon the poor wretches as above described, being by the law allowed to be credible witnesses, who obtain the reward to the amount of 5l. or more, when the team owner's servant or servants are all deemed prejudiced: so that as the act now stands, no one is safe from these convictions.

"The occupiers of farms in general, particularly those upon the middling sized ones, find themselves, it is said, very much oppressed and injured by the law now subsisting for regulating the turnpike roads, by their being restrained from drawing more than four horses in waggons, the fellies of the wheels thereof being under six inches broad. Were farmers permitted to draw any number of horses, it would, he says, be of great public utility in lowering the price of those animals, which is now enormously high; the farmer would find it his interest, as formerly, to keep breeding mares, which, with the colts they breed may be made useful great part of the year, provided they may be worked easy. The law as it now stands, acts nearly as a prohibition to farmers breeding horses; for a breeding mare or a colt under five years old is not fit to draw one of four in a waggon with no more than 60 bushels of barley or wheat, which is the common load of the Shropshire or Staffordshire farmers, neither of which being more than two tons, which is considerably under the weight the present act allows to be drawn on the turnpike roads in winter. Before the said turnpike laws were in force, the farmer's team to draw his 60 bushels of wheat or barley, consisted of six in number, two of which at least were mares either in foal or sucklers, two colts, one of them two, the other three years old, which were never oppressed or hurt by their work; consequently a succession came on, and the owner had one or two good sound colts to sell off every year to the harness or draught, as they best suited. Good waggon horses were then bought at from 10l. to 15l. each, which are now, by their scarcity, from 25l. to 35l. and those for the coach, that is, the light active half blood horses, are from 40l. to 60l.

"Another evil occasioned by this law is, that such farmers are obliged to keep horses of the largest size, which consume the produce of much land, by eating a large quantity of corn, when the smaller horses working easy seldom eat any."

It is conceived by the writer, that "upon this principle, a law for regulating roads may be enacted, so as to answer every good design of the present, and at the same time relieve those individuals who are exceedingly injured, and also be of general utility."

It is remarked in regard to "private roads, that they are by no means properly attended to; and which may be attributed to the general highway act being so easy of evasion, that every farmer is able to avoid doing statute duty, or at least next to none. Nothing is more valuable than *time*, especially to a man of business, and a farmer who executes the office of surveyor of the highway, *impartially and effectually*, will find he must neglect no small part of his own business, and after all he might, perhaps, have been as little out of pocket had he done the whole work with his own team and labourers." It is stated that "there is no trick, evasion, or idleness, that shall be deemed too mean to avoid working on the road: sometimes the worst horses are sent, at others a broken cart, or a boy, or an old man past labour, to fill; they are sometimes sent an hour or two too late in the morning, or they leave off much sooner than the proper time, unless the surveyor watch the whole day. It is true, that redress may be had by application to a magistrate; but then how often causes for complaint occur? and how many days must be lost to bring each home to the offender? who *from custom*, thinks he is doing no harm; besides the constant breach of good neighbourhood that must be occasioned by these petty litigations." It is suggested that "a remedy might easily be had in the following manner:—Abolish all personal service upon the highways. Let surveyors be appointed, as at present, who should have power, under the authority of two magistrates, to raise, by rate, certain sums that may be deemed necessary for the repair of the roads within the respective parishes and townships, and to account for the same at going out of office at the year's end. The farmer, who acts as surveyor, might then be able to repair the highways when most convenient to himself, and when he could give attention to them without any interruption or impediment, whereas at present some duty is given up, or nearly so, from the difficulties arising in collecting it."

On the same principles the author of the Present State of Husbandry in Great Britain, contends that an act of parliament should "be introduced for the purpose of rescinding the ancient laws respecting statute labour; which, he says, have in every instance been found ineffectual, and to establish other general rules and regulations more likely to answer the purpose in the now improved state of the country. He adds, that the existing acts of parliament respecting the making and repairing roads, where the justices of peace cannot commute the statute labour, are not sufficient for the purpose of raising a fund sufficient for keeping the roads in repair. Where the justices of peace have it in their power to assess the inhabitants in a sum of money in lieu of the statute labour, it is in general not the want of means, but the misapplication of that means, or negligence in the general management, that is the cause why the parish roads are almost every where a disgrace to the country."

The imperfect and indifferent modes of executing

the statute work, as stated above, render it necessary, it is supposed, that "those statutes enforcing the performance of this necessary duty should therefore be abolished; and in every county the justices of peace ought to be invested with the power to assess the inhabitants of the district by some equitable *ratio*, whereby they would pay only in proportion to the benefit they received. Were this generally done, as is the case in several parts of Scotland, the counties divided into districts of such size, that the proprietors could conveniently meet as occasion required; the money arising from the commutation act collected by one person, who should be allowed a certain *per centage* on the sum collected, be continued during good behaviour, and be responsible for his conduct to the gentlemen of the district; the money so collected be afterwards expended under the direction of these gentlemen, and the whole be subject to the review of the quarter sessions—the parish roads would, it is supposed, soon be materially improved. If to these regulations a power were added to mortgage the sum arising from the commutation of the statute labour for such a number of years, and to such an extent as was found necessary to put the useful private roads in a perfect state of repair, they might, it is supposed, in a few years, be made the reverse of what they are at present. The last measure would be found the most effectual of any that could be adopted, and as probably the only one that can be resorted to for the purpose of effecting an immediate and general improvement."

It has been well remarked by the author of the Landed Property of England, in respect to the improvement of farm lands by these means, that "the art of planning, forming, and repairing roads, is a subject with which for various reasons every manager of a large estate ought to be familiarly conversant. It is not enough for him, he says, to know the theory or general principles of the art. It is necessary that he should study it, practically, in the particular district in which he is placed; and with the given materials that it happens to afford;" as by these means he can only be capable of executing the business with the greatest possible advantage.

In this business a most material point, whether in the *laying* out of *new* roads, or *improving* such as have been long established, is that of giving them all the advantage in direction and other circumstances that the peculiarity of their nature and situation admits of. It has been stated by the above able writer, that "most or all the old roads of the kingdom (the remains of Roman ways excepted) owe their present lines to fortuitous circumstances. Many of them were, no doubt, he thinks, originally footpaths; some of them, perhaps, the tracks of the aboriginal inhabitants, the patriarchal savages, who lived by hunting; or of the pastoral tribes, who travelled with their flocks and herds from pasture to pasture, as herbage and browze invited; or of the first settlers, between biding places which may not now exist." And that "these incidental foot-tracks, especially when they led through woods, became, as the condition of society advanced, the most convenient horse-paths; as we not unfrequently find, at the present day." Consequently that "in this state of society, before wheel carriages were in use, many of the lands of the kingdom were appropriated; by which circumstance those fortuitous lines of roads became fixed and unalterable; there being no other legal lines left for carriage roads, than those incidental horse-ways" or small tracks.

He supposes that in this account of the probable origin of roads, we have at least in part "the cause of the crookedness, as well as the steepness, of carriage roads, between the places which are now inhabited: For true it is, that the traveller is not unfrequently led down one steep, to make an angle, and ascend another; while the hang of the hill would conduct him nearly on a level, and by a more direct line. But admitting that a cluster of habitations heretofore stood at the angle, the seeming absurdity ceases." He adds, that "formerly, it is probable, the zigzag direction of roads, between towns and villages, was much more observable, than at present. In more modern time, and since the legislature wisely interfered with respect to appropriated lands, many improvements of lines have been made. And, by the general laws which have more recently been passed, magistrates are invested with authority to alter established lines. So that now, the expense of alteration may be said to be the only obstacle, in ordinary cases, to the perfection of the lines of roads in this country." And which is of course a circumstance that has had much effect in improving the convenience of travelling.

It is suggested in respect to the direction of roads, that "the most perfect line is that which is straight and level. But this is to be drawn in a country only, which is perfectly flat, and where no obstructions lie in the way:—joint circumstances that rarely happen. Where the face of the country, between two points or places to be connected by a road, is nearly but not quite level, by reason of gentle swells which rise between them, a straight line may be perfect,—may be the most eligible under these circumstances. But where the intervening country is broken into hill and dale, or if one ridge of hill only intervenes, a straight line of carriage road is seldom compatible with perfection." And that "in this case, which is nearly general, the best skill of the surveyor lies in tracing the midway between the straight and the level line. Here the level line of perfection, for agricultural purposes, is to be calculated, by the *time* and *exertion* jointly considered, which are required to convey a given burden with a given power of draft, from station to station. On great public roads, where *expedition* is a principal object, time alone may be taken as a good criterion." It is likewise added that the most "regular method of finding out the true line of road, between two stations, where a blank is given,—where there is no other obstruction than what the surface of the ground to be got over presents,—is to ascertain and mark at proper distances, the *straight line*; which is the only certain guide to the surveyor." And

that where "the straight line is found to be ineligible, each mark becomes a rallying point, in searching, on either side of it, for a better. If two lines of equal facility, and nearly of equal distance from the straight lines, present themselves, accurate measurements are to determine the choice. If one of the two best lines, which the intervening country affords, is found to be easier, the other shorter, the ascent and the distance are to be jointly considered; the exertion and the time required are likewise, he says, to be duly weighed." Further also, that "the nature of the ground, the source of materials and, generally, the comparative *expense* of forming the road, by two doubtful lines, as well as their comparative *exposure*, are to be taken into consideration. A long line of road, across a broken country, should not be hastily drawn" or determined upon by the directors of this sort of business.

In regard to the most difficult and troublesome part of this sort of work, the necessary management in the ascent of hills; it is observed that—"whether in laying out a fresh line, or in altering an established one: modern road surveyors, like many other reformers, have run from one extreme to another. To do away the absurdity of going up one steep, and down another, to ascend a third, in order to reach the required elevation (a common occurrence on fortuitous roads), they have ingeniously, but very injudiciously, given a uniform rise, from the bottom to the top of the ascent. In the theory of mechanics, says he, and where mechanic powers, only, were to be used, a regularly inclining plane would be perfectly proper, in a case of this kind. Where the requisite power is to be applied by rational beings, the same principle though not altogether perfect may be allowed; but when the moving power is neither purely mechanical, nor in a sufficient degree rational, but an irregular compound of these two qualities, the nature and habits of this power require, he thinks, to be consulted." It is, he conceives, "one of many instances, which shew the impropriety of applying purely mechanical principles, in agriculture and rural concerns: in which they are to be combined, not only with the power, but the will, of animals. No man, says he, who has been accustomed to drive a road team, or in the habit of seeing one driven, in a hilly country, and who properly regards what he sees, would lay out a long line of ascent, without one or more breaks, or convenient resting places; in which the animals of draft may relax at their ease, and set off again without difficulty." He however observes, that "theory will readily suggest, that, by a drag staff, or pall, a carriage may be securely stopped on the steepest ascent. But practice well knows the danger of checking the efforts of beasts of draft, while they are struggling against the collar. For if they possess any habits, or even the seeds, of restiveness, nothing is, he contends, more likely to encourage or produce it, then suffering them to stop under the difficulties of draft. Besides those which are true to their work, well knowing the extraordinary difficulty to be overcome, in putting a carriage, at rest, into motion in such a situation, stop under a degree of anxiety; while the more spirited and irritable stand on the rack, and tremble at the apprehension of the painful effort they have to make. But let them see an end, or a respite, of their endeavours, and they will, he says, struggle with willingness. A rest after the difficulty is surmounted, comes as a reward for their exertions." But where "the natural surface of the ground is well studied, in any given case, there will seldom, he supposes, be much difficulty in assigning the places proper for rests;—so as to make the road, not only easier for carriages of burden, but safer and more pleasant to travellers, as well as more sightly: besides being better to be kept in repair, than a uniform descent; by reason of the flatter stages being checks to the surface water, and convenient places to get rid of it, without injury to the face of the road." But where such breaks do not occur, "the line of ascent should be uniform; or as nearly so as the natural surface, or immoveable obstructions, of the acclivity to be surmounted will allow" in the particular case.

In the setting out these lines, "the common level is to be set by an observation from the bottom to the top of the ascent (these points having been previously determined on, by the given circumstances of the general line of the road), or from station to station where a clear view cannot be had between the extremities; and the degree of ascent, thus ascertained, is to be marked, with a pencil upon the instrument" that is made use of for the purpose. And "by this mark, it is advised to trace a rough line along the face of the hill; in order to determine, with sufficient truth, respecting the proper breaks, or resting places, that may be required: endeavouring to fix upon such natural breaks in the slope, as are situated in, or sufficiently near, the general line of ascent. And that when this has been done, to ascertain, by similar observations, the exact angle of elevation, or degree of steepness, of each rise, or length of ascent, between the breaks, &c: by these means procuring an unerring guide, in marking out and forming the base or bed of the road: without the risk of incurring unnecessary labor and expense in doing the work twice over, to bring it to the truth," or a state of suitable exactness.

But it is well remarked by Mr. Marshall, that "the best services of the road surveyor lie in avoiding, not in surmounting, hills." And that "in a long line of road, between places of nearly equal elevation, this may often be done. There are instances of the most public roads going over the tops of hills, where lines of equal length might be traced along their bases; and the difficulty and danger of ascending and descending the steeps be avoided by such means."

Much attention has lately been bestowed on this department of the road maker's business, especially in the more northern parts of the kingdom; but much is still left to be accomplished; especially in the western districts of the southern parts of the island, where an attachment still remains to the original lines or directions.

It is suggested by Mr. Beatson in the paper above alluded to, that the business of laying out the lines of

roads may in fact be reduced to three simple principles, those of fixing upon the *shortest*, the *most level* and the *cheapest* directions, which though apparently very easy of execution, from the frequent occurrence of circumstances that render it necessary to deviate from them, the knowledge and experience of the surveyor are found requisite. The first requisite from its being a straight line, is often necessary to be departed from in order to avoid the removal of expensive obstacles, such as hills, rocks, water and morasses. The second is of vast importance, and "should invariably be adhered to if possible, even though the other two should in a certain degree be given up; for it is infinitely better to go a considerable way about to obtain a level road, than to go straight forward and be obliged to take an ascent; but it may in some cases be preferable even to ascend a gentle rise, in order to obtain a good hard bottom, and a road easily made, than to go on a level through a swamp or piece of water, which would require a much greater quantity of materials, be much more difficult to keep in repair, and occasion a great deal more expense. It is not, he says, the most hilly line to appearance that is always to be rejected as being the least level; for the steeper and shorter some hills are, it will be the easier to obtain a level road in that direction, by cutting down the summits, and laying the materials taken from them, in the vallies or hollow parts, which in many instances may be done with great facility. And the third or the least expensive line is also frequently given up in order to obtain one or both of the other two."

It is therefore concluded that much "depends on the skill and ability of the surveyor, who, before he finally determines on a line of road, ought to make himself perfectly master of every part of the intermediate and adjacent country; nor should he rashly determine at once, but should examine repeatedly, over and over again, whether no other line would be better than that he first thought of."

With respect to the parts or divisions of which a public road should consist, it is obvious that they should vary in some measure according to the nature of the traffic or business which is carried on upon them, the situation in which they are placed, and the particular circumstances of the different cases. It is however contended by the author of the Landed Property of England, that the "plan and formation of all *public roads*" should be the same; "every public *lane* or other scite of a public road, he conceives, ought, where the width and other circumstances will permit, to be divided into three travelable lines, namely:

"1. A middle road of hard materials, for carriages and horses, in winter and wet seasons: 2. A soft road, formed with the natural materials of the scite,—to be used in dry weather,—to save the unnecessary wear of the hard road,—and to favour the feet of travelling animals; as well as for the safety, ease, and pleasantness of travelling in the summer season: and 3. a commodious path, for the use of foot passengers, at all seasons." But in these cases, he thinks, "modern practice has simplified too much. Instead of these three requisites of a public road, we generally find, he says, a parliamentary or turnpike road (away from the environs of great towns) consisting, simply, of one uniform broadway of hard materials;—upon which horses stumble, and carriages jolt, the year round:—while travellers on foot are seen wading to their ankles in mud, or in dust," according to the state of the wind and weather.

"His notion of what the form of a public road ought to be, is shewn at *fig.* Plate XXV. in which *a*, *a* are the fences of the lane; *b*, the foot path; *c*, the hard road; *d*, the summer road; *e*, *e* channels to carry off the water collected by the carriage roads: the foot path being cut across, in proper places, to permit the water, which falls on that side of the middle road, to pass off freely into the ditch *f*; as well as to prevent horsemen from riding along the path, the opposite hedge bank being perforated, to let off, into the other drain *f*, the waters which may collect on that side of the lane or road."

And in regard to *private* roads it is observed, that where they are much used, as in such as lead from a village or other place to a public road, they should have a double carriage path, so that carriages may anywhere pass each other. But that for such as lead merely to a farm house or a hamlet, a single line sufficiently wide to let a single or saddle horse pass a carriage with occasional dilations for carriages to pass, in are only in general requisite.

In regard to the most appropriate form of roads, there has been a great difference of opinion among the persons engaged in this sort of work, some contending in favour of the *convex* form, while others are inclined to think the *concave* shape preferable in many cases; and still others, that they should be either made perfectly *flat* from one side to the other, with inclined planes longitudinally, or be *wholly flat* in every direction. But experience fully shews, that some degree of the raised convex form is necessary in almost every case, in order that the wetness and moisture may be discharged with greater facility, and of course the roads be preserved in a more dry state.

In speaking of this form of road, Mr. Beatson observes, that "the rise in the middle is more or less according to the fancy or whim of the makers, but in general it is a great deal too much. This form is adopted on the idea, that whatever wet falls upon the road will run off towards the sides into drains or ditches made there for the purpose of receiving it. If the road were a perfect smooth hard surface, this theory would no doubt, he thinks, hold good; but in practice it is found not to be the case, for the wheels of carriages occasion so many ruts, and such a roughness on the surface of roads in general, that little or no water can run towards the side-drains, however convex the road may be. It consequently lodges in those ruts, and every succeeding carriage, he thinks, the more easily makes them deeper, and works the materials and water together in such a manner, as very soon to render the road extremely disagreeable. This very frequently happens, he asserts, even on roads that have been made most incommo-

diously convex, for the very purpose of keeping them dry; consequently, the convexity of a road has not the desired effect of preventing water lodging upon the surface. Besides, it is, he conceives, extremely inconvenient for all wheel carriages, and destructive to the road itself, by making the loading rest unequally upon the wheels, unless when going on the very middle of the road, for the lowest wheel will always bear the greatest part of the burden, and therefore will injure the road the more in proportion. If a cart or any carriage with two wheels is loaded, we will suppose, with two tons weight; when that cart is upon a level from side to side, the load is equally divided, and each wheel sustains the weight of one ton, but if that cart is going on the side of a convex road, there will perhaps, he says, be the weight of a ton and a half upon one wheel, and only half a ton upon the other, consequently the lower wheel in this case will do the road as much injury, as if the cart were loaded with three tons upon a level, instead of two upon such a declivity. The proportion of weight upon each wheel, according to the declivity, will depend on the nature of the loading of the cart, for the higher the centre of gravity of the load is, the greater will that weight be on the lower wheel on the same declivity: and therefore a cart loaded with hay, or straw, or wool, or any other bulky commodity, will be more injurious to a convex road, unless when on the middle of it, than the same cart loaded with the same weight of stone, or lead, or iron, or any other weighty commodity which lies low in a cart: and nothing can, he thinks, be more injurious on such roads, than a stage coach loaded with outside passengers. But the destructive consequences of allowing carriages to heel much on any sort of road are even visible, though in a small degree, he supposes, from the effect produced by a wheel going over a stone, or any hard substance lying in one of the tracts or ruts, in which case there will soon be a deep hole formed by the wheel in the other tract, directly opposite to that stone or substance which raised the other wheel. Every precaution ought therefore, he says, to be used, to prevent carriages heeling to one side on any part of a road." And he suggests, that "the inconvenience, and in many cases the danger, of going on either side of a convex road, makes all waggoners, carters, coachmen, &c. keep always on the middle, by which, on such roads, there is seldom any other part used by wheel carriages, however wide the road may be; consequently, by the carriages being always confined to the same tract, that part of the road, he says, soon gets out of repair, and requires a constant outlay of money to keep it in proper order or condition for being travelled upon.

The same writer also adds, that the "method of forming and making these convex roads, in the first instance, appears to him very absurd, as shewn in the figure. He says, that before any hard materials are laid on, the road is generally formed, as shewn in *fig.* 2. in which *a* and *b* represent the drains or ditches on each side. *c c* the footways or horse roads, when made wide enough. These are also sometimes called the summer roads, on account, he supposes, of that being the only season they can in general be travelled upon. *d e* is a convex line, about 10 or 12 inches lower at *d* and *e* than the footway or summer road." After being thus formed and prepared, "the hard materials, mostly consisting of broken stones, are, he says, laid on, which it is supposed, will fill up that space, as shewn by the dotted line, and when finished, the whole surface, from one side to the other, forms one convexity; the footways or horse roads being made a continuation of the same curve, as represented by the dotted line."

It is remarked, that "this is still with the idea, that all the water that falls on the road will run into the drains on each side." But, says the writer, "let any person, in wet weather, take a view of a road thus formed, and he will find, that in general, however great the convexity may be, the water will stand in every rut and in every impression made upon it, especially if the road has been so long travelled upon, that the stones on the surface are pulverized by heavy wheel carriages, and the wet earth from below worked up among them." But where "the road is but newly made or repaired, and the materials are sufficiently porous to let through the water, it will then lodge on the convex surface *d e*, in every impression of a stone or other uneven part, and particularly at the sides *d* and *e* where it is dammed again by the footways, and thus the bed or foundation of the road is, he thinks, kept constantly moist, and of course it will very soon go out of repair. By this continual moisture, the stones, he says, sink down into the soft earth of which *d e* is composed, and this earth works up through the harder materials, and occasions all that dirtiness generally on the surface of roads in wet weather, although perhaps 10 or 12 inches in thickness of those hard materials had been at first laid over it. Sometimes indeed, he says, there are under-drains made through the footways from the parts *d* and *e* at every 10 or 15 yards distance, to convey the water into the ditches; but even this is not found, he observes, to answer the purpose intended, for the intermediate spaces soon become so impervious, that the water does not pass through them to enter these drains, the wet earth being converted into a sort of puddle, resembling what is used in aquatic works, for the purpose of preventing the moisture from penetrating through, and consequently it lodges in all the ruts and hollows on the surface," without passing off so quickly as should always be the case.

It is stated, that there is "another manner of forming these convex roads, advised in the Bedfordshire Agricultural Report, and which is shewn at *fig.* 3. in which it is, he says, proposed to leave a hollow, or *vacuum* as it is called, at *a* in the middle, to deposit the hard materials in. The only difference that appears to be between this and the method shewn at *fig.* 2. is, that instead of the bottom of this hollow being made convex, it is made flat and also deeper." He thinks

that this method is "liable to the same objections as the former, perhaps even in a stronger degree; besides, it would require a much greater thickness of hard materials which are very expensive, and those materials would be deepest or thickest in the middle of the road, where the wheels of carriages hardly ever go, consequently that part is not so liable to be cut up as the tracts in which wheels most generally run," and produce their greatest effects.

Mr. Marshall seems, however, to think more favourably of this form of road, especially for wet weather, "assuming, says he, as a sound position, that roads, in general, which are intended to be travelled in wet seasons, should be *convex*, or *shelving*,—not flat, or concave;—it remains to determine the proper degree of convexity of the hard line of road;—from the margin of which the dry-weather line ought to shelve gently to the foot of the hedge bank; so that carriages may pass freely, and safely, from one line to the other; and in order that the rain water which falls on that side of the lane, may find its way, easily, into the channel prepared for it." Which is, he conceives, for "a wet-weather road to be regulated by a variety of circumstances: as *first*, by the materials of which it is to be formed: soft materials are most liable to be worn into ruts and hollows, and require to be laid up with a quicker descent for rain water, than hard materials; which require less elevation or rotundity of surface; and least of all a firm even pavement." *Secondly*, that a convex road in the face of a steep is to be laid up higher, with a given material, than one on more level ground, on which rain water has no other tendency than to the sides; whereas, in the face of a steep, it may have an equal or greater tendency along the line of the road; and is liable to be caught by the slightest impressions of wheels; and thus to wear channels, as may too often be seen, from the top to the bottom of the hill. Even where the surface of the road is perfectly smooth, it may have twice the distance to run, before it reach the outer margin, that it has on a level." And *thirdly*, "that the degree of convexity is to be determined, in part, by the width of the road; the materials and descent being equal. A wide road requires, he says, to be formed with a greater sideway descent, than a narrower one; which more readily frees itself from rain water, inasmuch as the distance is shorter from the crown to the outskirts of the road" in such cases.

But, he says, that the "freeing a road from rain water is not the only object to be kept in view, with regard to its convexity. The ease and safety of carriages, and particularly those of burden, whose loads, being of light materials, are laid up high, require to be consulted. A carriage, he observes, moves most freely, and with the least exertion of draft, when the load lies evenly upon the wheels on either side. In proportion as the weight is thrown on one side or the other, the resistance is increased; especially on the road which is liable to impression. Hence, says he, "the inconveniency of a highly convex road in the face of a steep; and hence the utility of breaks in long ascents," or such roads as are formed in hilly situations.

In fact, he conceives it evident in respect to convexity, "that every part of a road should be equally and duly convex,—should be equally safe and easy for carriages of every description; otherwise it becomes partially worn; the more level parts only are used; the steeper being in a degree useless. Hence, a road of even and due convexity is, he says, not only easy and safe, but may be formed of a narrower width, than one whose steep sides are neither easy nor safe to be travelled; and whose crown, only, is in use" for passing upon.

It is remarked that, "on measuring different passages of roads which appeared to lie in the most desirable form, and taking their convexity, or the elevation of the crown or middle of the road above the base line, he has found that roads of twenty feet in width, rise about ten inches: namely, one inch in every foot, on either side. And he is of opinion that this result may be taken as a general guide in forming roads: this middle degree of convexity being liable to be altered, according to the width of the road, the nature of the materials, and other circumstances" which have been stated above.

In respect to the second or concave form of roads, Mr. Beatson remarks, that it is "quite the reverse of the common form, being lowest in the middle, where other roads are generally made highest. By differing so widely from the common practice, and the general opinion of road makers, one would at first almost, he says, be inclined to suppose, that so singular a practice in forming roads, could only proceed from a desire or propensity to differ from the rest of mankind: but when we are told that the late celebrated and ingenious Mr. Bakewell, was an advocate for this form; that the road by his farm of Dishly, and that through Mesham, in the same county, are both upon this principle, and in much better order than the roads round about them; likewise that the road through Bredon, made under the direction of Mr. Wilkes, is of the same form, and is said to be better now than ever remembered before, and kept in order at much less expense. When we consider of these well authenticated facts, supported by such respectable evidence, we naturally conclude, he says, that the reasons for adopting this uncommon form of road, are founded on something more substantial than mere whim or caprice;" and consequently deserve to be more fully investigated. This able writer states, that he has not been able to learn "the manner of forming these kinds of roads before the hard materials are laid on, but, when completed, he understands the form is something similar to that at *fig.* 4. The whole width of the road *a b* is divided into three equal parts, or nearly so, *a b*, *b c*, and *d e*. The sides *a b* and *d e* are made quite flat. The division *b* and *d* has a gradual but small descent, or concavity, from each side to *c*, which is the middle of the road. This concavity has also a small descent lengthways, made on purpose, if not declining naturally, sufficient to carry off the water to proper outlets. In the middle division *b d* the best and

hardest materials are, he says, laid." The direction of Mr. Wilkes, as stated in an ingenious paper, in the first volume of Communications to the Board of Agriculture, is, that "when the fall is one foot in 150 or 200 feet forward, the fall from the sides towards the middle ought to be 15 inches in 20 feet. When 1 foot in 100 to 150, to be twelve inches. One foot in 40 to 100, to be ten inches. One foot in 30 or less, to be even the whole breadth. Where the width of a road is 60 feet, one foot of fall to each 40 feet in length of the road. Twenty feet from the sides towards the middle, to have 9 inches of fall.

The inner 20 feet to be flat."

Mr. Bakewell's idea, he is informed, was, that "water, where it can conveniently be applied, should frequently be let run upon this concave part, in order to wash it quite clean; for it is always observed, where a small stream of water comes upon a road, that part, if the bottom is good, is generally firmest, and hardly ever gives way. To have a command of water, therefore, to flood the road at pleasure, he thought would be of great advantage, in keeping it in order." And the other useful properties attending a road of this form, are, he thinks, the following: There are three parts of it on which wheel carriages may go without heeling to either side. On the side divisions *a b* and *d e*, and also on the middle division, when *b d* the horses walk in the lowest part at *c*. This is certainly a material advantage, being much more easy for the horses, and less injurious to the road. By carriages using indiscriminately these three tracts, all parts of the road will wear more equally and for a greater length of time; whereas in the convex roads, there being only one part, namely, the middle, on which carriages can go without heeling, that part only is most generally used, and consequently soonest gets out of repair," which is a great inconvenience in such roads.

It is remarked with respect to flat roads sloping longitudinally, that the advocates for them observe "with good reason, that by being flat or level from side to side, the pressure of wheel carriages will be more equal, the friction less, and all parts of the road may be travelled on with the same facility; consequently it will wear more equally, be easier kept in repair, and require fewer materials" for keeping it up. But notwithstanding such advantages are deserving of attention, it must seem to those unaccustomed to such a form of road, a difficult matter to keep it sufficiently dry, or free from the stagnation of water upon it. But the writer, from its having been observed that the ruts made by the wheels of carriages prevent the water running to the sides of convex roads, says, it is proposed that roads of this form "should have in every level part, gentle slopes, sufficient for water to run along, which, supposing to be one foot in fifty, would hardly be perceptible. On these slopes, or inclined planes, the ruts made by the wheels of carriages would promote the water running off, by forming so many little channels or conductors for it to run into the lower part of these slopes, from whence it must be properly conveyed away. By this plan, it is said, such roads will be much easier kept dry than the common roads" usually are or can be from the nature of their construction.

The same writer observes, in regard to the wholly flat form of roads, that the reasons given for them, "are nearly the same as stated in support of the last, only that as there are few parts of a country so perfectly level, for any considerable distance, that water will not run either one way or another," it is consequently unnecessary to be at the expense and trouble of forming those slopes or inclined planes, recommended in the preceding form; but that proper outlets should always be kept clear at every hollow part, and if the road should in any place be quite level, a shallow cross drain, that will occasion no impediment to carriages at every 50 or 60 yards distance or nearer will keep the road sufficiently dry."

It is from these statements therefore concluded by Mr Beatson, "that the main objects sought after are, 1st. To keep the road always as free of moisture as possible; and, 2d, To construct it in such a manner as to render the draught or communication easiest, at the least expense. In these are comprehended all the requisites necessary to form a complete road. To attain them in the best manner is, he says, therefore the important point. Four different methods have been stated, each of which has its supporters. The arguments in favour of each have also been shortly mentioned, which will shew, he thinks, that their main object is the same, unless perhaps the idea of watering the concave road may be considered a deviation from one part of the general rule; but as that is proposed to be done only to wash the road occasionally, in case it becomes dirty or slushy, it cannot therefore, he presumes, be considered in that light" in any respect whatever.

But from these modes of constructing roads being in some measure unsatisfactory, he is induced to offer a new theory on the subject, which is, he says, founded on the knowledge of the stratified nature of the earth. It is however only given as theory, having never, he believes, been subjected to the test of actual practice. It is observed, that "every person who has paid the least attention to the structure and formation of the different *strata* of the earth, must have seen that some of these strata are of so close a texture as to be impenetrable to moisture; others again are so porous, that water will easily run through them in any direction, till it meets with some obstacle or finds a vent. Of the first sort some are less dense, and of the latter some less porous than others, consequently as they partake more or less of these qualities, the water or moisture will the more or less quickly penetrate through them." But in order to shew this more clearly, and apply the principles to the construction of roads, he supposes *fig.* 5. the section of a hill or eminence composed of a number of *strata*, 1, 2, 3, 4, &c. If the upper stratum or surface soil, marked 1, is, says he, of a porous nature, it is evident that any water which falls upon it, will penetrate through to the stratum marked 2, where if it cannot go farther, it will glide along the surface till it finds a vent at the bottom of the

hill *b*, if the stratum 2 is hollow at *a*, and continues on towards *f*, the water will lodge in that hollow, and form a sort of pool or bog, as is sometimes observed on the tops of hills; but if in this hollow place, there is a communication with the porus stratum 3, as at *a*, no water will lodge there, but it will penetrate through and glide along the upper part of the dense stratum 4, till it finds a vent on the side or at the bottom of the hill as before. And by the above figure it will also appear, he thinks, that if the upper *stratum* 1, is of a close texture or clay, any water falling upon it will not only lodge in the large hollow *a*, but in the smaller ones *c*, *d*, *e*, and in all the other irregularities or concavities that may happen to be upon the surface. Hence, also, it is evident, he supposes, that in order to keep dry the surface of any such piece of ground as represented in the figure, it matters not of what shape or form that surface is, or whether it is convex or flat, provided there is a communication with some under *stratum*, sufficiently porous to carry off the water below; but it is of some consequence, he says, the form of the upper part of that *stratum* upon which the water is to run, for the smoother it is, the water will of course the more easily flow away," and be discharged from it.

It is easy, he supposes, to apply these principles in the forming of roads; which he attempts, in the following way: "when, says he, a new road is to be formed let it be done in the first instance nearly in the usual manner, with such materials as are on the spot, and the nearer the quality of these approaches to *clay*, so much the better. Instead, however, of forming it convex, as is generally done, let the lines *a b* and *b c*, *fig.* 6: be quite straight, and meet in an angle or ridge at *b*, the middle of the road, having a slope from thence to each side of about an inch in a foot. *a* and *c* are small drains for the more easily conducting away the water that may be collected at those places. The road being thus formed, must, he says, be allowed to harden and settle for some time before any other materials are laid on, great care being taken, while in that state, to let no carriages or cattle upon it, and it should be rolled with a long wooden roller, that will reach at once from *a* to *b*, or from *b* to *c*. This roller should be loaded with a box of stones to make it sufficiently heavy, and that it may be the more portable when that box is taken off; and it may be so contrived, that by changing the horses from one side to the other, there will be no occasion to turn the roller, in order to make it roll the same space over again. Being rolled in this manner, will consolidate the materials composing the ridge *a b c*, and prepare it for receiving those to come afterwards, for it is a most absurd practice, he thinks, laying hard materials in the common way, upon this first form or basis of a road, before it is sufficiently firm to bear them." When "thus formed and properly settled, the next step to be taken is, he says, to imitate the works of nature in dry soils as nearly as possible, by forming a stratum penetrable by water, composed either of sand or sandy gravel, or any other substance easiest to be got that is sufficiently porous to admit water to pass through it. This stratum should be laid quite level, and extending from one side of the road to the other, filling up the small drains also, as shewn by the dotted part in the figure. Over this are to be laid the best materials that can be got for completing the road, consisting either of stones broken very small, or of the best gravel. This coat of hard materials need not exceed above six or seven inches in thickness, which being much less than is commonly used, will, he says, be a considerable saving; and it may even still be less, if the directions hereafter given are strictly attended to. If this covering consists of broken stones, they should afterwards be laid over with sand or fine gravel when easily procured, so as to fill up all the cavities betwixt them. The sand or rubbish from a freestone quarry is excellent for this purpose, providing there is no mixture of earth in it, which should be carefully guarded against in every step taken after the road is first formed. These finishing materials being properly laid on and smoothed with a rake, the whole should now, he says, before any carriages or horses are admitted upon it, be well rolled with a heavy iron roller, divided in three parts, and constructed as shewn at fig. 7. where *a* and *b* represent the two hind divisions of the roller, and *c* the front or middle division, to the framing of which the shafts are fixed, and so contrived that it turns in the manner of the forewheels of a waggon; *d* is a box for holding stones to increase the weight when necessary; but in adding this weight it must be observed, to lay about two thirds of it over *a* and *b*, and only one third over *c*, otherwise the pressure will not be equal. Fig. 8. in the same plate is the plan of the roller, shewing the manner of its standing on the ground. *a* and *b* being the back, and *c* the fore or middle division. Iron rollers are sometimes made in three parts as above, but being all in a line, and close together, are apt to be choked by gravel and small stones, which cannot happen in the construction here recommended." It is contended that if such a roller were generally used upon roads, especially when newly made, it would save a great deal of expense in repairing them; for it cannot be expected, that any new road will immediately bear wheel carriages, or continue long in repair, when composed entirely of loose materials without the smallest pains being taken to consolidate them together. Frequent and heavy rolling would therefore, he thinks, produce the most beneficial effects, and would tend very much to keep the road free from deep ruts and holes; besides, there is nothing could contribute more effectually to promote and preserve firmness and solidity, two qualities without which it is impossible any road can, with propriety, be called a good one," or have the necessary degree of solidity and firmness.

The advantages that would result from this mode of construction would, the writer thinks, be various: "by being level on the surface every part of it is equally commodious for carriages, consequently it will all be equally travelled upon, and the deep

ruts so frequent in other roads will almost entirely be prevented.

"It will therefore be much easier kept in repair, and if properly managed at first, will be made at less expense than the common roads, especially in a sandy soil, or where sand or gravel is easily procured. The draught will be much easier on such a road. And one very important advantage is, by having an under stratum through which water can penetrate, and the cavities among the harder materials being filled with the same porous substance, no water can ever lodge on the surface, nor can it ever become so dirty as other roads are in wet weather; all the water that falls on the surface, unless perhaps in very heavy rains, being conducted away underneath and in every part." And it may be added "that from the small drains on each side of the road, cross drains, as *d* and *e*, *fig.* 6. should be carried through the fences marked *f*, provided the level of the ground will admit of it, at the distance of every ten or fifteen yards. These cross drains may, he says, be made of wood, with about an inch bore, or of stone, if preferred."

And it would, he thinks, be of great advantage to this sort of road, as well as to every other road where the ground is inclosed on each side, that the fences should be sunk towards the fields, as shewn at *d* and *e*, and the water to be conducted through to these sunk fences, instead of the common method of leaving large open ditches and drains on each side of the road. It must also be particularly attended to, that on all sloping roads on a declivity where the water is apt in heavy rains to run upon the surface, or at the sides, that it ought never to be allowed to run in the same direction more than ten or fifteen yards, but at that distance to be conducted away to a side into the main drains. It will then, he says, do little or no harm, as it can never increase beyond a very weak stream; but if it is allowed to run one hundred or two hundred yards, it will probably be increased to such a size, before it reaches the bottom, that it will wash away a great deal of the materials, and may besides very much injure the road or the fences on each side of it," which would be highly disadvantageous in many respects.

Besides, it is suggested that a road formed on this plan "need not be quite so wide as roads in general are made, for the whole surface of it will be in use from one side to the other, and therefore from twenty to twenty-four feet wide is quite sufficient, unless near populous towns or extensive works, where great numbers of carts or waggons are employed." And "in the interior parts of the country, twenty feet in width will, he says, answer every purpose required. He has observed in several places where the roads have not been above eighteen or twenty feet wide, and properly made from side to side, that they were in much better condition than the neighbouring roads, from thirty to forty or fifty feet wide. On these wide roads formed in the usual way, there is seldom, he thinks, more than eight or ten feet in the middle of them generally made use of; the remainder one, on each side being occupied by heaps of stones, scrapings, and other rubbish, which although they may partly be of use sometimes in repairing the roads, ought on no pretence to be allowed at all times, or at any time, to lie there; such rubbish being not only disgraceful on the sides of a public highway, but even dangerous, particularly in the dark, for either carriages, or horses;" besides having various other disadvantages arising from the growth of weeds, and the dissemination of their seeds.

In respect to the most proper "and best form of the roadway of narrow lanes; as those leading from village to village, in recluse districts;—where bridle roads, or packways, have been so far opened as to admit carriages; though the whole width of the lane may not be more than eight or ten feet; it is remarked by the author of the excellent Treatise on Landed Property that on such a narrow space, a whole barrel, or convex road, cannot easily be kept up. If raised, it presently wears into a middle track, and two wheel-ruts, with foul drains on either side of them; and becomes, in wet weather, a dirty trough, which is unfit for either carriages or horses, and in which a foot passenger has not where to set his foot." But that provided such a lane be thrown into a shelving form, resembling half a barrelled or convex road, as that which appears between the letters *e* and *c* *fig.* 1, *Pl.* XXV. a greater width of travelable road, for carriages and horses will be obtained; ruts will not be so liable to be formed; the whole of the water of rains will be thrown to one side; while the other will afford a comfortable walking path at all seasons." And this, he adds, is now "no longer merely a probable, but a tried, improvement. Lanes ten, twelve, or more feet wide, have been strikingly improved by it."

It is further suggested, "that when water, in a wet season, is apt to ooze out of the banks on the upper side of the lane, a narrow channel is to be cut to prevent its overflowing the road: or, in forming the bed of the road, the inclination may in some cases be reversed; so as to throw the drain on that side of the lane from whence the spring water issues: thus the same drain will serve for the spring and the rain waters." And it is added, in regard to this semi-convex form of road, that it is applicable, not only to narrow lanes, but to the sides of hills; where the road, as it generally ought, is conducted sidelong (not directly) up the slope. By this form of the road the whole of the water which falls upon it will be got rid of, without inconveniency or expense. And the bed of the road, for this purpose, may be made narrower, than for a full convex road; a circumstance which in some cases may become a saving of much expense. The upper side of a road in this form being nearly level, and firm to the foot of the steep, would, he says, be chosen by ascending carriages; while the lower side would acquire a looseness of surface, and be used by laden carriages going downward; and while a raised footpath, on the lower margin, would be a secure guard, and a relief to the apprehensions of timorous travellers, as is shown at *fig* 1. in *Plate* XXV. between *f* and *c*.

In relation to the width of public roads where a blank is given, it should be regulated, Mr. Marshall says, by their publicity, as it is compound folly, he thinks, to make a road wider than its use demands. He supposes that "there are few roads, even near populous towns, that require a greater width than about thirty-three feet. But every public road under common circumstances should have a line which is travelable at any season, and of ample width to permit two carriages to pass each other, with freedom and safety. This ample width let us, says he, set down at one statute pole. In deep clayey districts, where hard materials are difficult to be procured, a single road, of half a pole in breadth, with dilations at proper distances to let carriages pass each other, may, in many recluse situations, be advisable." This regards "the breadth of the winter road, for carriages and animals of burden. But he says that "the width of a public *lane* requires a more enlarged view. On the plan offered, it is to contain, not only a wet weather road, for carriages and horses; but a summer road, and driftway; as well as a foot path, which may be used in any season." He observes, that "in many parts of the greatest public roads across the kingdom, the lane is not more than twenty feet wide. But this being filled with hard materials, from hedge bank to hedge bank, carriages alone seldom find any inconveniency in these narrow parts. But where carriages and large droves of cattle or sheep meet in them, stoppages are unavoidable," and great inconvenience is of course sustained.

And he thinks, that "the width of the *driftway* ought, like that of the hard materials, to be guided by the publicity of the given road. In a great public road, it should certainly be wide enough to let two carriages pass each other, or one pole in width. But in one of less publicity, or where the existing lane will not admit of that width, a single carriage path may suffice; as this being a continuance of the width of the hard road, no difficulty in passing can be experienced," he supposes, from it.

But "the width of the *foot path*, and the ditch, may vary, he thinks, from half a pole to ten feet."

It is therefore concluded that "on these premises, the width of the lane of a great public road, near a populous trading place, ought to be fifty-nine feet and a half; and that of a common market road, thirty-three feet. And these widths, without any previous intention, come out nearly, he says, the same as those directed by act of parliament, for the lanes of "turnpike roads" and "highways." A great error in the act, however, is, he thinks, that the lanes of all "turnpike roads" shall be sixty feet wide: thus incurring a serious waste of land; and creating great nuisances; which green lanes ever are, to the occupiers of adjoining lands. He from this suggests, that "where existing lanes are wider than all the desired conveniences require, slips should be sold off their sides; and be laid to cottages, or to the adjoining inclosures; leaving recesses, here and there, in which to lodge materials. It has long appeared to his mind an evident position, that every part of a public lane should be used; and consequently that no part of it ought to be a nursery of weeds, or an unprofitable common pasture for starving stock." Still he remarks, that "a wide lane has its advantages; especially in a low, close situation. It gives freer admission to the sun and air than a narrow lane, and the road dries more quickly." And further, that "by permitting a more forcible current of wind, the pulverized materials or dirt of the road is, in dry seasons, carried off in the state of dust; leaving the useful materials undisturbed." And it is, he says, highly proper to place "the principal line of road in the midway of the lane,—that it may be the most effectually exposed to the agency of the sun and wind."

Mr. Beatson, in his useful paper on this subject, suspects that in the whole kingdom thousands of acres of fertile lands are lost to the public, merely by making the roads so much wider than there is any necessity for; in the vicinity of large towns they should have an ample width, as thirty or forty feet or in some cases considerably more, as near the metropolis, but the practice of making them "forty or fifty feet wide, as is sometimes the case through a thinly inhabited part of the country, or near the most pitiful villages, where even twenty feet would be sufficient, is, he contends, a mere waste of ground for no purpose, and occasions a very great additional expense in making such roads, which certainly might be avoided." Supposing says this writer "the medium necessary width of roads to be seven yards, or twenty one feet, and that the medium width now made is eleven yards, or thirty-three feet, this is, upon that supposition, four yards wider than is necessary, which in every mile is a loss of one acre, one rood, and two perches; and supposing there are 5000 miles of such roads in the whole kingdom, there is a loss of more than 6300 acres, which if estimated the same as the improved value of the waste lands, at 27*s.* per acre, and at thirty years' purchase, would produce £.255,150, a sum, which if laid out in improving the roads, and making easy communications through different parts of the kingdom, would be of the greatest public advantage." And it is evident that where they have the width stated as necessary by the first of the above writers, the loss sustained in this way must be still greatly more considerable.

It is observed by Mr. Marshall, that in the operation of forming roads of the public kind, "the first business of the road surveyor is to examine the lane, or other site of the intended road, in every part, to ascertain whether offensive waters lodge beneath it; and whether quicksands or landsprings break out, in a wet season:—in which this examination is requisite to be made. If defects of this kind be found, effectual subdrains are to be run up to them from the ditches or side drains of the lane, or other site." And that "the next operation is to adjust the surface of the site:—to strike off the protuberances and fill up the hollow parts; and thus, in ordinary cases, to mould it to the form shewn at *fig.* 1. in *Pl.* XXV. or according to some of the other forms that have been mentioned; the foot path and the higher side of the soft road being raised with the earth which is required to be taken off the bed of the hard road; whose base

or foundation ought, he says, to be formed with peculiar care. Every part is required to be firm and sound: dry earth, or hard materials, being rammed into every hollow and yielding part." It is suggested, "that the form which appears in *fig.* 1. *Plate* XXV. is adapted to firm binding materials,—to such as acquire, by wear, a repellent surface, and shoot off the waters which fall upon it: not to those which are loose and incohesive; yielding to pressure, absorbing rain waters, and conveying them down to the base or bed of the road. These, he thinks, require a flat or a convex bed,—free from obstructions on either side; so that the absorbed waters may effect their escape at the base."

And that "on this firm and level bed the largest of the hard materials are to be laid; next, those which are more finely and evenly broken; and lastly, a covering of still finer materials;—to assist the roller in giving sufficient firmness to the surface; and to render it immediately capable of being travelled upon.

In regard to the proper materials for constructing roads with, it is remarked by Mr. Marshall, that "although every district may be said to have its own material, and often without choice or alternative; yet there may be instances in which useful materials are overlooked, or disregarded. He adds, that in some parts "particularly in Lancashire, *large paving stones* are in common use; some of the more public roads being rough pavements; resembling the streets of ill paved towns." But that "in the northern, and some of the midland provinces, *broken quarry stones* are the ordinary road material." And that, "taking the kingdom at large, they are the most common material." And that "in the southern and western counties, flints and other hard field stones, gathered off ley grounds, are in common use. And in the neighbourhood of the metropolis, and in other parts of the kingdom, sharp flinty gravel is a favourite and valuable material. In many parts of England, smooth, water-worn, pebbly gravel, collected on the sea beach, and in river beds, is used. And, if the pebbles are of a hard texture, and be properly broken, to make them bind, or unite firmly together, a good road may, he says, be made of this material." In some cases *sand* and *silt* or fine sea sand have been employed with success.

And it is added, that the artificial materials of roads which he has met with, in quantity, are the *dross* and *cinders* of iron and copper works; and *burnt clay* (burnt as bricks in heaps) which in a clayey district, destitute of other materials, and where fuel is cheap, may be found a valuable substance for the purpose.

It is suggested by Mr. Beatson, in the work mentioned above, that in a sandy soil "the roads may be made on the new construction he has already recommended, with the greatest ease. In such a soil, there will, he says, be nothing more to do than to level the surface properly, fill up all the hollow parts, roll it well with the long wooden roller, and lay on the materials intended to finish it with, in the manner directed, and then roll it with the heavy roller as has been advised above."

But in cases where the soil consists entirely of a deep loose sand, the best and easiest way to make a lasting road is, he says, to form it to the width intended for the hard materials, at each side of which, as at *a* and *b*, *fig.* 1. *Plate* XXVI. and then to let a channel be dug of at least eighteen inches in depth, and about the same width; let these be again filled and firmly built up with strong turf or clay, or any other solid substance that will prevent the materials to be laid on the road from spreading to either side, openings being left at every ten or fifteen yards to let the water that falls on the middle part of the road more easily through. Where the form of the ground requires making up, a little wall of the same nature, instead of digging a channel, may, he thinks, be built on each side, nearly as high as the surface of the road is intended to be, as shewn at *e* and *f* in the same figure. These will, he says, prevent the hard materials laid on from spreading, which is the principal cause of roads made in such soils giving way in so short a time; and these materials will not be so liable to sink into the sand: if it is properly rolled before they are laid on, as well as at different periods after it is finished." And if there be "a fence on each side of the road at *c* and *d*, in the same figure, and materials can be spared to cover it from side to side, there will be the less occasion for the little walls *a* and *b*, as these are, he says, only intended to keep the hard materials within the bounds prescribed, in case it is not judged proper to lay them the whole breadth of the road." Where, however, those walls are thought requisite, the spaces *a c* and *b d*, by being covered with a little gravel or freestone sand, will make very good footways or horse-roads; but in a road finished in this way, there will, he thinks, be no occasion for horse roads distinct from the main road, as the whole, if kept in proper order, will, he supposes, be sufficiently smooth and safe, for horses, or even foot passengers, to go upon" at any time.

In speaking of the making of roads through a clayey soil, it is remarked by the same writer, that those formed in such districts are in common the most unpleasant of any, "chiefly, he says, on account of proper precautions not being taken to prevent the water lodging on the surface; sometimes perhaps owing to a want of proper materials, such as stones or gravel: but he has often seen the very worst of clay roads, even where no such excuse could be given." He says, that "it seems hardly ever to have occurred to those who had the direction of such roads, that *sand* properly applied would in a great measure remedy all the defects complained of: and there are few parts of a country where sand of some sort, or freestone rock, or sandy gravel, may not be obtained by some means. In certain situations it may, no doubt, be more expensive and difficult to procure such materials than in others; but these are local disadvantages which road makers must, he says, lay their account with: but the excessive inconvenience of bad roads, the expense occasioned by the tear and wear of wheel carriages and harness, the risk of dislocating the limbs of horses, together with many other disadvantages,

ought to stimulate all concerned to exert their utmost endeavours to make the roads good and easily passable, be the difficulties what they may," that stand in the way of them.

It is hinted that in such places as "where no hard materials can be got, if the road were formed nearly in the same manner as at *fig.* 2, in *Plate* XXVI. the evils complained of might probably soon be remedied. The clay should be excavated, so as to form a ridge in the bottom of the excavation as *a b c*. The dotted lines *c d* and *a e* are small openings or drains, at every ten or fifteen yards, or at every hollow place, to conduct away the moisture into the main drains *d* and *e*. If this excavation is then filled with sand, or any other porous matter easiest to be got, and finished as formerly directed, there is no doubt, he supposes, but the road would soon become as good as could be wished for. Something similar to this he has known, he says, put in practice by a vey ingenious gentleman in Cheshire, on whose estate, being a strong clay soil, the roads were so excessively bad as hardly to be passable. He dug away the surface of the road to the depth of twelve or fourteen inches, and having the command of plenty of sand he filled up the excavation therewith, and covered the whole with gravel by which means he has now made, so far as completed in this manner, as pleasant a road as one would wish to travel on. He is not certain, he says, if he left the bottom of the excavation with a ridge in the middle, as here directed; but he is clear this would be an advantage, as well as the outlets at certain distances to let away the water."

In constructing roads through boggy or morassy soils, the same writer advises, after proper steps have been taken, "to drain off as much of the water as possible, by deep ditches or drains within-side the fences, if inclosed, or intended to be inclosed on each side. These drains should be cast, he says, at least a twelemonth before any thing else is to be done towards making the road; for if the place is very boggy, it will be found to subside considerably after the water is drained away, and some parts will subside more than others in proportion to the depth of the mossy soil, and to the quantity of water lodged there. Those parts will therefore be the better seen the second season than the first. All hollows or irregularities should then be filled up and levelled, either by taking from the heights and filling up the hollows, or by some other proper materials nearest at hand. In either case the surface sods should, he says, with a push-plough or paring spade, be carefully pared off the heights to be lowered, and also off the hollows to be filled up. These sods should be laid aside till those places are brought to their proper level, and should then be laid on again. This will make the whole surface of an uniform toughness, which would not be the case where the sods are not laid on" in this manner. After this has been done, "the breadth of the intended part for receiving the hard materials should be marked off, then let that part be covered with sand or such porous substance, as before recommended, to the thickness of at least ten or twelve inches. Then roll this, and finish it as already directed, and there is no doubt, he thinks, but a road made in this manner may be as good through a moss as in any other situation. This he speaks of from experience, having seen the most pleasant roads made in this manner, through mosses formerly thought impassible. When the moss is too soft to admit horses upon it, the sandy stratum may be rolled by men, the weight of the roller being regulated by the stone box according to their strength. Sometimes the rolling is, he says, altogether omitted, but it is much better to roll when practicable." It is added, that there are "other methods of making roads through mosses, as by laying a foundation of broom, furze, or heath, and then the hard materials above them; but sand is greatly preferable, he thinks, where it can easily be got, and when the the tract of the road is properly drained, as it always ought to be before any thing is laid upon it" with a view of making a road.

These principles and directions, are, it is said, equally applicable on all other sorts of soil with trifling variations, according to the peculiar circumstances of the cases.

It is supposed that in the above cases the roads were formed where the site or track was "nearly level from one side to the other; but there are other situations such as when cut or formed on the sides of hills, where some other precautions become necessary to be attended to. In these cases it is observed, that in making them it frequently happens that the excavation affords a sufficient quantity of materials for the purpose; and the part *d c*, *fig.* 3, cut out of the solid, very rarely requires any covering laid upon it. This, however, he says, depends on the nature of the soil. If the whole breadth of the road is formed from the solid, and that is sufficiently hard, no extraneous materials will be necessary, but if the soil is a compound of clay, or of a soft nature, the above rules and directions must be had recourse to." It is remarked that where "the part *d e* in *fig.* 3, is made up from the excavation, it ought to be formed considerably higher at first than the part *d c*, as it will naturally subside for some time afterwards, and the hard materials should not be laid on till it has had sufficient time for that purpose, which may be greatly expedited by rolling; and it should be observed, that it is much better to be obliged to lower that part to its proper level before the materials are laid on, than to be under the necessity of making up any of it at the time".

It is further stated that where the "hill is of a considerable height above the road, a good deal of water will sometimes come down. In this case it is in general better to intercept that water at some little distance from the side of the road, than to allow it to run down the face of the bank, *b c*. If allowed to run down this face, it will very soon, the writer says, moulder it away, especially in frosty weather, and will always choke up any drain that may be made

at c whether covered or open; for if covered, the earth that moulders down will in a short time become so close, that water will not get through it to the drain before it runs off upon the road; and if open, it would be extremely difficult and troublesome to keep it clear. In this case, by intercepting it at *b*, about four or six feet from the brink, and conducting it away to the most convenient outlet, it would, he thinks, be much easier to keep the road dry. If the face of the bank is irregular, the water may, he says, still be conducted away by making the drain *b* recede from the brink at such places, and keeping the course always at a proper level, or it might, he supposes, be let off at every hollow place by small recesses faced up with stone, or by wooden spouts sunk upright in the bank at every such hollow; as at *a* and *b fig.* 4. to conduct the water from the upper drain to a cross covered drain below the road, by which it may be carried away at the lower side," without any injury being done to the road.

It is advised that in the "forming and making of these, as well as all other roads, the preventing of any water running on them except what falls from the clouds, should be carefully attended to. Where this cannot easily be done, and where it is necessary to allow a stream to run along the side of a road, the drains or ditches which, as before observed, should be within-inside the fences," should, it is remarked, be made of a proper size accordingly, as the small drains filled with sand or gravel, as already recommended, are only meant for such roads as can have no extra water coming upon them in this way.

In respect to *private* roads, the nature and manner of laying them out has been already noticed. But in respect to the method of forming them, Mr. Marshall says, it is the same, where strong cohesive *binding materials* are made use of, whether in a lane or across open ground. The mode he advises is to "form a receptacle for such hard materials, twelve or more inches deep; either by digging to this depth beneath the natural surface, and carrying off the excavated soil: or to half the depth, disposing of the soil, raised in the operation, on each side of the receptacle; so as to elevate the general surface of the road, above that of the adjacent ground. And, in this receptacle deposit the materials;—leaving the surface either in a convex or a semi-convex form, as the turn of the surface of the ground to be travelled over may direct: the margin or margins of the road, at which the rain-water is to be collected, being left a few inches beneath the adjoining sward." But that "in forming roads of every description, with sand, loose gravel, or other *incohesive absorbent materials*, which imbibe the rain waters that fall on them, a receptacle of that kind is altogether improper. Such materials ought to be laid on a level, or an elevated, surface; and a shallow drain to be opened on either side, for the absorbent waters to filter into: thus preventing a surcharge, and freeing the surface entirely from collected moisture," which would be highly injurious to it.

It is here added that "the surface of a road which is formed of well broken stones, binding gravel, or other firmly cohesive materials, and which is much used, presently becomes repellent of the water which falls upon it; no matter as to the basis on which they are deposited; provided it is sound and firm enough to support them." And that where "the situation is low, and the land of a moist retentive nature, a deep drain on one, or on each, side may, he thinks, be proper, to give due firmness and stability to the base. Such drain, however, is not, he says, to be sunk close along the margin of the hard materials, to deter horsemen and carriage drivers from coming near it; but a few feet distant from it; so that every inch of the hard road may be used with equal pleasure and safety; and a commodious driving and walking path be formed, between the road and the drain: proper channels being cut across it," in order that it may be kept properly dry.

It is further suggested by the same practical author that "in a dry situation, as across a gravelly or stoney height, little more is frequently required than to remove the surface mould, and lay bare the rock, or the bed of gravel, beneath it: and, then, to give the indurate base a round or a shelving form, as the lying of the ground may require. In this way, he thinks, a travelable road may be made, and kept up, at one tenth of the expense incurred by the ordinary practice in this case; which is to gather up the surface soil into a ridge, and on this soft spongey bed to lay coat after coat, of some hard materials,—fetched perhaps from a distance!" at much expense for the purpose.

In addition to the above sorts of roads there are still others which require some art to form and keep them up in particular situations; these have the denomination of carriage and horse tracks, and are described under these different heads.

Repairing Roads. It is remarked by the author of the Landed Property of England, that this is a business that incurs a heavy expense on landed property, and of course requires the peculiar attention of the proprietors and managers of land.

It is observed by the author of the paper mentioned above, that where the funds of the parish will admit, which would generally be a saving, that proper persons should be appointed in them, or to have the charge of a certain extent of road to see where any part is giving way or getting out of order, and to direct their immediate repairs. Also to take care that no water stands in the hollows or ruts upon them. And, he says, that "the summer season is the best not only for making but for repairing roads, nor ought they on any account to be touched in winter, unless to give a temporary aid to some sudden breach that is, perhaps, almost impassable, or to let off any standing water. Yet nothing is more common than to see a number of labourers employed on the highways in winter, when the days are short, and but a few hours labour can be obtained of them. Indeed so little attention is there often paid to repairing the highways, he says, that sometimes old infirm people are employed for this purpose, as if repairing roads were a sort of trifling bye job, merely for the employment of paupers, or

lame, miserable objects, who can get no other means of subsistence."

And Mr. Marshall thinks, that in this sort of work the "best service of the surveyor is to keep their surfaces smooth and even; so that rain water may find a free and ready passage to its proper drain. Ruts and hollow parts are to be filled up, level, or even with the general surface, as often as they are formed,"—and perfectly free from water. "This attention is more especially requisite to a new-made road, whose bed and foundation are not yet fully confirmed. But in every case, and at all times, a solicitous regard is due to this most important, yet most neglected, part of road surveying. Much expense of materials and labour may thereby, he says, be saved; and the great end of road making be fully obtained: namely, that of rendering the road, in all seasons, easy, safe, and pleasant to the traveller," as well as easy in the conveyance of all sorts of articles.

And, he conceives, that in this operation, as well as that of making new roads "very much depends on *breaking* the materials *evenly*. For, by doing this, the wear of the road becomes regular. Where the heads of large stones rise above the general surface, they become obstacles to carriages, and stumbling blocks to horses: beside their tending, by the jolting motion which they give to carriages, to indent the surface on either side of them; and thus to increase the roughness, and hasten the decay, of the road." He adds that, "by the law of gravitation and the action of wheel carriages, a pit or hollow place in the surface of a road is made deeper every time the wheel of a carriage passes through it. The periphery of the wheel acts as a chisel, and in falling into the hollow receives an impetus or acquired force in addition to the actual weight it is loaded with; and, in addition to this, an undue proportion of the general load is, by placing it out of its upright posture, taken from the upper and thrown upon the lower wheel." Likewise "hard protuberances, beside being dangerous or disagreeable to travellers, whether on horseback or in carriages, are, he says, injurious to a road, as being the causes of pits and hollow places in its surface. Every hard protuberance, as the point of a stone standing above the general surface of the road, or a large stone lying loose upon it, is productive of four impressions: namely, two, by throwing additional weight on the opposite wheels (going both ways), and two more by the impetus or acquired force of the wheels (passing both ways) in falling on the surface of the road." He therefore considers it to be the first "duty of the surveyor, not only to fill up ruts and hollows, from time to time, but to pick out, or to crush with a heavy hammer, the stones whose tops rise above the general surface; as well as to gather off those which lie loose upon the road: the latter being, he says, an operation that is readily performed; yet frequently neglected; and, in some places, to a shameful degree; especially in the northern parts of the island."

In respect to the sizes most proper for "road stones it requires, he says, much latitude. Not only the intended use of the road, but the nature of the material, is to be considered. A road for broad-wheeled carriages of burden, only, may be made of larger stones than one for narrow wheels. And hard stones require to be broken smaller than those which more readily wear down, and form a travelable surface. For when once the surface of the materials becomes united and cemented together, and its rocklike texture established, the stones that are crushed, and the smaller fragments which are splintered off, in wear, serve, he supposes, to encrust and bind together the stratum of stones which lie next, in succession, beneath: especially if proper attention be paid to the irregularities of wear, and to bring back the surface, wherever it is requisite, to its original evenness of convexity" where that form is adopted:—"so that it may, in every part, act as an arch, and may be able to resist, with the greatest firmness, the weight with which it may be impressed." It is however to be observed, he says, "that, in forming and repairing roads, with stones of size, a considerable share of the expense arises from the labour of reducing the materials; and, in consequence, the smaller they are broken the greater becomes the expense. This, on ordinary occasions, is a serious consideration. Hence, in constructing and repairing common roads, it is advisable,—instead of reducing the surface stones to small fragments, with the hammer, at a great cost,—to cover them with materials that are already reduced; as the rubbish of stone quarries, soft stones or gravel, or the scrapings of the road to be repaired. Such cementing materials being washed and worked down, by rains, and the action of carriages, and the feet of travelling animals, among the surface stones, assist much in binding and fixing them in a firm crust; and in making the road immediately passable by horses and light carriages; most particularly if the whole be compressed, and united together, with a heavy roller (suitable to the purpose) repeatedly passed over the surface of it." And another good method of saving expense in this way where materials are readily procured, is that of placing the coarse unbroken stones or other hard materials in the bottom part or bed of the road, covering them over with gravel or other sorts of materials that are of a small kind. However where the hard materials are broken down small and evenly the roads are found to wear the best.

It is well observed by Mr. Beatson, that if the above directions were strictly "attended to, and every appearance of a breach or defect in a road at once repaired, the same materials when displaced, would very often, if properly relaid, and fit for the purpose, repair the part beginning to fail; whereas if neglected for some time, and allowed to get much out of repair, it will probably require a considerable additional quantity of materials, and thereby occasion a great deal of expense that might have been saved."

He also suggests that "during the time of hard frost it may be very proper to drive materials and

lay them down for the purpose of being at hand to repair the roads when the season permits, but such a time is the most improper of any for applying those materials." And that in laying them down "it is a very general practice to place them in small heaps along the sides of the road, and even encroaching sometimes very much upon the space allotted for travelling on. This ought, he says, on no account to be allowed (unless those materials are to be immediately used) for reasons so obvious it is unnecessary to mention them. It would be much better to have recesses at certain convenient places, for the purpose of laying the materials in till wanted; by which means the inconveniences attending the common way would be totally avoided; and travellers might then, without interruption, use any part of the road they found best; and besides, there would then be the less occasion for making the roads so wide as they are generally made, which would undoubtedly save a great deal of money in keeping them in repair," or proper condition.

It is usefully remarked that "rolling of roads with a heavy roller, as directed above, would be a very beneficial practice for keeping them in good repair, especially if the hard materials that are worked out of place by the wheels of carriages are raked in again previous to the roller passing over them. This would be an easy and expeditious operation, and if taken in proper time would in many cases be all that is necessary to put the road in repair." It is however an implement that is very seldom made use of for this purpose by the overlookers of roads.

The use of machinery has probably been hitherto too little attended to in the execution of this sort of work, but from the increasing price of hand labour it certainly at present demands the serious notice of the managers of this sort of business.

For dragging over roads, when much out of repair in order to replace the stones or gravel disturbed by wheel carriages, a sort of harrow has been invented by Mr. Harriott of Great Stambridge, in Essex, for which he received a premium from the Society for the Encouragement of Arts, &c.

Of which he gives the following account: "being appointed, says he, surveyor for the roads at Michaelmas, 1786, and finding them very bad, I provided a sufficient quantity of stones and gravel against the next summer, to cover the roads pretty thick; but when so done, I found the heavy loads of chalk, gravel, and corn, soon turned the stones out, and made almost as deep a rut or rake as ever. Stubbing the quarters in I found an endless job, as well as a great expense, I therefore contrived the road-harrow, and by the help of which I have during last summer, at a very trifling expense to the parish (after the ruts were again filled up with stones), kept the roads in extraordinary good condition. A man, a boy, and two horses will do three miles in length in one day, completely harrowing down the quarters, and drawing the stones together, which, by means of the mould-boards, are dropped into the ruts far better than a man can stub them in. Now if a man was employed to stub, he could not do it for less than a penny per rod, of sixteen feet and a half, (the most common price is three halfpence or two-pence per rod, if they stub the outside as well as the inside quarter) which would amount to one pound six shillings and eightpence for one mile in length, consequently to four pounds for three miles, which the road-harrow will do in one day; and for which I charge the parish for man, boy, and horses only eight shillings." And it is further stated by him "that it does the work better as well as cheaper; that several other parishes are using them, and thinks the use of them will soon become general, especially where roads are mended with gravel. The head of the harrow is three feet long, from outside to outside of the bars. The bars four inches square, and the length of them five feet. The mould-boards extend eleven inches farther, which is necessary to draw the stones (which the teeth of the harrow work up to the top) nearer the middle of the road. The mould-boards are four feet two inches long, ten inches deep, and two inches thick, they are shod with a bar of iron, and lined about six inches high with an iron plate. The teeth (which should be steeled at the points) are one foot in length, from the underside of the bars to their points; they are one inch and quarter square, and are fixed with strong nuts and screws, with collars both on the under and upper side of the bars. The bars are made to go lengthwise instead of across, to prevent them from splitting. The harrow is drawn by two horses abreast; a boy leads the outside horse on the outer quarter, the other horse goes on the horse-path, the man steadying the harrow by the handles. Of course they take one inside, and one outside quarter as they go, and the other two quarters as they come back." And as "this harrow is certified, by several people in the parish where it is used, to do more work with one man, a boy, and two horses in one day, and in a much better manner than could be effected by twenty men in the same time in the usual way," it must certainly produce a prodigious saving both of time and money, and having been found to answer the purpose so extremely well, renders it worthy of attention by those engaged in this kind of work. This harrow is represented at *fig.* 6. in *Plate* XXVI.

It is suggested by Mr. Beatson, "that after the use of this harrow, the heavy roller shown at *fig.* in *Plate* would have a very good effect, or there might be a roller of a lighter construction fastened behind the harrow, to roll at the same time; although the heavy roller would certainly make the best work." He likewise adds that, "other implements, nearly on the same principle, have been constructed, particularly one of which he was shown a model by a gentleman near Chester. Its shape is in form of an isosceles triangle, which is laid upon the road, and drawn by shafts at the base. The two sides, by meeting in an angle opposite the base, are supposed to draw the loose materials towards the middle of the road. It has two small wheels near the base or front, and one at the angle in the rear, with different contrivances for fixing the whole frame higher or lower as required."

It is suggested by the same writer, that "a machine for the more easily breaking stones to repair roads in the common way would be of very great use," as "at

present this is a tedious and laborious task. Under the article Machine, a very ingenious contrivance for removing the mud and dirt from roads has been described and illustrated by a figure.

But, "although several contrivances have at different times been proposed for facilitating the repair of roads, and lessening the expense, yet that expense, Mr. Beatson says, is no doubt very great, especially in those places where many heavy loaded carriages are continually passing. The ruts made by the wheels soon become so deep, and the materials of the road are thereby so much torn up, that it is almost an impossibility, however hard the materials, to keep the road for any considerable time in proper condition or state of repair." It is therefore suggested that "these effects should be attempted to be remedied by some means or other, as by a sort of roller so fixed as to prevent the wheels from sinking so as to form ruts."

The principles and directions which have been given apply equally to private or parochial roads, which in general are in a worse condition from their being commonly worse managed. The causes of their being in bad condition should be attended to and removed as much as possible in the manner already suggested, as it is evident that they must have a great effect in promoting improvements in agriculture, by lessening the expense of labour, and facilitating the means of conveyance of different articles.

The effects of some sorts of wheels have been supposed to be more destructive to roads than others, and of course acts of parliament have been formed with the view of affording proper regulations in this respect. See *Wheel* and *Waggon*.

The author of the paper stated above thinks it a matter of great consequence to have proper regard to "the nature of the fences on the sides of roads," as "on these the goodness of them, and the expense of upholding them very much depend. Where the form of the ground and situation will admit of it, the sunk fence facing from the road, that is with the deepest part towards the field is, he says, by far the best. A fence of this sort, in the form of a ditch or drain, may be made of any depth without the least danger or inconvenience, which is not the case when open to the road; and the deeper it is made, the better effect it will have in keeping dry the foundation of the road, if properly constructed, nor will the road require to be so wide as usual, at the same time there will be fully more room to travel on; for if the fences are of this kind, the whole width of the road may with safety be occupied, but when open to the road a considerable space is lost, by the fear or danger of approaching too near them." And the fences on the "sides may either be of stone, sod, or a hedge or paling; but ought not to be more than eighteen inches, or two feet above the level of the road (except a paling), and the top of them, if broad enough, may in some places be made to serve as a footpath. Nevertheless, the fence towards the field may be six feet in height, or as high as the purpose of it requires. The road will thus receive the whole benefit of the sun, which is very essential towards keeping it dry, as well as the depth of the drains or ditches withinside the field, to which there must be proper openings at certain distances, as before recommended; and in winter after heavy falls of snow, there will be little chance of a road fenced in this manner ever being blocked up, for it will be observed, when a storm of snow is attended with a high wind, that the drifted snow lodges chiefly about the fences, or where it meets with an obstacle to occasion an *eddy*; for where high fences are on the sides of roads, they are almost to a certainty in such cases blocked up, to the great inconvenience of the whole neighbouring country or district in which it happens."

The planting of trees on the sides of roads should always be avoided as much as possible, but where rows of them are to be put in, it should never be done at less than ten or twelve feet distance from the fences, and not less than forty or fifty feet from each other, being constantly so situated as not to produce much shade on the road in the middle of the day, as shewn at *fig.* 5.

ROAD-*Horse*, such a one as is employed in the teams on the road and which in general performs the most laborious work. Under this description comes the greater part of all the horses in constant use, as it includes carriage-horses of every kind, roadsters, and hacks. Road horses of every denomination are, from their constant hard work, entitled to a proportionable degree of care and attention with the best horses in the kingdom; and should undergo the useful part of stable management that so much contributes to the preservation of health, in horses of a superior discription: those which have incessant labour, or which travel post, must be supplied with, at least, from one to two pecks of corn a day. Large and strong carriage-horses, in perpetual work, require considerably more, or they will become apt to lose flesh by frequent perspiration. These rules however offer only a kind of general standard.

ROADING, a provincial term used to signify the striving of teams for the lead on the roads. It was formerly much in use in Norfolk; but is at present nearly laid aside, probably from the danger that attended it.

ROAK, a provincial word signifying a mist or fog.

ROAN-*Colour*, a particular colour of the horse. See *Colour*.

ROAN, a sort of bay sorrel or black colour in horses, with grey or white spots interspersed very thick: when this party-coloured coat is accompanied with a black head and black extremities, it is called a roan with a blackmoor's head; and if the same mixture is predominant upon a deep sorrel, it is called claret roan.

ROARING, in *Farriery*, is a disease little noticed by writers, though well known to jockeys and horse-dealers. It takes its name from a singular noise which the horse makes in breathing whenever he is put into a brisk motion, and according to Mr. Ryding, is owing to lymph being extravasated, and coagulating on the inside of the trachea, or windpipe, and by that means obstructing respiration.

"It is added, that the principal cause is sudden or long-continued and violent exercise. In its incipient

stage, blistering the whole length of the wind-pipe may be of use; but when the disease has continued a length of time it becomes incurable." It usually accompanies broken-wind in horses, or at least is the fore-runner of it.

ROD, a measure in length, consisting of sixteen feet and a half

RODDEN *Cribs*, a sort of large fixed wicker-work basket for containing the hay or other fodder in farm yards. It is observed by Mr. Marshall in his Rural Economy of the Vale of Gloucester, that these large baskets are "made of the top-wood of willow pollards, and are an utensil common to this county and to Lincolnshire, though situated on the opposite sides of the island: but they are alike grass-land counties, wherein cattle are fattened on hay. They are about six feet diameter. The height of the basket-work is two feet and a half; of the stakes three feet and a half; their heads rising about a foot above the rim of the basket. The width between the stakes twelve to fourteen inches. The size, that of large hedge stakes. The thickness of the rods varies from that of a small hedge-stake, down to a well-sized edder.

"In making these hay baskets the stakes are first driven in a ring of the required size, firmly into the ground. Some of the larger rods are then wound in at the bottom, in the basket-work manner. Upon these the smaller rods are wound; the middle part of the work requiring the least strength, reserving the largest for the top. In the winding and due binding of those the principal part of the art of withy crib making rests. Some makers warm these thick rods in burning straw: others wind them cold; one man drawing them in with a roper while another beats them at the stake with a wooden beetle until they acquire a degree of suppleness. They are mostly made by men who go about the country, and who by practice make them very completely; winding in the top rods so firmly and so regularly that it is difficult to know which has been the last put in.

"In use, the cattle lay their necks between the tops of the stakes. Each being thus kept in its place, the master cattle are in a degree prevented from running round and driving away the underlings. The closeness of these cribs prevents a waste of hay, either by the wind or by the cattle."

On the whole they are useful, simple, cheap, and if well made will last several years.

ROLL, a sort of wreath of hay or straw, used for placing on the head under the milking pail, &c. to keep it steady and prevent its bearing in a partial manner.

Roll, a term often applied to the roller by the farmer. See *Roller*.

ROLLER, a well known implement formed of wood, cast-iron, or stone, so as to turn upon its axis, and be drawn over the surface of the land by means of horses, for the purpose of reducing the lumpy or cloddy state of tillage lands, and rendering these as well as those of the grass kind, smooth and even. They are constructed in different ways for different purposes, and of different sizes and weights to suit different uses in husbandry. They are however in general distinguished into the tillage and grass kind.

It has been a matter of dispute whether rollers with large or small diameters have the advantage in point of effect upon the land. It is probable that there may be inconveniences in both extremes. The roller should not however be so small as to require much loading, as by such means much time and labour is lost. A late practical writer however advises that in "constructing heavy rollers, the workmen should be careful that they have not too great a diameter, whatever the material be of which they are formed, as the pressure is diminished where the implement is of very large size, by its resting on too much surface at once, except an addition of weight in proportion be made. By having the roller made small, when loaded to the same weight, a much greater effect will be produced, and a considerable saving of expense be made in the construction of the implement." And he recommends that "all the larger sorts of rollers should have double shafts, in order that they may be drawn by two horses abreast; and such as are employed for arable lands should have a scraper attached to them. This addition, he thinks, saves much time, and prevents the driver the trouble of constantly scraping the machine, especially in wet seasons, and clayey tenacious lands. Strong frames are also necessary for rollers, so that proper weights may be put upon them; and open boxes or carts placed upon them may sometimes be requisite, in order to contain any additional weight that may be thought proper as well as to receive stones or other matters that may be picked up from the ground. Pieces of wood or stone, as heavy as a man can lift, are the most suitable substances for loading these implements with, where they have not the advantage of boxes" for the purpose of containing such weighty substances.

There has been much inconvenience experienced in the use of this sort of implement in turning at the ends of ridges, fields, or other places, from their not moving upon their axis, but being drawn along the surface of the ground, by which they are liable to tear it up, and make deep holes and depressions before they come again into the direct line of draught, and are not brought round without great exertion in the teams; it has therefore been attempted, in order to obviate these inconveniences, to construct rollers in two pieces, and by the division in the middle to enable the different parts to twist round on their proper axis, one forward and the other in a retrograde direction. When formed in this way, the cylinders are best made of cast iron" as they turn with greater ease and readiness.

Common Roller; this is a sort of roller which is employed for the common purposes of tillage and which is mostly used for rolling wheat in the spring, and grass-seeds, they are generally about five or six feet long, and from fifteen to thirty inches in diameter; but those employed for flattening one-bout ridges, in order to prepare them for drilling turnips upon, are commonly shorter and of much less diameter. It is seen at *fig.* 1. *Plate* XXVII.

If the various kinds of these rollers that are made

use of, Mr. Morley of Newark observes that those that he considers as of the best construction, and which answer the most perfectly in practice, are such as are made of cast-iron, and divided into two parts: the length from three feet to three feet six inches, covering a surface of from six to seven feet, and being above ten hundred weight: the frame should be made in a stout manner, with shafts for one horse, to be fixed on the near side, and hooks put in on the other side in order to have recourse to an additional horse when it may be necessary. The gudgeons or pivots should act upon small case-hardened friction wheels, two to be fixed upon each side the frame; with a small roller made of hard wood, about nine inches long and three inches in diameter, bound at each end with iron, and to be fixed to the back part of the frame, so that both rollers may act with each other in the centre wheel, which will be a mean of keeping the great roller steady, and at the same time very much diminish the draught of the implement.

And it is observed by the author of the Norfolk Report that Mr. Priest of Besthorpe uses a roller that is divided in two parts, rising and falling in the centre for the purpose of rolling the slopes of ridges. And that the same useful tool is in practice in Suffolk by the Rev. Mr. Hill.

Compound Roller. This is an implement of the roller kind constituted of the plane or common and spike kinds united in the same frame, but it is capable of being used separately, and its weight varied according to the nature or circumstances of the land. It is the ingenious invention of Mr. Amos of Lincolnshire, and is represented at *fig.* 2, in *Plate* XXVI, in which A is the spike roller made of a piece of oak wood, seven feet long and fifteen and a quarter in diameter, hooped with iron at each end. The inventor advises in constructing it to "divide the circumference of this roller into twelve equal parts, from which draw parallel lines, one division oblique the whole length of the roller.

"On the first of these lines set off two inches at each end, and divide the remainder into twenty equal parts of four inches each.

"On the second line set off four inches at each end, and divide the remainder into nineteen equal parts, and so of all the other lines alternately. In every division fix an iron spike so that there will be twenty spikes in one row, and nineteen in the other throughout the whole circumference, making in all two hundred and thirty-four spikes. That part of the spike which projects out of the wood is four inches long, one inch square at the circumference of the roller, and three quarters of an inch square at the point.

"The tongue which goes into the wood is four inches long, seven weights of one inch square at the circumference of the roller, and tapers to a point at the end.

"B. is the plain roller made of a piece of oak wood, seven feet long and eighteen inches diameter. In the centre of each end of both rollers are fixed iron bushes of two inches diameter.

"C. the bow part of the left hand side of the frame, made of iron, four inches broad, half an inch thick, and is a segment of a circle twenty-seven and a half inches radius, fixed as per figure for turning the rollers upside down.

"D. is the string part of the bow, five feet two inches long and eight by three inches square, made of oak wood. In these pieces are fixed gudgeons of two inches diameter as at *a a* on which the rollers move, and at four feet one and a half inches asunder.

"E. E. E. E. the four shafts, eleven feet long, six by three and a half inches square at the hinder ends, through which the centre bolt passes.

"F. F. F. F. four bars, four by one and a half inches square, and three and a half feet long, for bracing the shafts together.

"G.G. two bars, eight feet long, and three by eight inches square, with double tenons at each end for bracing the outside frames together. In the outer ends of these tenons are linchpins for the convenience of taking the machine to pieces, but these are omitted in the plate.

"H. the centre bolt made of hammered iron, two and a quarter inches diameter, at one end is a round head, at the other a linchpin as per figure.

"The principal use of this bolt is to give the uppermost roller an inclination forward when working and the degree of inclination is governed by the breadth of, and the distance between the two braces, G.G. which rests upon the shafts when the roller is at work so as to make the horses carry a little on their backs, otherwise it would be in danger of endeavouring to fall backward.

"The distance between G.G. is twelve inches, or six inches from the centre bolt H." This implement is found of vast use in reducing the stubborn sorts of soil to a fine state of mould or what is termed tilth by farmers. The ingenious inventor remarks that it affords the farmer a command over dry seasons, and enables him to sow his spring and fallow crops in proper time. It likewise, he thinks, furnishes him with the means of cleaning his tillage lands from weeds whether of the root or seed kind. After passing this sort of roller two or three times over the land, with drag harrowing in the intervals, he supposes it would be rendered sufficiently fine for any purpose that it may be wanted for. And that when the cloddy surface is reduced to such a condition as to be incapable of being longer acted upon by the spike roller, the plane roller may be had recourse to with the dry harrow. It is likewise stated to be of great advantage in restoring such grass-lands as have the sward in a degenerated state. See *Rolling*.

Drill Roller, this is a roller originally contrived for the purpose of forming drills in dry light soils for putting the grain in; but which is likewise found useful in reducing cloddy rough tillage land into a state of pulverization and fineness. The invention of it has by some been ascribed to the Norfolk farmers but the writer of the Agricultural Survey of that district says that he has at different periods made many inquiries for the inventor, of this tool but could not ascertain it thirteen years ago. Mr. Sillis, of Hartford Bridge, near Norwich, was mentioned to him as a person who had improved it. It is described as a cylinder of iron about seven feet in length, around which are fixed cutting wheels of cast-iron that each turn inde-

pendently of the others around the common cylinder; weighing from a ton to a ton and an half, being drawn by four horses, and is heavy work. It is observed that the "the cutting wheels, being moveable, may be fixed by washers, at any distance, commonly at four inches. By passing over a fresh ploughed layer, the soil is cut into little channels, four inches asunder; the seed is then sown broad-cast, and the land bush-harrowed in the direction of the drills; thus the seed is deposited at an equal depth. George, Earl of Orford, gave the writer one, he says, but the soil was too heavy for it: for breaking clods in a dry season no tool he ever beheld comes near to it."

It is supposed by some that the main object of the practice is to save the trouble and expense of dibbling, though it is not near so good a practice.

It is remarked by the author of the above Report that "they are much in use in Loddon hundred. Mr. Burton, of Langley, puts in a great deal of corn thus, and approves the method so much, that hitherto he has drilled little; but thinks dibbling a vast improvement." It is however added that "the implement was more commonly used in the county ten or twelve year ago than it is at present, for the drill machine has been adopted by many who formerly had a good opinion of this tool."

It must however be found beneficial in its original intention, in many cases, on the very light friable soils, and as a pulverising machine on those of the heavy kind when used in suitable seasons.

Furrow Roller, this is a tool of the roller kind, contrived for the purpose of rolling the furrows in steep hilly situations, and other places where the common sort cannot be employed. It is the invention of Mr. Pinchard, and is an useful contrivance for the purpose for which it was intended. It is seen at *fig.* 3.

Grass Roller, this is a heavy sort of roller made use of for the purpose of rendering the surface of grass lands smooth and even. It has been suggested that "the wooden rollers of this sort, which are frequently employed with great propriety on grass and pasture lands, are in many cases made too large to produce that powerful effect which is wanted without the aid of additional weight being given. If made less and well loaded it is supposed that a greater degree of pressure would be afforded. A medium size is probably the most effectual in giving the requisite pressure in such cases.

A representation of a powerful implement of this sort which is used in the best grass districts of the kingdom is seen at *fig.* 4. in *Plate.* XXVII. It is however made of wood, but iron or stone where they can be had are much better materials.

It is stated in the Norfolk Agricultural Report that Mr. Coke has the most powerful roller for grass land that the writer has seen: it was cast at the Carron foundry: it is five feet six inches high, and five feet six inches long; weighs three and a half tons; is drawn by four horses, and cost sixty pounds. It is observed that it leaves the surface of grass lands in the order that it ought always to be in.

Spike Roller, this sort of roller is constructed much in the same way as those of the common kind, only instead of being plain it is studded, or set with a considerable number of spikes, by which it is supposed to break the soil more effectually. It is mostly employed on the heavy stiff lumpy tillage lands for the purpose of reducing and bringing these into a better state of pulverization. In some cases it may be a good implement. It may be seen at *fig.* as connected, with the compound roller. Where the drill roller is in use this sort of roller is unnecessary.

ROLLING, the action or operation of drawing a roller over the surface of the ground with the view of breaking down the clods, rendering it more compact, and bringing it even and level; or for only levelling the surface as in grass lands.

This is a practice that becomes necessary both upon the tillage and grass lands, and which is of much utility in both sorts of husbandry. In the former case it is made use of with different intentions as for the purpose of breaking down and reducing the cloddy and lumpy parts of the soil in preparing it for the reception of crops. It is also of great use in many cases of light soils, in rendering the surface more firm, even, and solid, after the seed is put in. It is likewise found beneficial to the young crops in the early spring in various instances.

It is stated by the author of Practical Agriculture that in the cases of stiff, heavy, and adhesive soils of different kinds it "may frequently be made use of with the first mentioned intention, with very great advantage; but it should only be employed when such lands are tolerably dry, for when drawn over the ground under the contrary circumstances, little benefit can be afforded in the way of pulverization, while much mischief must be produced by the poaching of the horses, and the plastering of the earth round the implement. But by using it in the manner just directed, all the lumpy or cloddy parts of the surface soil may be effectually crushed and reduced into a fine powdery state, fit for the reception of the seed. And that if in such sorts of soil it be applied in the intervals between the different harrowings, it may contribute much in the same way not merely by reducing a great number of the lumps by the pressure that it causes, but by forcing others so much into the ground that they may be acted upon and further broken down by the fermentation that mostly takes place in the soil after land has been stirred. In all the light and more porous sorts of soil very beneficial consequences may also, he thinks, be derived from this operation by the consolidation of surface that is thus produced, and the more perfect retention of moisture, by which the seed, especially if of the small kind, is enabled to vegetate more equally, as well as in a more expeditious manner than would otherwise be the case. It is likewise supposed that in cases where lands have been left rough after ploughing for the purpose of more effectually destroying weeds, it may be of utility, by being employed before the harrows, to give them more power in laying hold of and reducing the soil, and by the pulverization that it affords, and the more perfect retention of moisture that it causes in consequence of the surface being rendered more close and compact, the seed weeds are produced more abundantly, and more readily destroyed. It is likewise in these last

methods Mr. Donaldson says, that it proves so highly beneficial in all cases where grass-seeds are sown; as well as by the equality and smoothness of surface that is thereby produced; and it is well observed by the same writer, that if no other benefit were derived from rolling lands in tillage, than smoothing the surface, even that in harvest is of material consequence, more especially where the crops are cut down with the scythe, which is general in most of the southern districts of the kingdom, and which the increasing scarcity of labourers must soon in all probability introduce into those of the north."

It is also remarked by Mr. Morley, in the fourth volume of Communications to the Board of Agriculture that "old sward, or grass-seeds upon first breaking up, should always be rolled before dibbling for either wheat, beans, or pease, as it makes the land more solid, and the grain, when it vegetates, will form a stronger root. Wheat should always be rolled in the spring after frost, as it will make the soil adhere more closely to the roots of the plants, which very much encourages vegetation, and will cause the stem to be much stronger, and the grain will be brought to greater perfection. Barley and oats should always be rolled when the blades are about an inch above the ground, if the weather permits; and turnips should be rolled at night, soon after the plants make their appearance, which will be a mean of destroying a great number of slugs and snails, that are very destructive to the young plants."

And it is supposed by Mr. Somerville in his Survey of East Lothian, that "rolling when conducted in a judicious manner is highly beneficial, and admits of being much extended, especially upon all winter crops after that season has been severe, and without any regard to soils, as both loams and clays, after much naked frost, have their cohesion so much broken as to leave the plants quite loose, and almost without any establishment."

It has been stated, that "the rolling of wheat, rye, barley, &c. with a roller of a good length, and half the weight of the common ones, above described, may be advantageous in other ways, as it presses down the soil that has been raised by the frosts, about the minute ramifications of the attracting ducts, and augments the quantity of mould upon them by breaking the little lumps of sod; which, indeed, were very serviceable in winter by affording shelter, but in spring will still be of greater use, by such imminution in filling up the fissures, and preventing, in a great measure, the ill effects droughts have on light soils, by retaining and filtering rain-water; whereby the soil imbibes whatever is nutritive, and what is superfluous of the simple fluid only escapes.

It is added that, "although these are some of the many advantages rolling produces in agriculture, notwithstanding it amounts to no more than mere conjecture, that in general, rolling corn may do more damage than it can do good, if such cautions as the following be not carefully attended to, viz. never to roll corn but in dry fresh weather; by no means to use heavy rollers, nor to roll too early, as before the blades be pretty strong, for the wounds that the blades may receive, the roots, being then tender, will be unable ever to recover; nor too late, as, when the stalks are hardened and grown to any height, for the roller will break them, which injury can hardly be repaired, and the crop is thereby greatly hurt; that none but light lands are proper to be rolled with this view, and those which have been manured that or the preceding year with dung only: in short, none but rich light soils, in general, can be improved by rolling in this intention; for in poor lands it opposes the most active principles, and undoes all that has been done for the crop by ploughing, &c." It is consequently concluded that "the soil, the condition, the growth of the corn, the weather, and the weight of the roller, are all to be most scrupulously regarded; when all coincide, the advantages of rolling may be great; but when they do not, the disadvantages may be insuperable. "Rolling then is neither the least critical, or most insignificant piece of the husbandman's profession; therefore ought not to be performed at random and without circumspection," in cases where young crops are concerned.

Mr. Marshall, in his Rural Economy of Norfolk, in speaking of rolling, remarks that one circumstance requires to be mentioned, which is, that "the roller, notwithstanding the lightness of the soil, and its proneness to be injured by dry weather, is never used in Norfolk for the purpose of compression. He never saw one used by a farmer either upon fallow or upon a lay; not even upon the first year of a clover-lay, to smooth the surface for the scythe. "The only uses to which he has seen a roller put, in that district, are that of smoothing the surface before sowing, to prevent the seed from running down too low, and that of smoothing it afterwards as a preparation for the scythe: and even this operation is performed with a roller not more perhaps than seven or eight inches in diameter; a circumstance which, he confesses, he is no way able to account for; nevertheless, it would be rashness to condemn an established practice, unless he could, from his own experience, or from adequate observation on the experience of others, prove it to be ineligible."

And it is stated, "that there is a sort of land, which, when clover is sown upon it, throws out the young plants after a frost. Rolling in the beginning of winter, and immediately after the frost is gone, will, in some measure, prevent this. The first rolling hinders the frost from penetrating so deep as it would otherwise do; and the second makes the land firm, after having been loosened by the change from frost to open weather.

In the latter case, or that of grass land, this is also a process that is of much advantage, especially where such lands are kept under the scythe. And it is probable that in many cases of pasture lands it may be found of great benefit. In the former it is found beneficial in keeping the surface free from hills, and in a more even state, as well as the grass from becoming in so tussocky a condition as is often the case where the practice is neglected or not well understood. And in the latter it may perhaps have a similar effect, and keep the grass more free from tufts, and in a more regular con-

dition which is a circumstance of great consequence in the practice of grazing. It has been remarked by a late practical writer, that "the impression of the roller not only renders the surface more level, and fine, but at the same time induces the grass plants to spread more laterally, and in that way to form a better and more close sward, which may be highly beneficial in both cases. Its importance on new laid down grass-lands is therefore, he says, extremely obvious, as it must be highly serviceable in these different intentions. And the worm casts are by this means reduced and brought into order, by which means the mowing can be performed with greater facility and in a closer manner. Besides, it may, he says, be useful in other views, as by pressing the mould as well as the manure, more closely round the roots of the grass-plants; and in consequence of such means they may not only be better established in the soil, and their vigorous growth more effectually promoted, but from the moisture being more fully preserved in the ground be in less danger of injury from the effects of heat in the summer months, and of course better crops be afforded at the period of cutting them down. In order to perform this business in the most complete and effectual manner a roller of considerable weight is necessary, such as has been already described; and it has been advised, in order to prevent as much as possible the ground from being injured by the feet of the animals that draw it, as may frequently be the case where they follow each other in the same part, it may be the best practice to have them yoked double, as by that means there will be less treading on the same portion of surface; and that where two horses are sufficient to execute the work more should never be made use of; but if a third should be found necessary, it may be attached as a leader in the middle before the other two: a greater number of horses can seldom or ever be of any material advantage in this sort of work." It is also suggested as necessary to be very careful in executing this operation, to see that every part receives the due impression of the implement. On lands where this sort of work is regularly performed, it will seldom be requisite to pass more than once in a place, but in other cases it may often be done more frequently with benefit, and in particular cases a more frequent repetition of operation is absolutely requisite in order to bring the ground into a proper state. It is necessary in the execution of this business on grass lands to attend in a particular manner to the season as it cannot be performed with advantage either when the surface is in too dry or too moist a condition. It is stated that in these cases the work of rolling may be advantageously performed at different seasons, as in the beginning of the autumn, and in the commencement of the year, or very early spring months: but the latter is the most common period. But in order to its being executed with the greatest possible benefit, a time should always be chosen, if possible, when the ground is in a suitable state for receiving the impression of the implement. In the drier descriptions of land it may frequently be performed in the most beneficial manner, after the land has been rendered a little soft by a moderate fall of rain; but in those of the contrary sort, it may be necessary to wait till the superabundant moisture be so much dried up as to admit the animals employed in drawing the machine without poaching or otherwise injuring the surface of the ground while the process is going on. It has been remarked by Mr. Boswell that the rolling of watered meadows should be executed towards the latter end of February or beginning of the following month, after the land has been left in a dry state for a week or ten days. And that the work should be performed lengthwise of the panes going up one side of the trenches and down the other. And in the case of rolling the common hay lands it is a good mode to proceed up one side the field and down the other somewhat in a similar manner, as by that means the work may be the most completely executed.

A writer, in the Communications to the Board of Agriculture, mentioned above, has remarked that sward and meadow land should always be rolled in April or the beginning of May, and when the ground is in a moist state, as it causes the grass to be of a more kind nature, and reduces the hills raised by the ants to a proper state for being mown over.

And on such new grass-lands as have been just restored to the state of sward, and which are often thin and patchy, when seeds are sown over such parts the roller may frequently be run over them in order to force in the seeds, but a better practice is to turn sheep upon the lands, confining them upon such patches by means of hurdles, in order that they may tread them in. In either case a rather moist time should be chosen for the purpose. In cases of this nature where there is a degenerate sward, Mr. Amo, in his Minutes on Agriculture, advises the use of his compound roller, which should, he says, be run over the ground early in March, when the sward will admit the spikes without being injured by the feet of the horses, the land being previously covered with well-rotted dung, or compost, in the proportion of from about eight or ten tons to the acre. It should be well rolled in different directions, till the surface sward is pretty much broken, then sowing the grass seed over the land, and after letting it be well dressed with the sward dresser, and all the rubbish collected cleared away rolling it well down with the plain roller and admitting no sort of live stock afterwards upon it. In this method of using the roller vast improvements may in many cases of degenerated or worn-out grass-lands be effected without incurring any very heavy expenses. See *Sward-dresser*.

ROOD, a quantity of land equal to forty square poles or perches, or a quarter of an acre.

ROOF, the covering of any sort of building. These are formed of many different sorts of materials. Thatch was formerly almost in general use for covering the roofs of farm buildings; but it is obviously objectionable on many accounts, it not only serves as a hiding place for rats, mice, insects, and other sorts of vermin; but is extremely perishable in its nature, subject to be much damaged by high winds, and of course liable to frequent repairs, and, above all, highly dangerous from its combustible nature: it is therefore

probably the most improper, the least safe, and in the end the most expensive material that can be employed for the purpose. Mr. Middleton, however, thinks that it keeps out the summer's heat and winter's cold more effectually than any other material now in use; but that, as it is not quite so compact and sightly as slates or tiles, and the straw being of such value for other purposes, it will, he thinks, probably be superseded by them. Tiles though little exposed to danger from fire, do not by any means constitute a good roof, being ill calculated for preserving grain or other farm produce. In summer they admit a heat very unfriendly to hay, corn, or straw, while in winter they are equally objectionable on the ground of transmitting moisture in a high degree, while slates, though more expensive at first, are liable to none of these objections, especially when of the more thick kind. A roof covered with them therefore, answers every useful purpose, and is very durable, lasting half a century with very slight repairs.

The author of the Middlesex Report on Agriculture remarks, on this important subject, that "pantiles are so easily heated through by the sun during the summer months that the rooms underneath are as hot as an oven; while in the winter season, in every common frost, these tiles are so completely frozen through, as to become as cold as a covering of ice. These extremes must consequently have a very bad effect on the health of the inhabitants. The blue slates are so very thin, as to be equally liable to the same objection, particularly as they are now laid on most of our fashionable houses, under Wyatt's patent. They are rather better, he thinks, when laid on in the common manner (*i. e.*) on double laths, but much better on boards. Plain tiles make a considerably more *temperate covering* for houses than either pantiles or slates, by reason of their being laid double and in mortar, and thereby forming a much thicker and closer roof. In this they are nearly equalled by the thick or stone slating of the midland counties; they might also be *glazed* of a *slate colour*, in which case they would, he says, make a roof more *handsome*, *temperate* and *durable* than any other covering material now known."

A good cheap durable material for this purpose would be a valuable discovery.

ROOFING, a word applied provincially to the ridge cap of thatched roofs.

ROOK, a well-known bird, of the crow kind, which feeds on grain, insects, &c.

Great care should be taken to guard against these mischievous birds at the time when the wheat is just shooting up; for they perceive it shooting much sooner than the farmer can, and are led by the shoot to pick it up. They must therefore be carefully kept off the ground about a week or ten days after this season; for at the end of that time the blade will be grown up, and the grain so exhausted of its substance that they will not give themselves any trouble to pick it out of the ground. They seldom or ever molest the wheat which is sown about Michaelmas; because so much grain of the late harvest then lies scattered about the fields, that they find it much easier to pick up there, than to search for corn under ground in newsown lands. They often do harm when the snow is going off from the green wheat towards the end of winter; for having been pinched for food during that season, they then greedily pluck up the young plants, in order to come at the remainder of the seeds still adhering to their roots; and are greatly assisted in this by the loose state of the earth at that time.

They are also highly destructive to pea and bean crops, in the early spring season when they first appear above the ground, as they dig up the whole both root and stem, even when considerably advanced in growth. They must therefore be kept off with great care. A great many contrivances have been invented to frighten them away, such as feathers stuck up, the limbs of rooks scattered about the ground, dead rooks hung on sticks, the gun, a boy to halloo, and toss a dead rook up in the air; Mr. Tull found this last to be the most effectual. It is probable, however, that firing at them frequently with a gun, is the most certain means of deterring them from doing such injuries, as they have a great dislike to the smell of gunpowder.

It is remarked by Mr. Marshall, in his Rural Economy of Norfolk, that "the method of frightening rooks in practice there, especially when they take to patches of corn which are lodged before harvest, is simply to stick up a tall bough in the part infested; and if a gun be fired near the place, before the bough be set up, this simple expedient seldom fails of being effectual." And that "if rooks make an attack after seed-time, or when they take generally to the crop before harvest, a boy is set to scare them; they being seldom attempted to be shot at in Norfolk; where a notion prevails, and is perhaps well founded, that rooks are essentially useful to the farmer, in picking up worms and grubs; especially the grub of the cock-chaffer, which, it is believed, is frequently injurious to the meadows and marshes of that country." This opinion also prevails in other districts, and has most probably some foundation in truth, as they are often seen to follow the plough close to pick up such grubs.

ROOKERY, a term applied to a nursery of rooks, or place where they build their nests, and collect in large numbers.

ROOAC, a provincial word used to signify a fog or mist. See *Roke*.

ROO, a provincial term signifying rough.

ROOP, a term applied to signify a hoarseness.

ROPE, a thick sort of cord formed of hemp or other material; much used by farmers. See *Cordage*.

Cart Rope, the rope used in loading hay, straw, or other bulky loads.

ROPE, a word signifying to tedder as a horse or other animal.

ROOT, the lower part of a plant, or that which is in the ground, and by which it adheres to the earth, draws its nourishment, and transmits it to the other parts. For the method of clearing lands from the roots, see *Clearing of Land*.

The roots of plants are of use to them principally in two respects, viz. to give them stability in the ground that they may not be displaced, or blown down by high winds, or other accidents; and by their spreading in the ground, for collecting and preparing food for

the whole plant. Plants are in part fed or nourished from the air, fine vapours, dews, &c. which enter by their leaves and branches, but principally by what is absorbed and taken up by their roots; for which reason the farmer takes infinite pains to prepare the land by tillage and manure, whereby it is opened, pulverized, and not only made more easily penetrable for the roots to spread in, and collect their nourishment, but rendered more proper for being impregnated with such matters, as well as for retaining and conveying them to their fibrous roots in order to be drank up.

Roots may be divided into two sorts, viz. perpendicular or tap-roots, which penetrate deep, and run down in the ground, usually singly, such as carrots, parsnips, and the roots of some trees, &c. And those that divide near the surface of the ground, and spread in it in various directions, which are called horizontal and fibrous roots, and if very small, capillary roots. The tap-roots have also fibrous roots issuing from their sides, all round the tap-root; and these lateral roots are longest near the surface of the ground, and gradually shorter as the tap-roots descend deeper into the soil.

The surfaces of roots are soft and spongy, more particularly in the small or fibrous roots, and these are furnished with absorbent vessels, the mouths of which drink up the vegetable food, and distribute it to all parts of the plant. As the large roots are more close and hard on their surfaces, it would appear that they are chiefly intended for the support and stability of the plant, while the fibrous roots collect the nourishment for the support of the plant, as well as the large roots.

The branches of roots are formed with their extreme ends pointing from the stem of the plant, and hence it appears that roots when once well formed do not afterwards increase, or extend farther longitudinally; they lengthen at their ends, but not at their intermediate parts, for if they did, the branches being left behind, would be drawn back, with their ends pointing towards the stem; but they are constantly found in a contrary position, with their ends pointing in a direction from the stem. If a root is cut it extends no farther in length, as already observed, but new roots are formed near the cut end of the old root; two or more new or young roots being formed in the room of the former old one. Hence the fibrous roots of plants are multiplied by cutting them with a spade or hoe; and this is often a great benefit to the plant. The pores of the fibrous roots are the mouths of the absorbent vessels, by which the whole plant is fed, and the more they are multiplied the more nourishment they collect for it.

Thus a plant that naturally extends its roots to a considerable distance is in danger of being killed by transplanting, unless it is also furnished with fibrous roots, which must be carried with it to the new ground; or new ones must be formed to make the plant thrive. Hence it is, that plants which have long straggling roots are removed with difficulty; but plants of the same kind and age, and that grow in the same ground, are transplanted with safety and success, if they have been previously dug round with a spade, whereby their fibrous roots have been cut and multiplied, so that they rise with a ball of earth adhering to them.

There is a communication between the different roots of a plant, as when some of them are well nourished the others are benefited thereby. If some of the roots of a plant be laid in dry earth or sand, and others in water, the latter will furnish the dry roots with water sufficient to keep them, and the earth about them, moist, so long as they have a supply of water; it is for this reason that deep rooting plants are little affected by drought; the tap-roots finding moisture below send some of it up to the roots near the surface: for which reason also lucern and saintfoin flourish in dry hot weather, in which common grass, and other fibrous-rooted plants, that do not descend deep, are scorched and burnt up.

And as roots communicate moisture to each other they therewith also communicate nourishment; for it is found by experience, that drilled plants, well hoed on one side of a row only, are better nourished than sown plants standing at equal distances, or upon an equal surface of ground with the drilled, and not hoed.

Besides these sorts of roots, some kinds of grain, as that of wheat have them double, or what may be termed two sets; the first coming directly from the grain or seed, while the latter shoots sometime afterwards from the top or crown. Hence they are denominated *seminal* and *coronal* roots. The "seminal root is," Dr. Hunter says, "pushed out at the same time with the germ, which together with the *farina* nourishes the plant during the winter, before the crown and coronal roots are formed." But that "in the spring when the crown has become sufficiently large, it detaches, he says, a number of strong fibres which push themselves obliquely downwards. These are the coronal roots serving to nourish the plant till it arrives at maturity." And he adds that "a small pipe preserves the communication between them and the seminal roots. This," says he, "makes an essential part of the plant, and is observed to be longer or shorter, according to the depth that the seed has been buried." But on the contrary, "it is," he says, "remarkable that the crown is always formed just within the surface. Its place is the same whether the grain has been sown deep or superficial." And that as the increase of this sort of grain "depends upon the vigorous absorption of the coronal roots," it is obvious why they fix themselves so near the surface where the soil is the most rich, and contains the largest proportion of nutritious substances. It is also evident that as this sort of grain must be exposed to the severity of the winter season, its roots are admirably disposed to withstand its effects.

These facts, and those connected with the nature of the roots of different plants of the grass kind, lead to many important considerations in the practice of the farmer, and fully show the necessity as well as utility of his being perfectly acquainted with the nature, form and mode of growth of the roots of

such plants as have been introduced into field culture.

Root *Crops*, such sorts of field crops as afford their produce in roots, such as potatoes, turnips, &c.

Root *House*, the place where roots are deposited for the more readily supplying stock of different kinds with them. It is of much consequence to the farmer to have this place as near as possible to the stables, feeding-houses, and cattle sheds. These houses are essentially necessary wherever there is a number of cows or other sorts of cattle to be supported on roots of the carrot, parsnip, turnip, and potatoe kinds, as well as for cabbages, as without them it would not only be inconvenient, but in many cases in severe weather impossible to provide them for the daily supply of such stock. The cabbages should not, however, ever be kept long in these houses, as they are very apt to take on the putrid fermentation, and become useless. The farmer should be careful that the yard man constantly keeps such places perfectly clean and sweet, in order that the roots may contract no bad smell as cattle are in many cases, extremely nice in their feeding, and when once disgusted with any sort of food seldom take to it again in a proper manner.

ROOTWELT, a term applied to the hattocks of grain when the but ends of the sheaves are turned up towards the wind in order to dry them.

ROSIL, a term applied to such land as is neither light nor heavy, being a medium between sand and clay; it is sometimes written Rosills.

ROT, in *Farriery*, a disease incident to sheep and other animals, in which both the liver and lungs are affected, and there is often a dropsical tendency. It is mostly connected with moisture or moist situations; but its causes are far from being perfectly investigated. Dr. Harrison of Lincolnshire has, however, lately done much in this way, and drawn many useful and scientific conclusions. The disease is readily known to experienced shepherds by a careful examination of the eye, which is done by placing the sheep "betwen his thighs, and holding the head with both hands. He then proceeds to raise the upper and depress the under eyelid; by which mean the blood-vessels of the tunica albuginea, or white, are brought into view. When they are red, and in great numbers, the sheep is supposed to be in good health. The caruncula lacrymalis, or haw and inner surface of the eyelids, should be as red as the vessels on the eye-ball. If they are pale, and the veins are in small quantities, and faint-coloured, or livid, the sheep is in a debilitated state, or afflicted with the rot. And in all cases where the blood-vessels have entirely disappeared, the mutton is bad. By frequently examining the eyes in dangerous seasons shepherds may always discover the rot before the sheep begin to shrink, and, consequently, in time to prevent any material injury to their profits."

The intelligent writer just noticed traces the nature and effects of the disease in the following manner: When, says he, "In warm, sultry, and rainy weather, sheep that are grazing on low and moist lands feed rapidly, and some of them die suddenly, there is reason to fear that they have contracted the rot. This suspicion will be further increased if a few weeks afterwards the sheep begin to shrink, and become flaccid in their loins. By pressure about the hips at this time a crackling is sometimes perceptible. Now, or soon afterwards, the countenance looks pale, and upon parting the fleece, the skin is found to have exchanged its vermilion tint for a pale red; and the wool is easily separated from the pelt. As the disorder advances the skin becomes dappled with yellow, or black spots. About this time the eyes lose their lustre, and become white and pearly, from the red vessels of the tunica adnata, and eye-lids, being contracted or entirely obliterated. To this, he says, succeeds debility and emaciation, which increase continually till the sheep die; or else ascites, and perhaps general dropsy, supervene, before the fatal termination. These symptoms are rendered more severe by an obstinate purging, which comes on at an uncertain period of the disorder. In the progress of the complaint sheep become what the graziers call *chockered*, that is affected with a swelling under the chin, which proceeds from a fluid contained in the cellular membrane, under the throat." And he adds that "in five or six days after contracting the rot, the thin edge of the small lobe of the liver becomes of a transparent white, or bluish colour, and this spreads along the upper and lower sides, according to the severity of the complaint. Sometimes it does not extend more than an inch from the margin. In severe cases, the whole peritoneum investing the liver is, he says, diseased; and then it commonly assumes an opaque colour, interspersed with dark red lines or patches. The upper part of the liver is sometimes speckled like the body of a toad, to which it is said to bear a striking resemblance: round the ductus communis choledocus, and hepatic vessels, a jelly-like matter is deposited, which varies according to the severity of the attack, from a tablespoonful, or less, to five or six times that quantity. Upon boiling, the liver loses its firmness, and separates into small pieces in the water, or remains soft and flaccid."

It is observed, that graziers and butchers having remarked that sheep are much disposed to feed during the first three or four weeks after being tainted, avail themselves of this circumstance, very commonly, to increase their profits. "When the first stage is over," he says, "flukes begin to appear in the poribiliarii, the ductus communis choledocus, and in the gall-bladder. At first, the number of these creatures is small; but as the disease advances, they increase, and before death are often very numerous. In the last part of the complaint they are sometimes to be found in the stomach, as well as in the intestines and liver." This, like the visceral disorders of the human body, may, he thinks, terminate in resolution, effusion, suppuration, or schirrus. "1st, The complaint is said to terminate in resolution, when the inflammatory action goes off, without destroying the state and texture of the parts. However, he is strongly inclined to believe, that every considerable inflammation in the human body, and in other animals, although it ends in resolution, leaves behind it some remains,

which may be discovered by an experienced anatomist. When the vessels are thrown into inflammatory action for a few days only, effusion commonly takes place, and the coats become thicker, and assume a buff-like colour. These changes in the sanguinary system often continue through life, and lay the foundation of many chronic and incurable disorders. Sheep that recover from the rot exhibit very different appearances after death, according to the severity of the attack; but the taint is seldom or never entirely removed." The liver of an old ewe, that lately died fat, and contained fourteen pounds of suet in her body, had, he observes, the following appearances: "The back part of the small lobe was dappled with whitish spots; the coats of the ductis communis and pori biliarii were considerably thickened, and more solid than usual. In colour they resembled the human aorta in old people, and were full of flukes: in other respects the liver appeared to be sound and natural. The butcher asserted that the variegated appearance and alteration in the ducts were occasioned by a slight taint of long standing, which had not been considerable enough to disorder the economy, or impair the health of the animal, sufficiently to prevent its feeding."

That 2dly, "when sheep die suddenly in the first stage of the disorder an effusion of serum, or of wheyish-coloured fluid, may be commonly discovered in the cavity of the abdomen, and then the peritoneum surrounding the liver is generally covered with a membrane or coat of coagulable lymph. This form of the rot has, he says, been frequently confounded with the resp or red-water, though it differs from the latter disorder in the colour of the effused liquid, in being much less disposed to putrefaction, and in several other particulars."

And that 3dly, "Abscesses in the liver exhibit another termination of this malady. They are seldom considerable enough to kill immediately; but, in consequence of the absorption of purulent matter from them, the sheep frequently waste away, and die hectical or dropsical. When the collections are small sheep will recover sufficiently to bear lambs, for three or four seasons, and afterwards become tolerable mutton." That 4thly, "The most common termination is in schirri, or what the shepherds call knots in the liver. The whole substance of this important viscus has been found so full of small roundish lumps, or schirrous bodies, that it was difficult to find any sound part in it. The first attack is unfortunately so very insidious that the disorder is scarcely observable before the animal begins to waste and lose flesh. In this advanced state it is said to labour under the rot or pourriture, from overlooking the commencement of the disorder." And "hydatids are observed, he says, to effect schirrous and purulent livers more frequently than others. When livers are much diseased the butchers carefully conceal them from the public eye. To him it is always matter of surprise to find the mutton saleable in these severe cases. It shows, in an extraordinary manner, the accommodating power of living matter, which is able to maintain life, and increase corpulence, under such unfavourable circumstances. Shepherds and breeders, who make it a general rule to kill every sheep that becomes indisposed, from an opinion that very few of them ever recover from any illness, would, he thinks, do well to examine the livers and other viscera of slaughtered sheep. By such a practice they would soon be convinced that sheep are able to endure a great deal."

In respect to the causes of the disease, he says, it has been imputed, 1st, "To a vitiated dew. 2dly, "To a crust, which adheres to the grass after wet weather, or the overflowing of running water. 3dly, "To the luxuriant and quick growth of plants, in hot, moist seasons. 4thly, "To grazing certain herbs. 5thly, "To *fasciolæ hepaticæ*, or their ova, being introduced into the stomachs of animals, by feeding on swampy and low grounds in moist weather. 6thly, "It has been called the *sheep-pox*, by professor Vibourg, of the veterinary college at Copenhagen; but this is not properly a cause of the rot. 7thly, "It is ascribed, by Daubenton, to poor diet, and drinking too much water."

These different causes are objected to and shown not to be well founded by the writer, who thinks that 8thly, "It seems to be occasioned by *poisonous effluvia*, which, under certain circumstances, are emitted from *marshy soils*."

In support of which the author states the following strong facts:

His residence, he says, "consists of high and low lands of a loamy and tenacious nature. While a brook which runs through the farm remains overflowed, and the water continues upon the adjoining flat grounds, his sheep, he observes, never suffer any inconvenience, though they are frequently obliged to wade for their provisions. As soon as the flood is subsided, the sheep can at any time be tainted in a quarter of an hour, while the land retains its moisture, and the weather is hot and sultry. The butchers are so well acquainted with the importance of this fact, that when his friend has disposed of any fat sheep, they are usually turned upon his rotten ground to make them thrive faster." But "by judicious management he has laid the greatest part of his farm completely dry, and is now little troubled with the rot, unless when he wishes to give it to some particular animals. His neighbours, who have been less provident, are still severe sufferers by it, nor are their misfortunes confined to sheep alone. Pigs, cows, asses, horses, poultry, hares, and rabbits, become rotten in this lordship, he says, and have flukes in their livers. Many years since his grandfather removed ninety sheep from a considerable distance to his own residence. On coming near to a bridge, which is thrown over the Barling's river, one of the drove fell into a ditch, and fractured its fore-leg. The shepherd immediately took it in his arms to a neighbouring house, and replaced the limb. During this time, which did not occupy more than one hour, the remainder were left to graze in the ditches, and lane. The flock were then driven home, and in a month afterwards, the other sheep joined its companions. The shepherd soon discovered that all had contracted the rot, except the lame sheep; and as they were never separated upon any other occasion,

it is reasonable to conclude, he thinks, that the disorder was acquired by feeding in the road and ditch bottoms." And he adds that "a Lincolnshire farmer purchased some turnips in Nottinghamshire, upon which he intended to winter a flock of sheep. The first division, consisting of about forty, were detained one night at a village near to the place formerly alluded to, by the overflowing of the Barsing's Eau, and were put upon a piece of flatland which leads to the river. The water had not returned to its former channel more than a day or two. Every one of the forty sheep became rotten; whereas the other division, which stopped no where by the way, escaped the disorder, and remained well. Sheep were formerly admitted into some adjoining pastures, in travelling to and from the neighbouring fairs and markets; but so many of them contracted the rot, that, for some time past, the graziers in this county will not suffer their flocks to stop for a moment near the village. He has repeatedly examined the suspected ditches and pastures, but never observed either flukes, or any of the plants, to which the rot has been attributed: though he must candidly acknowledge, that he ought to have sought for them with more care and attention. These ditches communicate with a rivulet, which frequently overflows its banks, and the inclosures are then deluged with water. The soil consists chiefly of loam or clay, and the surface is so flat and level on both sides of the river, that for want of proper descent, the water is a long time detained upon the ground. He is credibly informed, that in this place the rot affects swine, hares, and rabbits, as well as sheep."

He further states that "he has likewise been informed, by Mr. David Wright, that a few years since, as a drove of sheep were passing through a long lane in the parish of Irby, one of them, being weary, fell down in the middle of the road. The others were permitted to range at large, till their companion was able to travel. They were then driven all together into a pasture, and it was soon discovered that only the *tired* sheep had escaped the rot. As the flock had never been separated upon any occasion we are entitled to conclude that the disorder was contracted while the tired animal remained upon the road."

From these and other cases the writer thinks himself justified in ascribing the rot in sheep, and other animals, to *paludal effluvia*; but in regard to the nature and constitution of which, he acknowledges it is very difficult to form any rational opinion, as they have hitherto eluded the most subtile and delicate inquiries.

With respect to the prevention of the disorder he suggests that "where necessity requires the pasturage of moist grounds in summer or autumn, the shepherd ought carefully to remove his flock into a dry situation before the evening, and provide them with corn, and good hay, or green food." He says that "a considerable farmer of Bohemia kept his sheep sound in the wet and fatal year 1769, by feeding them every night, when turned under a shed, or into stables, with hashed straw; and by eating it greedily they were all saved. By this judicious practice the sheep were removed to sleep in better air, as well as preserved in a more vigorous state of body. Sir John Pringle, he says, informs us, that persons have maintained themselves in good health, during sickly seasons, by inhabiting the upper stories of their houses; and he has reason to believe, that merely by confining sheep on high grounds through the night, they have escaped the rot." He adds that "after the dew is exhaled by the sun's heat, sheep may be suffered to range in moist and swampy places, with less danger, because the miasmata, which are formed in the night, and remain entangled among the grass, or float in the lower part of the atmosphere are chiefly dissipated with the dew. Therefore, unless they be very copiously produced in the day time, or are unusually virulent, they will not be sufficiently concentrated to do much injury to healthy sheep. While at rest and asleep, the operations of the system are more feebly performed, and then sheep are peculiarly exposed to diseased actions. By conforming to these regulations he has known one flock escape entirely, while others have suffered materially in the same open field."

He observes that "it is confidently asserted, that decoctions of bitter herbs, with salt, have frequently preserved sheep from the rot. Salt is supposed to constitute a part of Fleet's celebrated nostrum: and we know, he says, that bitters are deservedly recommended to prevent intermittents, the dysentery, and other disorders, which originate from exhalations." And In Oxfordshire, Dr. Lower has, he says, frequently known six or seven spoonfuls of strong brine and stale urine, with soot steeped in it, to be given with great success. This is done at spring and the fall of the year, when the dew is counted most dangerous. This course of physic is continued eight or ten days, or till the sheep eat their meat heartily; and if they were taken in time, there seldom died any in a whole flock. For the same purpose, Ellis, he adds, recommends the following medicine in his Practical Husbandry: "Take a peck or more of malt, and mash it as though you would brew it into ale or beer, and make eleven or twelve gallons of liquor; then boil in it a quantity of shepherd's purse, comfrey, sage, plantain, penny-royal, wormwood, and bloodwort: add yeast, and afterwards salt the mixture: then turn the liquor into a vessel. After April comes in, give seven or eight spoonfuls to every sheep, once in the week, if the weather be wet, and if dry, not so often."

These remarks and directions deserve the notice of the grazing farmer, as by proper attention to them much mischief may often be prevented.

Some suppose that most dependence in the cure of this affection is to be placed upon the removal of the sheep into dry situations, keeping them warm and sheltered, and giving them dry food in the yard. In the Report on Agriculture for Lincolnshire, some circumstances are given that may direct the farmer on this point. It is stated that in "rotting years, the sheep that feed on the salt marshes over which the spring-tides come sell very high in confidence that they are safe." And that a shepherd, who when young was shepherd's boy to an old man who lived at Netlam, a place noted for the rot, says he is persuaded that sheep only take the rot in a morning before the dew is off, as by keeping them up till the dew is gone they have been preserved from the disease, while

others where this precaution has been neglected, have become disordered.

Rot in *Timber*, a disease in trees which quickly injures and destroys the woody parts of them by inducing a sort of rotting and decay. It has been stated to proceed from different causes, but the principal according to the author of the Practical Planter, are those of external wounds or bruises, the trees growing in unfavourable soils the roots of which, have been barked at the period of planting, or in cutting out plants. And secondly, by the tree growing in spouty soil, whose larger roots have been injudiciously hacked at the time of transplanting, or in cutting out a neighbouring plant. In this case, says he, the disease affects the pith, eats upward, and often consumes the heart to such a degree, while the bark remains in a perfectly sound state, that the trunk is enfeebled, and easily broken. This is demonstrated, he adds, by cutting affected trees at different ages, and the *rot* is generally found less or more advanced upward, according to the size of the cavity. He here states, "a very curious instance of this species of rot that occurred at Wemyss Castle in Scotland, in 1795. In thinning a wood, whose trees consisted chiefly of elm and ash, in one part of it the soil was observed to be spouty, and the elm trees rather in a sickly condition. Every elm tree cut in this part was more or less affected; some were rotted a foot, others two, three, &c. feet upwards, and the wood above, to the extremity of the bole, was uniformly sound, and sold at two shillings a foot. One beautiful ash tree, in particular, was, he says, sold standing, at the rate of half a crown a foot of timber; nor was there the smallest outward blemish from the ground to the very top. When it was cut down, a complete ready made *pump*, fifteen feet in length from the ground upwards, was discovered, and actually, as he was afterward informed, applied as such.

He conceives that in this case "the remedy is to be at all due pains to prevent the cause, by carefully draining the soil of poisonous, ochry water, and when necessity occasions the cutting of large roots, to treat them in the manner of an amputated branch."

A third cause of the rot which he notices is that of "stagnant water lodging in the angle formed by the stem and an upright branch or in the angle formed by rival stems, where no actual ground has ever been made; but, which often happens, if the tree be in a youthful vigorous state, a cup or hollow is formed, resembling that between the thumb and finger half opened. Here the water lodging, in time penetrates the bark, and forms the first receptacle of corruption, which being once begun advances apace to the great injury of the trees."

In this case the first thing necessary towards a cure, or prevention of further injury, "is, he says, to clean out the water, (for which a syringe may, be useful,) dust, &c. and dry the whole well by aid of a mop or woollen cloth; then to fill it up, until it run over with tar; after which to fix on an apron of thin lead, in such a manner as that its edges may reach about a foot upwards on each limb of the tree, being joined close, and fastened with saddle tacks &c."

The composition advised by Mr. Forsyth is probably much better for the purpose, as being less liable to decomposition; and at the same time capable of being applied with greater exactness.

It is remarked by the first writer that knots or excrescences are frequently found on the boles and branches of trees, particularly of elms. What may have occasioned them, in many cases, is not, he thinks, easily accounted for; but it is sometimes obvious that they proceed from bruises, or the maltreatment of trees in youth. In this case, we frequently find them hollow within, and full of water, which if not removed, will of a certainty induce the rot." And he advises that "when the knot is quite entire on all sides, and perfectly sound, which may be known by striking it with a mallet, it should be suffered to remain." But that "when it is found hollow, as above, it should be sawn clean off, the wound should be smoothed, as already directed, cleaned, dried, and laid over with tar, &c. The composition before mentioned is however here probably preferable for the same reason as in that case." See *Composition for Trees*.

Dry *Rot*, a highly destructive vegetable disease, affecting, the timber in the foundations, and other parts of buildings in particular soils or situations. It affects the wood, or ligneous parts, in such a manner as to leave it connected by nothing but the small hard fibrous portions, which give it a curious tremulous appearance, but all of which when touched by the hand in the more advanced stages of the disease, readily moulder into a brownish snuff-like dust. It is attended with a peculiar earthy smell similar to that which issues from fresh dug up wood which has laid some time in the ground, in contact with decaying animal matter. It is very materially different from that natural sort of decay which takes place in wood from the presence of wetness.

It has been supposed to originate from very different causes, such as the use of wood in too green a state, excessive dampness in the foundations of the buildings which are effected with it, the want of a sufficiently free circulation of air in such situations, and more lately to be the effect of a plant of the fungus tribe which has leaves as in the misletoe, &c. The *Boletus Lachrymans*.

On the former suppositions it has been stated to the Society for the Encouragement of Arts, &c. by Mr. Bramley of Leeds, in the twenty-first volume of their Transactions that "to bring the matter to the test by experiments would require the observation of a long period, and in selected situations." And that "wood used for the general purposes of man is cut down at different periods; and although it may be felled at the proper season, or when most free from sap or moisture, it is not always to be effected." Nay, even admitting it to have been cut down in the most favourable situation, it still abounds

with such an extra proportion of moisture, as to require a regular exposure to the air, prior to its being applied to use, if we wish to guard against that shrinking which always takes place, where this precaution has not been taken." And "although the fir kind contains less of this watery portion, yet it assuredly possesses a considerable share; and it is in this species, he apprehends, that the evil called the dry rot most generally occurs, as from the facility of working the same it is most generally applied in buildings. But supposing it to be fir, or any other species, wood felled when abounding with any extra proportion of sap, and applied to use without the proper seasoning or exposure to a free current of air, until such extra moisture has had time to exhale, is most liable to the disease in question; and the cure, or principal prevention against it, would be the precaution of felling all wood only at the proper season, or when the sap is not in circulation. The next mode of prevention would be to use such wood only as has been for a considerable period exposed to the influence of a free current of air, or where convenience will admit, to that of air heated to a moderate degree; such air extracting with greater facility the enclosed moisture, and in a more certain ratio than the irregularity of our atmosphere will allow," under other circumstances.

It is suggested that "in all rapidly-improving countries, this evil is likely to be an increasing one, as the current demand for wood generally exceeds the supplies laid by in store, so as to be applied to use in regular succession, after being properly seasoned." And that another cause that affects all wood most materially when not fully dried, is the application of paint, the nature of which prevents all exhalation, and confines the inclosed moisture till it occasions a fermentation through the whole fibrous system of the wood, and brings on a premature state of decomposition, or the dry rot." It is likewise supposed that "a similar evil may be induced, in consequence of any newly-finished building having all the doors and windows shut up, and that for some length of time, particularly in moist weather. The wood, even though unpainted, is thus frequently placed in our atmosphere more charged with vapour than its own internal contents, and it is consequently in an imbibing instead of an exhaling state, and tending to decay. Wood placed in dampish situations, and the ends of timbers near to moist walls, suffer from similar causes," but "what particularly attracted his observation to the circumstances was this, that both oak and fir posts were brought into this premature state of decay from their having been painted prior to the due evaporation of their moisture; and then extending the observation, and tracing the history of other wood affected in a similar manner, he is convinced that the evil frequently thus originates, and its prevention would be in using timber previously well dried and seasoned," for such purposes.

It is added that since these observations were made having been busily engaged in draining from 4 to 5000 acres of ground, further ideas on the subject of the dry rot have occurred to him from the work he has been engaged in. "Where houses are troubled with damp walls, near to the earth's surface, it is generally, if not universally, occasioned by the percolation of water from the higher adjoining ground, which, thus intercepted in its current, attempts to follow the general hydrostatic law, of elevating itself, by the syphon line, to a height equal to that from whence it has its origin. Thus in houses differently situated we see the damp arising to varying degrees of height, on the walls; and those are probably all corresponding to the height at which the moisture circulates in the adjoining ground. At its first entrance to the building, and whilst the moisture is in small quantity, the excavated part of the foundation wall, he thinks, may absorb, and gradually quit such proportion: but the excess, as is generally the case in moist weather, exceeding that power, the foundation stones are then saturated in a more rapid proportion than the adjoining rarefied internal atmosphere can evaporate: the watery particles then creep up, in degrees proportionate to the ascent from which they originally descended, excepting when prevented, or driven off by the superior heat of the adjoining rooms, when, in addition to the disagreeable damp they cause, they frequently occasion considerable damage to pictures, furniture, &c. Drains laid out athwart the ascending ground, with a very slight descent or fall, and made of the depth of one yard for each yard of ascent, and from the foundation until equal to the height that such damp ever rises, would, there is little doubt, he says, completely secure the house and furniture than the conveniences hitherto sustained, and would generally prove an effectual prevention to most cases of the dry rot, where it originates in extreme moisture." He is of opinion that the fungus which pervades decaying wood is not the first cause, but an attendant on the peculiar state to which such wood has been reduced by prior causes. The disseminated seeds finding a proper bed, or *nidus*, like to the mushroom, toad-stool, &c. fix there their abode, and pervade the whole substance, thus accelerating the general law of Providence which tends to make all matter re-productive."

On these grounds cellars, or such other places, should, he says, be drained in the manner he has mentioned, by taking off the percolating water, prior to its gaining admission to or contact with the walls: and it is probable that, in most cases, a single drain will have complete effect; it would assuredly, he thinks, do so, if it was not for the variation of the earth's internal strata, which are not easily discernible." And that if "attention to this rule was paid prior to the building any new streets in towns, it would prove essentially useful in preventing such mischief."

It has also been suggested to the above society "that mortar made of lime from burnt chalk is much more destructive to timber than stone lime, or that burnt from lime-stone. Chalk lime attracts moisture; and communicating it to any timber which it touches, occasions its decay." And further, likewise, that "sea sand is prejudicial, if made into mortar, from a similar quality of attracting moisture from the atmosphere: this, it is supposed, may in some degree be

corrected by washing the sand well in fresh water, where good sand cannot be procured." But that "good mortar, where any is required to be in contact with timber, may be made from a mixture of stone lime fresh burnt, and river sand, to which a very small quantity of common brown, or yellow iron ochre, should be added, and well incorporated therewith" in the operation of making it up.

It has also been suggested by Mr. Johnson of Ipswich, in the same volume of the transactions of that society, that "some time between 1771 and 1773, he went, at the request of a friend, to the chapel at the Lock-Hospital, through curiosity, to examine a pew there, that had frequently been repaired for damages by the dry rot." And that "after a close investigation, he found that it was the operation of a plant, whose leaf resembled that of the vine. Wherever it had touched, the effect of its poisonous quality got through the wood to the paint, which he has seen a mere skin. He proposed to cover the floor with bricks, laid in mortar, which was accordingly done. He called twice since, the last time about seven years ago; and has reason to think that it had never appeared again." And that "the next opportunity of examining it carefully was at Mark-Hall, in Essex, the seat of Mr. Montague Burgoyne. In a parlour there were three pillars of about ten inches in diameter, the outwood of which was between two and three inches thick. Two of them were eaten through in less than seven years, from the bases, about two feet upward, within the hollow, and were as rotten as if it had been the effect of a hundred years standing." The gardener of this gentleman was a botanist; and found the plant where he directed him to search for it; and said it was the *boletus lachrymans*.' And he adds, that some authors call it a parasitical plant; and it is sometimes to be found with the willow and sallow tribe; but this is not to the purpose. Till within a few months he has never been without some leaves of the plant. For many years they appear exhausted and dead, and soon crumble into dust; but he suspects that fresh wood attracts a fresh growth from the root."

And "at another time, he saw it in a house at Whitehall, built by Sir John Vanbrugh, whose nephew then lived in it. The house is, he thinks, only two stories high; the plant had ascended to the upper story, committing devastation on the wainscot all the way. It will destroy half-inch deal wainscoting in a year. He has also had it twice in houses he inhabited, one in Suffolk, and the other in Gloucestershire. He bore, he says, with the first; in the other case, he undertook, and did stop it effectually."

He supposes, that "the cause is from the floor being laid on the earth, which has been, where he has observed, of a gravelly or sandy loam. The moisture from a water-course at hand, or a north aspect, where the outer wall stands in a garden-bed, so that the rain percolates, are great encouragers; it requires moisture," he suspects. But "it never rises in the middle of the floor; because, if the seed were there, it could not germinate for want of air; but it is easy to suppose that after the floor is shrunk, an air may be created between that and the vacancy between the wainscot and outer wall, sufficient for the purposes of vegetation." He says, he "saw an instance, last summer in the house of a friend, a student in botany. He was surprised when he told him it was a visit from a plant; but so it proved, and always is, and ever was, he says, so; nor does it, says he, originate from any other cause."

With the view of removing it in his own case, he removed, he says, the original soil near the part affected, and supplied its place with sand. He then placed pieces of tile; on those he laid mortar, and tiles over them, pushing them under the wainscot, so that it had no communication with the joists or floor. Pillars in like manner, should, he thinks, be kept from the earth. And in laying a floor upon the ground, he should take away the earth for a foot in breath, and four inches in depth, all round the walls, and place the ends of the joists in mortar, covering them with tiles pressed under the floor and wainscot, quite to the outward wall. Iron or tin plates would do, but are not so cheap as mortar and tiles." And probably much less durable in such situations.

It is supposed, that "this plant has no adhesive powers, but in contact with wood. If it could pass over brick or mortar, it might, he says, be seen to spring from the cellars and infect half the houses in the kingdom."

He recommends, in short, that "the wainscot be kept free from contact with the joists and floor.

He observes that "the leaves of the plant appearing exhausted and dead, is owing to their having imparted all their juices to the wood, which change it to a fungus, and not to a powder, like rottenness from length of time." And, he thinks, that "nothing is more easy than to prevent the damage from the plant. Besides what he has said above, he is "positive that a tile laid close along the walls round the room would prevent the growth of the plant, even without mortar; and perhaps it is only necessary where the walls are next to the air." And "charring the ends of the joists for a few inches, and the side of the wainscot at bottom next to the wall, would, he supposes, be sufficient; for the plant cannot adhere to any thing but wood, and that possessed of its natural juices, to a certain degree; so that he questions if old dry oak would receive it." But "all the white soft woods, as beech, poplars and deals, are for a long time ready to receive it. Repairing the damage with fresh wood, without removing the earth and plant, is, he says, only feeding the evil" or extending the disease.

It is supposed, that as "the plant is of the creeping kind and cannot rise two inches; the wood in all cases, must be in contact with the earth to support it." He adds, that "a fungus broader than the palm of one's hand, and an inch or more in thickness, is commonly seen at the bottom of an old post, on the surface of the earth; but it is not easy to discern whether the wood or the earth furnishes the matter."

The same writer further remarks, that "he had

lately a conversation with an old friend, who shewed him two parcels of rotten wood, from an oak barn floor laid about sixteen years ago. After lying twelve years, it shook upon the joists. On examination it was found to be rotted in various parts, and the planks, two inches and an half in thickness, were nearly eaten through, though the outside was glossy, and without blemish. The joists and a large middle beam were laid at the ends, in brick and mortar, to create a firm level. No earth was near the wood; and, he thinks, that no air could find a passage. The rottenness was partly an impalpable powder, of the colour of Spanish snuff, and other parts were black, as if burnt, the rest was clearly a fungus." He adds, that "this gentleman is a person of undoubted veracity; but a nice and exact observation is necessary in such examinations. He thought nothing of any plant, and it is likely there was none of the *Boletus*; so that his assertion that it was always to be found, was rather too systematic." He asked him if the timber was dry when laid down. He could not however say, that had been particularly adverted to. It had been sawed from a large oak, and was, as he thought, in all respects proper for a barn floor. As this seems not the operation of the *Boletus*, he asks, how did it happen? "We know, says he, that the oak, when in vegetation, is subject to what we shall call an exudation of juices, which produces the fungus, named the Agaric of the oak, with which the Druids of old played many tricks. The oak, then, if sawed into thick quantities, may emit these same juices, as the progressive course of nature to its entire decay." It is added that "we have all seen oaks of vast size and ancient record, with a great part of the outside whole and all the inside gone; perhaps the work of a century. In all hollow trees fungus is, he says, discoverable. To use a law term, it is a *misnomer* to call it dry-rot; for the rotting principle is in moisture." He further states, that he "had never seen the rot upon so large a scale in timber, till lately. The prevention then, says he, of beams, rafters, large joists, and post put into the earth, from decay by the rot, is in charring only, which will dry up all the fungus juices of wood in large substance. Paint, or a bituminous preparation, may probably stop up the pores, and prevent the rot in slight work, where the treatment he before observed, with fire, might be incommodious, as in half inch waistcot," &c. The incorruptibility of charcoal is proved by a variety of indisputable facts.

Various useful facts on this subject, have been also stated by Mr. Batson, of Limehouse in the twelfth volume of the same transactions, in respect to his methods of preventing the dry rot in a room much affected by it. The mode he adopted "was to clear the ends of his timbers, to take away the infected earth to the depth of two feet, and to fill up that space with anchor-smith's ashes, or ashes from a foundry, before his flooring boards were laid.

On minute examinations being made under the direction of the society, at the distances of six and twelve years after the flooring was laid, the boards, wainscot and timbers, were all found entirely free from any appearance of the dry rot. The use of stone work next the ground as the foundations of posts, door frames, partitions, &c. has also been found useful in preventing such wood works from being attacked by this disease. And also the causing a more free circulation of air about such foundations by the fixing of iron gratings in stone work in different places, so as to produce the most perfect ventilation.

But notwithstanding all that has been yet done in respect to the nature and modes of preventing this sort of rot, much still remains to be effected both in regard to its origin and the most certain means of eradicating it under different circumstances.

Rot, a sort of putrid decay, taking place gradually in different substances, either from the effects of moisture or other causes.

ROTATION *of Crops*, the means of cropping lands of the arable kind in such a manner as to prevent their being exhausted as much as possible, and at the same time to preserve them free from weeds in the most complete method. The proper alternation of different sort of crops in this intention, is a matter of vast importance to the interests of agriculture, and in which immense improvements have been made in this country, within this last half century. Mr. Young has remarked it, in his Calendar of Husbandry, as a singular circumstance, that before the reign of his present majesty, notwithstanding the multitude of books on the subject, there is not one writer who had any tolerable ideas upon it, or even annexed to it any importance. He adds, that "they recite courses good, bad, and execrable, in the same tone; as matters not open to praise or censure, and unconnected with any principles that could throw light on the arrangement of fields," in respect to the growth of crops. It is on this part of the farmer's business being performed in a proper manner, that much of the profits and advantages which he is to derive from his lands must depend." It has been observed by the author of the Somerset Agricultural Report, to be "the most prominent feature in good farming," and that by which the produce of the soil may be augmented in a three fold proportion. And Mr. Middleton considers it, in his Survey of Middlesex, as one of the first points that can engage the attention, or exercise the ingenuity of the cultivator. It is sufficiently obvious that it deserves the full consideration of the farmer, from the many advantages that have been the result of it, since the principles on which it proceeds have been more perfectly understood and applied. And the editor of the Annals of Agriculture has suggested, that wherever either very good or very bad husbandry is found on arable land, it is more the result of a right or wrong arrangement of crops, than of any other circumstance. And that no district is well cultivated under bad rotations, while it is extremely rare to find any badly cultivated under such as are good.

In regard to the general principle on which the proper cropping of arable land depends, it is now perfectly understood that some sorts of crops deteriorate or exhaust land in a much greater degree than others; that some by their capability of being consumed on the farm, though they are found to exhaust, return in such consumption, as much or probably more to the soil than was drawn from it, during the time they were growing upon it; that others by admitting of profitable tillage and cleaning the land in their growth of course render it clean, instead of filling it with weeds; while others by not permitting such cultivation, and being great exhausters, when combined in succession, deteriorate the soil and render it foul with weeds. It consequently follows in practice, that by suitable arrangements of these different sorts of crops in rotations, soils of most kinds may be constantly preserved in a clean and fertile or productive condition; but in the management of the business, much nicety and attention is requisite in the cultivator, to carefully adapt them to the nature and circumstances of the different cases. It has indeed been stated by a late practical writer, that "as different sorts of plants as crops not only require different kinds and proportions of nutritious materials to be drawn from the earth for their increase and perfect growth, but also different situations and conditions of soil; it must be necessary to adapt them as much as possible to the peculiar qualities of the soil, as well as the state of the land and the nature of the climate in which it is placed;" and likewise "to alternate or interpose them in such a manner," as to injure the land in the least possible degree, by their exhausting effects.

But besides it is suggested, that it may also "be of great utility to attend to other circumstances, as those of introducing such sorts of green crops as are most suited, by the shade of their leaves and the kind of culture which they require while growing, for keeping the ground clean from weeds, and in a mellow and suitable state for the reception of the more valuable kinds of grain crops, as in this way the necessity of having recourse to the uneconomical process of fallowing may be considerably lessened," if not wholly prevented. It has indeed been stated by the writer of the Survey of Middlesex, that "the aggregate benefits that will be derived to the country from this measure, are not to be estimated: but among the first of these will stand the abolition of fallows, and the introduction of green crops to supply their place, over an extent of about three millions of acres of arable land, which have hitherto under the fallow system, produced nothing useful during the fallow year. So far as tares and turnips, or potatoes; or peas and turnips, or potatoes; or any two good crops, can be raised in one year, in place of a fallow, the produce will be double in quantity to what it has been under the former system." And he further adds, that "there are about nine millions of acres in England and Wales, in the course of two crops and a fallow; *i. e.* six in crop and three in fallow. Hence it follows that, by procuring one crop in lieu of the fallow, fifty per cent. is added to the former produce. But so far as two crops can be obtained in place of a fallow, it adds 100 per cent. or double the former number of acres of produce."

It is suggested likewise, that "as most sorts of soils, when continued for any great length of time, either under grain or grass, are liable to sustain injury, and become less capable of producing full crops;—in the first case, probably from the carbonaceous principle being too greatly exhausted; and in the latter, from the occurrence of moss, or other noxious vegetable productions, that establish themselves in consequence of the weak and imperfect growth of the grass plants;—it may be proper to occasionally alter and change the nature of their crops, by keeping them for a while, after being broken up from grass, under the plough, and then restoring them again to the state of grass; as, in this way, the deficient principles may probably be the most readily supplied, where manure in sufficient quantities cannot be procured, and the injurious vegetable products be the most effectually removed," or extirpated from the land.

And it is further advised, in "directing the modes of cropping lands, to be constantly attentive that such an intermixture of green root, pea, bean, and grain crops be grown, as will not only be best adapted to keep the soil in the most perfect order, but suit the demands of the cultivator, for the purposes of sale, as well as the keeping of such numbers of different sorts of live stock as may be proportionate to the supplying of those quantities of manure that may be requisite for preserving the farm in the most perfect condition," or state of fertility.

And that in "regulating the courses of crops on all descriptions of land, with the view of preventing their exhausting the soil, it will be particularly necessary to guard against the occurrence of grain, potatoe, or other crops of a similar kind in succession, as the result of experiments attentively made, as well as the experience of the most correct farmers in different districts, have decidedly shewn their effects to be very powerful when employed in such a manner, in deteriorating and lessening the productive powers of the ground" or soil.

The results of various trials made by Mr. A. Young, and recorded in the twenty-third volume of his Annals of Agriculture, "not only demonstrate the advantages that may arise from the alternation of different sorts of crops in different ways, but the effects of various rotations, both good and bad, upon the soil, and the produce derived from it." These deserve the nice attention of the tillage farmer, as from a full consideration of them he may derive much advantage in the culture of his land.

It may be remarked, that in this sort of management, a matter of the greatest moment is that of preventing the bad effects that necessarily proceed from the too frequent repetition of such sorts of crops

as exhaust the soil in a high degree, such as those of the white or corn kinds, potatoes, and others of the same nature.

Where the soils are of the more stiff and retentive kinds, as those of the clayey and heavy loamy sorts, they may probably be the best obviated, by having recourse to the introduction of bean, clover, tare, rape, and other crops of the same kind, between them, according to the particular circumstances of the cases, as they are found by experience to answer well in such intentions.

But when the lands are of the more light and dry descriptions, as those of the sandy and gravelly sorts, the intermixture of other kinds may be more proper and successful, such as those of the turnip, pea, and other similar kinds.

It may likewise often be necessary on lands of the former of these sorts, to have recourse to two crops of the green kind for one of the grain, as experiments have not only shewn such a practice to be highly beneficial, but the success in some districts fully confirmed it. The clean state of culture which is thus preserved, and the great fertility of the land, in consequence of so few grain crops, renders the corn of a much finer quality than would otherwise be the case. It has been suggested by the author of the Survey in Middlesex, that land under ordinary circumstances is not even capable of bearing a corn crop every two years, without being injured. A fact which he thinks is fully confirmed by the Norfolk turnip crops being uniformly found to be not only less certain, but likewise much lighter than was formerly the case. And the same thing also happens in respect to clover, and probably grain crops.

It is suspected, that such reductions in the quantity of the produce shew, that the valuable and favourite rotation in that district, of turnips, barley, clover, and wheat, is in some measure more than the land can support, as it appears to be declining by too great exhaustion. Even with the aid of sheep walks he considers the soil as not capable of supporting the deteriorating effects of the present rotation of crops, particularly where a five years' course, by having barley after wheat, is improperly introduced.

It is likewise advised by the same writer, that the following courses should be had recourse to as the most proper in the following descriptions of land. In cases of the best sort, green and white crops in alternation; for those of a full medium quality, three of the green kind for two of the white or corn description; for ordinary land, two of those of the green for one of the corn sort; and for the poorest or that which is the most deteriorated, as those of the down and sheep-walk kind, three green crops for one of the white or grain kind. By cropping in this manner and these proportions, it is supposed that the lands may be preserved in a state perfectly free from weeds, as well as in a high degree of culture, and that "under *such* management, they might be continued in *perpetual* aration with a *constant* succession of *large* products." And in addition, it is supposed that by such a system the cultivator would not be vainly flattered by a *promising* seed time, and miserably disappointed by a *scanty* harvest, as is frequently the case; but, on the contrary, be sure (at least as far as depends on human means) of reaping a plentiful return for all his labour and expense."

I. *Rotation.*

Two green crops to one of corn.

1. Corn, or	1. Peas,
2. Clover,	2. Beans,
3. Peas,	3. Corn.

II. *Rotation.*

Three green crops to one of corn.

1. Corn, or	1. Corn,
2. Clover,	2. Clover,
3. Tares,	3. Peas,
4. Turnips,	4. Beans.

Which is four crops in three years.

III. *Rotation.*

Four green crops to one of corn.

1. Tares,
2. Potatoes, or cole, for sheep feed,
3. Turnips,
4. Corn,
5. Clover.

Making five crops in four years.

IV. *Rotation.*

Five green crops to one of corn.

1. Peas,
2. Beans,
3. Corn,
4. Clover,
5. Tares,
6. Turnips.

Making six crops in five years.

There are a great variety of courses that may be adopted under different circumstances of soil; but the following are probably some of the most proper:

On strong wet lands where a fallow is had recourse to—

Rotation.	*Rotation.*
1. Fallow,	1. Fallow,
2. Barley,	2. Barley,
3. Beans,	3. Clover,
4. Wheat,	4. Beans,
5. Tares,	5. Wheat,
6. Barley,	6. Cabbages,
7. Clover,	7. Oats,
8. Beans,	8. Tares,
9. Wheat.	9. Barley.

In these cases it is the most improved practice to make the fallow the preparation for the first grain crop, depending upon some sort of green one for those that follow, without repeating it: The following are other rotations: 1, fallow; 2, barley;

3, clover; 4, wheat. Where manure is in abundance, a preferable course may be: 1, fallow; 2, wheat; 3, beans; 4, barley; 5, clover; 6, wheat. Or it may be more advantageous to crop in this way: 1, cabbages, beans, or peas; 2, barley or oats; 3, clover; 4, wheat: And 1, cabbages; 2, oats; 3, beans; 4, wheat: Or to begin with 1, beans; 2, wheat; 3, cabbages; 4, barley; 5, clover; 6, wheat. And in particular cases, of good culture; 1, turnips; 2, oats; 3, vetches; 4, wheat.

And in breaking up, and bringing these sorts of soil into cultivation from grass, by paring and burning, a proper course may be: 1, cole; 2, beans; 3, wheat; 4, beans; 5, wheat. Mr. Cartwright has remarked in the third volume of Communications to the Board of Agriculture, that tares, though properly objected to by some, as coming too late in the spring on such soils, may sometimes be beneficially introduced for the purpose of being eaten off by sheep, or mown green for horses, milch cows, young stock, and hogs. In these modes of cropping, by proper attention to the eating the green crops off, where it can be done without injury, or the removing them to be consumed in the farm-yards, or other places, in order to the manure being afterwards applied, the land may not only be improved by being rendered more rich and friable, but be kept clean and free from weeds of almost all kinds.

In most of the more heavy sorts of soil of this nature, when broken up from the state of old sward, it is probable that beans will be the most proper crop to begin with, though it has been mostly the practice to puts oats in under such circumstances, as from the gradual decay of the grassy material the growth of the beans is greatly promoted, and abundant crops of course produced. And in addition to this, the roots of the bean crops greatly ameliorate and improve the mellowness of the land, which brings it more quickly into the proper condition for wheat.

But where the lands are more light and friable, peas may often be had recourse to with advantage, as a first crop after breaking them up. But where the sward is very old, injury may often be done in the first crops by the destructive attacks of worms, grubs, and slugs, which frequently much abound in them. In cases of this sort, paring and burning should be had recourse to, or the use of the trench plough, in order that the grassy matter may as much as possible be got quit of. In this intention it has also been suggested by the Rev. Mr. Young, as of great benefit, to keep such lands as closely fed down as possible, previous to their being broken up, as by that means less ova may be deposited by the fly, and of course fewer of these destructive animals produced.

In all cases of this kind, beans are, however, less liable to be injured than peas, consequently they may frequently be the best crop to be employed.

On lands of the sound loamy description where fallows are excluded—

Rotation.	*Rotation.*
1. Turnips,	1. Turnips,
2. Barley,	2. Ruta baga,
3. Clover,	3. Barley,
4. Wheat,	4. Clover,
5. Cabbages,	5. Beans,
6. Oats,	6. Wheat,
7. Tares,	7. Beans.
8. Barley,	8. Wheat.
9. Beans,	
10. Wheat.	

On sandy soils of the better kind the following may be proper:

Rotation.	*Rotation.*
1. Turnips,	4. Barley,
2. Barley,	5. Clover,
3. Carrots,	6. Wheat.

On these two descriptions of soils, it seems to be the practice of the most improved arable districts to make turnips the preparation for the barley crop, and clover that for wheat; in this manner: 1, turnips; 2, barley; 3, clover; 4, wheat. In this course oats may sometimes be substituted for the barley; and, instead of the clover, tares, chicory, or some other sort of artificial grass seeds.

In breaking up soils of this kind from the state of sward, where the process of paring and burning is adopted, the course should be: 1, turnips; 2, barley; 3, clover; 4, wheat; 5, turnips; 6, barley; 7, clover; 8, wheat; 9, turnips; 10, barley. And where the ground is to be kept in tillage only a short time, the most proper course may be: 1, turnips; 2, barley; 3, clover; 4, wheat; 5, turnips; 6, barley; with grass seeds. However, "where the practice of paring and burning is not adopted, which is not so common, it may be the best method to begin by beans or peas dibbled, and then proceed in the manner above. In cases of this nature, the turnip and clover crops are constantly to be eaten off by sheep, or some other kind of stock upon the land. Also in the more dry and light soils of this nature, pea crops may be introduced, especially those of the white sort dibbled, as a first crop, then proceeding with the other crops in the manner above. But where potatoes are begun with, more of the ameliorating crops will be required, on account of their qualities in exhausting and injuring the ground being greater, as shewn by the detail of experiments noticed above.

It is likewise the practice on some soils, merely of the sandy kind, in particular districts, to make turnips the preparation for grass, as well as grain: and it is found by experience that there are few of these soils so light, as that they will not afford such a crop. In instances of this sort the course is commonly, 1, turnips; 2, barley; 3, grass seeds. The grasses in these cases, being cultivated with a view to the feeding of sheep, should consequently be such as will stand for some length of time, as it

is by no means a good practice to break up again too soon; the flocks fed upon the turnips during the winter season not being provided with a due quantity of food on such *new* layers for their summer support. In Suffolk, according to the survey of that district, on the better lands of this sort, the layers are often planted with peas, by dibbling, to much advantage, after being broken up, without being fed with sheep in the summer season. The succeeding crop of wheat being in such methods much larger; the following is said to be an excellent course on such soils: 1, turnips; 2, barley; 3, trefoil and ray grass; 4, peas dibbled; 5, barley. And in such cases, as where this sort of soils are poor, or partake of the nature of heaths or sheep walks, it may be the best practice, in bringing them into arable cultivation; 1, to pare and burn for turnips; 2, turnips; 3, barley with grass seeds. If they are intended to be kept under the plough longer than this course, the turnip and barley, and grass crops, may be alternately repeated until the fifth or seventh year, or even longer, if it be thought necessary. And from potatoes exhausting in a considerable degree, where they are employed as the first crop; in breaking up soils of this nature, they must be succeeded by improving crops, such as turnips and grass, as in the above rotations. Where such soils are poor, and of the light blowing kind, their looseness must be remedied by the application of clay in proper proportions, and the feeding the crops off by sheep. However, where such means cannot be made use of, the above course will be the most beneficial and proper.

On the more dry descriptions of soils and those of the calcareous or limestone kind—

Rotation.	*Rotation.*
1. Turnips,	5. Turnips,
2. Ditto,	6. Barley,
3. Barley,	7. Peas,
4. Sainfoin for ten years, and upwards; then pared and burnt for.	8. Wheat.

In regard to the gravelly and flinty soils, when of the lighter kinds, they should be cropped in such a manner as may be the most effectual in preventing their moisture from being dissipated, and their fertility from being impaired. In which views, two or more green crops may often be necessary for one of the grain kind as above: or it may be in this way; 1, turnips; 2 barley; 3, clover; 4, wheat; 5, turnips; 6, barley, with grass seeds. And likewise peas, tares, and cole, may be introduced in courses for these soils with great propriety, and advantage in many circumstances. And where flints abound, as hoeing cannot, it is supposed by some, be practised with facility, it has been advised to sow the turnips thinly, and mix a portion of cole-seed with them, by which means an abundance of sheep food may be produced. It has been here recommended that, the grain crops, especially those of the spring kind, should always, where the land is sufficiently dry, be sown nearly, that they may cover the ground well before the hot season commences, and thereby prevent the injury that would otherwise take place. But that upon the heavier sorts of these soils, beans or peas may frequently be made the preparatory crops for barley, or even wheat, in this manner: 1, beans or peas; 2, barley; 3 clover; 4, wheat; and which may be still further varied by tares and turnips, according to the particular state of the land. With respect to the thinner kinds of chalky soils, and such old down lands as are become so unproductive of herbage as not to be capable of being continued in the state of sheep pasture, it has been suggested as the most advantageous method of cropping when brought into tillage, to make turnips or some other luxuriant green crop, which, at the time it keeps the land clean, and produces a large proportion of green food for the support of sheep or other animals, is beneficial by preserving the moisture which in such sorts of soil is liable to be dissipated too quickly, the preparation for grain. With these intentions the rotation may be in this way; 1, turnips; 2, barley; 3, clover; 4, wheat; or in some cases, as where seed weeds are liable to prevail much, two crops of turnips may be taken before any grain crop, with utility and advantage. And "where it is intended to keep such lands longer in the state of tillage, two crops of turnips may be again grown after the wheat, which will leave the soil in a high state of preparation for barley; then saintfoin may be introduced, as affording an excellent pasture for sheep for several years. In these cases, the turnip and clover crops must constantly be fed off by sheep, which should not be removed from the land during the whole of the time the crops are in consumption, such other kinds of dry food as may be necessary being conveyed to them. By these means, it is supposed, the soil will be left in the best possible state for the growing of barley, without the trouble and expense that must otherwise be incurred for manure. And in cases where the land is sufficiently mellow and friable, the mode of cropping may be in this way; 1, peas; 2, oats; 3, turnips; 4, barley with grass seeds: or where it is intended to continue the course, it may be done by proceeding with turnips or peas as before, closing the rotation with saintfoin, as affording a pasture for sheep for several years. By this sort of attention in cropping and managing lands of this nature, vast improvements may be effected, not only in rendering them capable of affording valuable grain crops, but as producing a much larger proportion of green food for the use of sheep and other animals than is usually the case."

On soils of the peaty sort, and such as have been long under the grain system—

Rotation.	*Rotation.*
1. Cole-seed, or Turnips,	8. Grasses,
2. Ditto,	9. Ditto,
3. Oats,	10. Potatoes,
4. Ruta baga,	11. Barley,
5. Barley,	12. Tares, or Peas,
6. Grasses,	13. Barley and Grass.
7. Ditto,	

It is advised by some cultivators, that in the business of cropping peaty, moory, and fenny soils, after clearing them of their prejudicial moisture by proper drainage, a difference must be made according as they are deep, or only possess a slight covering of the peaty material. In cases of the deeper kinds, it may be the most judicious mode of practice to make turnips, potatoes, cabbages, cole, or such sorts of crops as produce much shade, and by preserving the moisture in the more superficial parts of the soils, promote its decomposition and decay, as the preparation for grain. With this intention the crops may be; 1, turnips, cabbages or cole; 2, oats; 3, turnips, cabbages or cole, as before; 4, oats; 5, clover; 6, wheat; 7, turnips, &c. as above; 8, oats, with grass seeds, to remain some years. And potatoe crops, though they have been objected to by some as being exhausting on soils of this kind, experience has shewn to be highly beneficial. Where they are in use the course may be; 1, potatoes; 2, oats; 3, turnips, cole or cabbage; 4, the same; 5, oats, with grass seeds. On soils of this kind in the northern parts of Scotland, according to Mr. Donaldson, the use of potatoes as a first crop has been found to be by much the most certain and advantageous method, the succeeding crops of oats being not only more certain, but greatly more abundant in most cases.

However, on the thinner sorts of these soils, as those of a moory and fenny nature, and where the subsoil is of the stiff and retentive kind, it may be the most proper practice to begin with cole, and make it the preparation for crops of grain in this method; 1, cole; 2, oats; 3, cole; 4, oats: and 1, cole; 2, oats; 3, beans with dung; 4, potatoes; 5, wheat; 6, cole; 7, oats. But in this last rotation from potatoes and wheat coming together, it may probably be too much for the land, as they are shewn by Mr. Young's trials to be both highly exhausting crops, therefore a better method may be to have recourse to beans instead of the potatoes, as they have a tendency to improve the land: the rotation may then be in this manner: 1, cole; 2, oats with manure; 3, beans; 4, wheat; 5, cole; 6, oats. In some cases of this kind, crops of red clover may perhaps be had recourse to as a preparation for the wheat. Much advantage and improvement may be constantly effected, by proper cropping in soils of this nature.

In cases where the dry nature of the soil, and its propensity to the production of good sward is such as to permit of its being cultivated under the alternate modes of grain and grass, which on the whole is certainly a very beneficial practice, it will be necessary in directing the rotations of cropping not only to the particular quality of the land, but to the growing of such kind of roots, plants, or other crops, as may, while they tend to clean, improve, and prepare the soil for the crops, of abundant grass crops be the most adapted to the feeding, rearing, and maintaining those sorts of live stock that are capable of affording the most abundant and regular supplies of food at the different periods when they are most in demand.

This is a system of management in which the loamy, as well as the gravelly, fenny, and the thinner kinds of peaty soils, may be conducted to great profit; as by their having a variety of green crops fed off upon the land, a degree of amelioration and improvement is produced while under the plough, that must be beneficial for the production of grass, and by being occasionally laid to grass for a few years, and then thickly stocked with sheep or other animals, they must undergo an excellent preparation for being again brought into tillage. "Indeed it is a sort of husbandry which is practised with great advantage in Northumberland, according to the Report of that district, it having been found that, on the sandy and dry light loamy soils, excellent grain crops, especially oats, may be grown by the land's remaining three years under grass, closely eaten with sheep, which could never be done while they were managed according to their old method of practice."

In this system, on the wetter and more stiff kinds of loamy soil, and where there is considerable fertility after breaking up, the rotations may be as below—

Rotation.

1. Beans or Oats,
2. Turnips,
3. Barley,
4. Clover or Winter Tares.
5. Wheat,
6. Turnips,
7. Barley,
8. Grass seeds for three, four, or more years;

Or,

1. Oats,
2. Beans,
3. Wheat,
4. Fallow and grass for four or five years.

But on those of the dryer kind it is advised as more proper to commence in the following way—

Rotation.

1. Peas or Turnips,
2. Barley,
3. Clover,
4. Wheat,
5. Turnips,
6. Barley with grass seeds, to continue not less than three years;

Or,

1. Oats,
2. Turnips,
3. Barley with seeds, to remain three or four years.

And where large proportions of green food are necessary, or injury is apprehended from the wire worm, grubs, &c. the rotations may more properly be began by cabbages or turnips.

It is stated by the writers of the Cumberland Agricultural Report, that different methods of cropping in this intention have been there attempted, and that, that of 1, turnips; 2, barley; 3, clover; 4, wheat; has been employed until there has been an

obvious falling off in the crops, particularly in those of the green kind; in which cases the only means of restoration is that of letting them remain after their being three years under the plough, an equal length of time in the state of grass; it being remarked that "by this mode, nature has time to prepare a sufficient lea clod, which, being turned up for the turnip fallow, will insure a vigorous crop of turnips, as it is well known they always flourish upon fresh land, or where they find the remains of a lea clod to vegetate in." And further, that the quantity of ground that is kept "in grass for three years, breeds and fattens such a number of sheep, as leave a considerable profit, probably equal to, if not more than, the arable crops." It is therefore evident, from these as well as many other facts of a similar kind, that great benefits may be derived from the cultivating of lands under the convertible system of husbandry, especially where the nature and management of different sorts of live stock, and the best means of combining them with arable cultivation, are well understood.

In cases where the ground is after some time to be restored to the condition of sward, and the horse-hoeing husbandry made use of so as to keep the various crops in a perfectly clean state; and the green crops, as turnips, pease, and beans, are sown in double rows on three feet ridges, as well as those of the cabbage kind planted on similar ridges in single rows; the rotations given below have been suggested by Mr. Close, as the most proper for any length of time, in the soils of different kinds:

Rotation.
Clays.
1. Turnips or cabbages,
2. Oats,
3. Beans and Clover,
4. Wheat,
5. Turnips or Cabbages,
6. Oats,
7. Beans and vetches,
8. Wheat.

Rotation.
Clayey Loams.
1. Turnips or Cabbages,
2. Oats,
3. Clover,
4. Wheat,
5. Turnips or Cabbages,
6. Barley,
7. Beans,
8. Wheat.

Rotation.
Rich or sandy Loams.
1. Turnips and Potatoes,
2. Barley,
3. Clover,
4. Wheat,
5. Beans,
6. Barley,
7. Pease,
8. Wheat.

And,
1. Beans or Turnips,
2. Barley,
3. Pease or Clover,
4. Wheat,
5. Wheat for any length of time, or Potatoes,
6. Barley,
7. Pease,
8. Wheat.

Rotations.
Peaty Earth.
1. Turnips,
2. Barley,
3. Clover,
4. Wheat,
5. Potatoes,
6. Barley,
7. Pease,
8. Wheat.

Rotation.
Chalky Subsoil.
1. Turnips,
2. Barley,
3. Clover,
4. Wheat,
5. Potatoes,
6. Barley,
7. Pease,
8. Wheat.

In this case, ten acres in each hundred should be laid down with sainfoin for eight or ten years.

Rotation.
Gravels.
1. Turnips,
2. Barley,
3. Clover,
4. Wheat,
5. Potatoes,
6. Barley,
7. Pease.

Rotation.
Light Lands.
1. Turnips,
2. Barley,
3. Clover and Rye-grass,
4. Clover and Rye-grass,
5. Clover and Rye-grass,
6. Pease,
7. Wheat or Rye,
8. Wheat.

Having thus shewn the most improved modes of cropping land of different kinds, under different systems of management; it may be useful to the farmer to shew the methods that are most commonly practised in the best tillage districts of the kingdom.

In Hertfordshire, according to the corrected Report that district, where the system of fallowing is still

the practice on the clays and strong loams of Sawbridgworth, the following rotations are common:

1. Fallow,
2. Barley,
3. Clover,
4. Wheat;

also,

1. Fallow,
2. Barley,
3. Pease,
4. Wheat.

And

1. Fallow,
2. Wheat,
3. Fallow,
4. Barley;

And many farmers pursue,

1. Fallow,
2. Wheat,
3. Fallow,
4. Barley,
5. Clover,
6. Oats.

It is here observed that, "whatever fault may be found, and perhaps justly, with so much fallowing, it must be admitted that their crops are good."

It is stated, on the authority of Mr. Byde of Ware Park, that all the turnip-land he knows in the county is managed in this manner:

1. Turnips,
2. Barley,
3. Clover; the first crop mown, the second fed.
4. Wheat;

good farmers stopping here, and bad ones adding,

5. Oats.

And "the turnips may be reckoned at 50s. an acre; the barley three quarters, and the wheat 17 to 20 bushels."

But the strong heavy soils are cropped inthis way;

1. Fallow,
2. Wheat,
3. Fallow,
4. Barley,
5. Clover,
6. Oats;

varying the course thus:

1. Fallow,
2. Wheat,
3. Clover,
4. Barley,
5. Fallow,
6. Wheat,
7. Oats, peas, or beans.

An acre of wheat yields 25 bushels.

It is added on the same authority, that about Watford there is a peculiar course of

1. Fallow,
2. Beans, on which they put all the dressing,
3. Wheat.

And at Little Hadham, there is a course of

1. Fallow, ploughed four times,
2. Wheat,
3. Fallow, four or five times ploughed,
4. Barley;

the only variation being, sometimes

5. Clover,
6. Oats;

but Mr. Jones is, it is observed, decidedly of opinion, that the crop and fallow course is the most profitable, He asserts that beans will not succeed on this soil. The writer however says, he knows they will on land exactly such in Suffolk, and give four quarters per acre.

About Westmill, the course is

1. Fallow, ploughed four times,
2. Wheat,
3. Clover,
4. Barley, on three earths,
5. Peas;

But Mr. Whittington, on light land, cultivates

1. Turnips,
2. Barley,
3. Clover.
4. Wheat; and if the land is in good order, he adds
5. Peas or oats.

On clay land, his course is,

1. Fallow,
2. Wheat,
3. Peas;

or,

1. Fallow,
2. Barley,
3. Peas;

or,

1. Fallow,
2. Wheat,
3. Clover,
4. Oats;

and this he reckons better than either of the former. On proposing barley on a fallow with clover, and then beans and wheat; he objected, that if clover is sown at the time of sowing barley, it gets so forward as to spoil the crop; and if sown at rolling, it is apt to fail. This the writer however cannot admit to be fair reasoning, in a country where it it common to sow clover on wheat in the spring, and even so late as May and June.

On much of the poor hungry gravel in the open fields near Hatfield, let at 7s. per acre, the rotation is

1. Fallow,
2. Wheat, producing two or three loads, (five bushels.)
3. Oats, produce $2\frac{1}{2}$, or three quarters.

On better land, inclosed, they cultivate

1. Turnips, sheep-fed,
2. Barley; four quarters are produced, on an average;
3. Clover, twice mown, two loads are grown;
4. Wheat, 22 bushels are reaped;
5. Oats or pease.

It is remarked that "this is the course of Mr. Cassmajor, at North Mims."

But his course on wet land is,

1. Summer fallow;
2. Barley, four quarters are grown;
2. Clover, twice mown, and 2½ loads at the two, are grown;
4. Wheat, four or five loads are reaped;
5. Oats, peas, or beans; three to four quarters of either are the amount of the produce.

"But it is observed that "the last crop, in either case, is only taken when land is in high order."

It is stated by the writer that in this there "is a proof of the impropriety of the question, whether clover may safely be sown with barley on land in high order; the point, on which the objection to clover sown with barley on land summer-fallowed is founded."

It is stated that Mr. Leach follows the under-mentioned course:

1. Turnips,
2. Barley,
3. Clover,
4. Wheat,
5. Oats or peas.

Then they return to turnips on some land; but on about 40 acres of gravel he sows

1. Turnips,
2. Barley,
3. Trefoil, white clover, ray-grass, common clover, fed,
4. Ditto, fed,
5. Ditto, fed,
6. Oats, on one earth,
7. Three earths are given immediately after oats, and then wheat is sown,
8. Winter fallow, for barley,
9. Grasses, as before, for three years;

and then the land is cultivated as above. Thus, says the writer, these 40 acres neither want nor have any manure, more than they receive from the feeding of the sheep on them, and from 60 bushels of ashes per acre, spread the first year on the grasses only, and 30 bushels of soot per acre on the wheat. It has answered greatly for 18 years to his full satisfaction. He makes it a rule to feed his land as bare as possible, and always wishes not to let the ray run to bent."

"And it is observed that Lady Melbourne has a field, which has been thus managed,

1. Potatoes were planted on it and well manured, and the produce amounted to 400 bushels per acre:
2. Wheat was drilled on it, at the distance of nine inches. The crop amounted to seven loads, or 35 bushels an acre.
3. Winter tares were next sown, for which 12l. an acre were this year (1803) offered; but they were mown for soiling; and at present the turnips after them are good.
4. Barley will be drilled next spring, as the fourth crop.

It is further stated that "Mr. Young, of Hurral, who farms on a large scale, with much intelligence, pursues the common course of taking oats or pease after wheat. It is extraordinary; says the author, to see how general this practice is; but if the clover is at all foul, he passes over this crop, and sows turnips. The same course holds to St. Albans, and he found it steady on the fine farm of 483 acres of Mr. Clarke, at Sandridgbury." But "Mr. Biggs, near that town, omits the oats after wheat, returning to fallow for turnips, instead of an after-crop, except on 20 acres nearly in a year, which he sows with pease.

"Tares he sows on the wheat stubble, and grows good turnips the same year. On his heavier strong land, of which he has not much, his course of crops is;

1. Fallow,
2. Barley,
3. Pease,
4. Fallow,
5. Wheat,
6. Beans.

And "the common Hertfordshire course, of 1. Turnips, 2. Barley, 3. Clover, 4. Wheat, 5. Oats, continues about Watford, Rickmansworth, and all around Berkhamsted and Hempsted." But Mr. Jennens, of the latter place, has a course,

1. Fallow,
2. Wheat,
3. Pease drilled,
4. Barley,
5. Clover,
6. Wheat, but not in general, only as a variation from his common course.

It is remarked that, "Mr. Cotton, of the same place, observed, in defence of the common practice of taking oats after wheat, that they are the black oat, which, according to his opinion, succeeds best in land held together by roots, though of weeds, which will yield better than land in tilth, though clean; and this makes a bad manager in many cases, obtain a better crop of black oats than a good farmer would produce from the same land."

It is added that, "the old course continues to Beechwood and Market-Street; where, if clover fails, they sow pease, followed either by turnips or summer fallow. They sow winter tares after wheat, three bushels per acre. They use them for feeding and soiling, and then fallow for turnips, or give a bastard fallow for wheat; but the crop is not so good as on clover."

It is stated that, "round Hitchin, in every di-

rection, the old course of five shifts is continued: it however, varied by a few by,

1. Turnips,
2. Barley,
3. Barley,
4. Clover,
5. Wheat,

and by some a sixth shift of oats is added.

In the open land they follow a course of

1. Fallow,
2. Wheat or barley,
3. Oats or pease;

but sometimes sow turnips, by agreement, on the fallow.

"Mr. Sedgwick, of Rickmansworth, on stony land, pursues a course of,

1. Fallow,
2. Wheat,
3. Oats or pease.

On dry land, this is the common course, but often turnips are sown after wheat. If a field grows so tired of clover as to want a change, their course is then;

1. Turnips,
2. Wheat,
3. Barley, or pease, or oats,
4. Turnips
5. Barley,
6. Clover,
7. Wheat,
8. Oats.

And "Mr Parker at Munden, sows,

1. Turnips,
2. Barley,
3. Clover,
4. Wheat.

Upon which he "remarks, that by this course the land is favoured, as oats never follow wheat. If dung should run short, and a farmer not have it in his power to manure all his turnips, he may venture to sow a field of turnips without dunging, and succeed; a practice by no means to be depended on in the common rotation of taking oats after wheat. In order to favour the land, he has occasionally omitted sowing the clover, and taken pease for one round; but he suffered in his wheat; so that he scarcely knows what to do in the awkward circumstance of the failure of clover." And "when clover fails at King's Langley, some farmers sow pease; others (but this is not common) fallow for wheat, and then take oats." And the Earl of Essex sows, near his farmyard,

1. Tares, and then turnips,
2. Barley,
3. Clover,
4. Wheat;

and the writer saw at Cashiobury, very fine turnips after tares used in soiling, though sown twice and three times. This course affords, he says, much provender for the yard, in tares and clover for soiling, and turnips for stalls. In other parts of the farm, oats follow wheat."

But "At Cheshunt they sow,

1. Turnips,
2. Wheat,
3. Clover.
4. Wheat,

also,

1. Fallow,
2. Wheat,
3. Oats, pease or beans.

On the clays of Albury, Pelhams, &c. their course of crops is,

1. Fallow,	1. Fallow,
2. Wheat.	2. Barley,
3. Oats.	3. Pease.

Some courses consist of, 1. fallow; 2. wheat; 3. fallow; 4. barley; clover is also added with wheat, and oats and barley sometimes. They feed their clover in the spring; and then give a bastard fallow for wheat or barley. In the extensive open fields about Barkway, the writer finds the rotations to be,

1. Fallow.
2. Wheat,
3. Oats,
4. Fallow.
5. Barley,
6. Pease.

The same in the open fields (and all are open) about Royston, There are no inclosures, he says, in the parish, except small patches, quite in or near the town. And "Mr. Foster of Royston, practices a husbandry which, long ago, he publicly recommended; not that he took it from that recommendation, but his practice has confirmed it.

Common Course.	Mr. Foster's.
1. Fallow,	1. Fallow,
2. Wheat,	2. Wheat,
3. Oats,	3. Clover and trefoil,
4. Fallow,	4. Ditto,
5. Wheat.	5. Wheat.

It is stated that, "the seeds are sown on the wheat in March; the first year he tops them in Maye and then mows the ground for hay or seed. The second year the flock-master feeds them with the rest of the field; but the grass entices the sheep to the spot, and dresses it consequently better than other parts; and his following wheat has always been much superior to that fallowed; even to the degree of heating that on which 3l. 4s. per acre have been bestowed in dressing; a clear proof that so much fallowing is a real injury to the land. Besides this, he keeps two horses in eight, fewer than before he practised this husbandry." But Mr. Doo, of Bygrave, is in the Norfolk four-shift course, leaving out the oats taken so commonly in Hertfordshire. If clover fails he sows turnips; and if turnips fail, carries on

the fallow for barley. This is excellent husbandry, the writer says.

But "around Baldock, generally, but with some exceptions, oats are taken after the wheat. And Mr. Smith, of Cloth-hall, has a course of,

1. Fallow,
2. Wheat,
3. Clover,
4. Oats or barley;

and the four-shift turnip course.

In the open field he finds,

1. Turnips,
2. Barley,
3. Pease,
4. Fallow,
5. Wheat,
6. Oats: this by agreement.

And "in the open field near Baldock, he finds another course by a singular agreement.

1. Turnips,
2. Barley,
3. Barley,
4. Clover; which the parish flock-master eats till the last Thursday in May, then removes his sheep, and the farmer lets it stand for seed.
5. Wheat,
6. Oats,

It is remarked by the reporter on these courses that the too general practice of taking a crop of oats after the clover land wheat is extremely incorrect; "it is, he says, putting in a crop the fourth from the fallow; for though clover is certainly to be esteemed a fallow respecting amelioration, yet, in that of cleaning land, it is by no means powerful: if there is any couch in land, it is sure to increase very considerably, while the land rests from tillage: this circumstance makes it such ill husbandry to leave broad clover a second year. To sow wheat on one ploughing, which can destroy no root-weeds, and then to put in a second crop of corn, must, in the nature of things, he supposes, be injurious, by encouraging weeds. But what is the motive, he asks, for this conduct? Those who say that the land will bear it, simply assert that profit is thus to be gained, provided the land be kept in heart. He could never, he says, understand this, nor upon what principles the idea can be founded: and in order to place the question in the clearest light, it appears to him that nothing more can be necessary than to contrast the two courses for any given number of years."

And on the rotations in the clay district, in which the fallow system is found, he offers one remark that "great crops are gained in favourable years, is, he thinks, an undeniable fact; but great as their expences are, these exertions are little or no security against bad seasons, which form a very material deduction from their profit. That husbandry, upon the long run, will, he says, be most beneficial, which is calculated by a variation of crops to be advantageous with a moderate produce: when a year's fallow and manuring are given to one crop, a moderate produce will not be a profitable return; if the farmer has not great success, he has loss: and consequently his hazard is considerable. The course he wishes to see tried effectually is this:

1. Fallow, in partial compliance, not with his, but with the opinion of others;
2. Barley,
3. Clover,
4. Beans.
5. Wheat,

"All the manure should, he says, be laid for the beans. The fallow will secure barley. The clover will give good beans; and the beans, if well cultivated, are sure to give good wheat." He adds that "in answer to this he has been told, that beans will not do in this county; that they have been tried, &c. The trials made have he says been broad-cast, and therefore no rule whatever. They should be dibbled in double rows; that is, two furrows dibbled, a row on each, and then two or three furrows (according to soil and circumstances) should be missed, and two others dibbled, and so on; the intervals should also be well horse-hoed; the rows must be hand-hoed, and weeded, and the whole kept clean, like a garden. The soil is, he says, unquestionably well calculated for this crop; for similar land produces great beans in other counties, and therefore, if well managed, would do the same here. When beans are compared with fallow, let the consumption of the straw be considered, which yields excellent dung; let that dung be carried to the field which produces it, in addition to the quantity the land receives in the present system; a condition absolutely necessary, if the comparison be made fairly. Let these circumstances be duly attended to, and he has little doubt what the result will be. But when random assertions are ventured, and the propriety of the recommendation questioned, he admits the fairness of all, if the proposal could be applied at once to a whole farm. But how very easy is it, says he, to try the experiment on three or four acres in perfect management, not merely for one season, good or bad, but to try such a quantity every year. It would then soon be ascertained, by a truly practical man, free from prejudices, whether the husbandry be really adapted to the land or not." And he advises that "in the tillage preparatory to the beans, the Middlesex management should be adopted, of ploughing while the land is dry, in *autumn*, to throw the field into the destined form, it having been previously well gripped. Spring tillage should also be avoided, as it is pernicious on wet stiff soils, and nothing should require to be done then, except the planting of the field, when the weather would permit the work to proceed" without injury to the land.

In Norfolk where the principle of cropping according to the report of that district has for a long time been that of avoiding two corn crops in succession, and that of making turnips the preparation for barley and grasses that for wheat and other sorts of corn; the rotations on lands and turnip loams are as below. Some of the finest rye the writer has seen was on Mr.

Bevan's farm in 1802 after two successive years of sowing cole, eaten off with sheep. The rye put in on one earth; there are thirty acres of it, and fourteen of them on a black sand. And his tenant Mr. Bradfield pursues regularly this course of crops:

1. Turnips,		1. Turnips,
2. Barley,		2. Barley,
3. Seeds,	But if seeds fail,	3. Vetches,
4. Seeds,	changed to	4. Turnips,
5. Wheat,		5. Barley,
6. Turnips,		6. Turnips,

by which means, in the sixth year, the variation ceases, and it comes, as in the other, to turnips again. The system, however, is open, the reporter says, to two great objections: in the fourth year, he has no summer food for sheep; and, what is as bad, he doubles his quantity of turnips: he also loses wheat in the course. To have two successive years of vetches, appears to be a better system, and a much less interruption, or rather none at all. If the first vetches are to be fed, grass-seeds might be sown with them for the second year, and this would save the expense of seed vetches and tillage for that year."

By Mr. Fowel, of Snetterton, this rotation is in use,

1. Turnips, drilled at eighteen inches,
2. Barley, ditto at nine,
3. Seeds,
4. Seeds,
5. Pease, drilled at twelve inches; or wheat at nine, &c. and this is the rotation of the vicinity.

Wheat, pease, oats, or rye, the fifth year; if rye a bastard fallow for it: the second year, seeds."

He says that in general about Hingham:

1. Turnips,	1. Turnips,
2. Barley,	2. Barley,
3. Clover,	3. Clover,
4. Wheat,	4. Pease,
	5. Wheat.

About Watton:

1. Turnips,	3. Clover, &c.
2. Barley,	4. Wheat.

Mr. Blomfield, at Billingford, in one field near his farm-yard:

1. Winter tares, and then turnips,
2. Barley;

and the crops always good. And Mr. Drake gets better turnips after wheat, the stubble ploughed in than after pease." While "Mr. Wright of Stanhow, never takes barley or pease after wheat, though his soil is a good loamy sand: he thinks that no district where this is the practice deserves the reputation of having the true Norfolk husbandry." And "Mr. Drozier remarked, that upon the sandy land of Rudham, and that vicinity, the greatest improvement perhaps would be, to lay down for eight or ten years to repose, the land from turnips and corn, which would so freshen it as to render it productive perhaps in the stile of the first breaking up; but common grasses wear out, and will not pay the present rents after two years: they sow trefoil and ray."

Sir Mordaunt Martin's course is a five-shift:

1. Turnips,	6. Turnips,
2. Barley,	7. Barley,
3. Clover,	8. Trefoil and ray,
4. Wheat,	9. Pease,
5. Potatoes, mangel wurzel, or vetches, &c.	10. Potatoes, mangel wurzel, vetches, &c.

It is stated that "Mr. Overman, of Burnham, has found, from many observations, that pease do not succeed well if sown oftener than once in twelve years. Where he has known them return in six or eight years, they have never done well. He ploughed up a layer of four years, and drilled wheat on it. Then ploughed for winter tares. Ploughed the stubble once for a second crop of wheat, which the writer viewed: a very fine produce, and as clean as a garden. Three crops of great profit on only three ploughings, and yet the land kept perfectly clean. Not a little resulting from four years sheep feeding without folding from it.

His common course:

1. Turnips,	8. Barley,
2. Barley.	9. 10. Seeds two years,
3. 4. 5. Seeds three years,	11. Pease,
6. Wheat,	12. Wheat,
7. Turnips,	

But with the variation of having part of the twelfth under pease on the three years layer, and also some tares. This course is partly founded on the experience of pease not doing well, if sown oftener than once in twelve years."

And by Mr. Coke:

1. Turnips,	7. Barley, drilled at 6¼ in.
2. Barley, drilled at 6¾ inc.	8. Seeds,
3. Seeds,	9. Seeds,
4. Seeds,	10. Peas, drilled at 9 inc.
5. Wheat, drilled at 9 inc.	or tares at 6,
6. Turnips,	11. Wheat, drilled at 9 in.

Mr. Purdis, of Eggmore, has a very uncommon variation from the general husbandry:

1. Turnips,	4. Seeds,
2. Barley,	5. Tares,
3. Seeds,	6. Wheat.

It is added that "upon a large part of this fine farm the former rotation included a summer-fallow, which afforded (broken at whatever time) little food for live-stock; tares now occupy the place, and

support immense herds of cattles and sheep. What a noble spectacle, says the writer, is this farm! 300 acres of turnips, 300 of barley, 600 of seeds, 300 of tares, and 300 of wheat: 1800 acres arable, the crops luxuriant, much the greater part of the farm very clean; all of it except the layers; on which, however, some thistles, so difficult to extirpate."

But "Mr. Thurtell, near Yarmouth, is in the four-shift, returning, to turnips always after the wheat, for, he thinks, that nothing is so bad as taking a fifth crop." And at Caistor, in Fleg, the land excellent; they are in the five-shift of East Norfolk, that is,

1. Turnips,
2. Barley,
3. Clover,
4. Wheat.
5. Barley;

with two variations practised sometimes by Mr. Everit, at the hall farm.

1. 2. Cole seed instead of turnips and barley, taken two years,
3. Wheat,
4. Barley; but not a great crop; and then turnips again.

"The other is, to substitute pease instead of clover, followed by wheat, and then in the four-shift, to come again to turnips." But a remarkable circumstance in the rotation of crops here is, that spring corn will not succeed well after wheat which follows cole seed: they will give an excellent summer-fallow for this crop; spread 14 loads of fine dung per acre, and sowing wheat after the cole, get the finest crops, yet if barley or oats follow, the produce is seldom tolerable; oats better than barley, but neither good.

By some farmers at Hemesby, the rotations are,

1. Turnips,
2. Barley,
3. Seeds (clover once in 10 or 12 years),
4. Wheat,
5. Peas, or oats,
6. Wheat.

"It may easily be supposed, the writer says, that the wheat of the fourth year is much better than that of the sixth. The course cannot be defended even on Hemsby land, and the wheat stubbles were some of them not so clean as they ought to be."

And "at Thrigby, Mr. Brown, &c. is, he says; in the Fleg five-shift; barley after the wheat; with the variation, to avoid clover every other round, of sowing half the barley with other seeds, and dibbling peas on the other half.

"But at South Walsham, Mr. Syble, and others:

1. Turnips,
2. Barley,
3. Seeds, one or two years,
4. Wheat,
5. Barley or oats,
6. Pease,
7. Wheat.

Unworthy of Norfolk in any case whatever.

,, The variation of the seeds is to prevent clover coming two rounds together, as the land here, as elsewhere, is sick of it. Upon a part white clover, trefoil, and ray are substituted, and left two years; about one third of the wheat is on a two years layer. If the clover be a good crop, the wheat is better than after the other seeds. The barley after wheat (if that followed a two years lay) is better than after turnips. But Mr. Syble, if the land is foul after the first wheat is sure then to take turnips. Sometimes peas on a two years lay, and then wheat; but he does not like peas from their being so liable to failure. He is of opinion, the reporter says, that the husbandry of Fleg and Blofield wants variation, from having been kept too long in a regular course. One which has succeeded with him, is to sow barley, after pease or vetches, in which way he has had great crops. It is added, that at Repps and Martham the common Fleg five-shift husbandry; that is, barley follows wheat; clover and other seeds alternate, and the wheat as good after one as the other. And at Ludham, the common five-shift.

"But that at Catfield, he found a variation; there the course is a six-shift husbandry:

1. Turnips,
2. Barley.
3. Clover, &c.
4 Clover, &c.
5. Wheat,
6. Barley.

It is stated, that "Mr Cubit practises this in common with his neighbours; the seeds riffled the second year before harvest, that is, rice-baulked, raftered, half ploughed: some scaled, a clean earth, as thin as possible; the management Mr. Thurtell reprobated for his soil: and what is singular, they seem to do it with equal reference to dibbling and broad-casting."

And "Mr. Repton, at Oxnead, has been, from the year 1773, regularly in the sixth-shift husbandry, of

1. Turnips,
2. Barley,
3. Seeds—hay,
4. Seeds—ollond,
5. Wheat,
6. Barley;

which is common throughout the county.

But "Mr. Reeve, of Heveringland, is in the five-shift; the seeds two years. And with Mr. Bircham, at Hackford:

1. Turnips,
2. Barley,
3. Clover, and other seeds alternately,
4. Clover and other Seeds alternately,
5. Wheat,
6. Barley, oats or peas.

"But if the land be out of his condition, method to recover it, is to take,

1. Turnips,
2. Barley,
3 Turnips,
4. Barley,

But "Mr. Johnson, of Thurning, thinks that the common course of,

1. Turnips,
2. Barley,
3. Seeds, two year's
4. Seeds,
5. Wheat,
6. Barley;

which is the usual system about him, would be improved by the following variation:

1. Turnips,
2. Barley,
3. Seeds,
4. Seeds,
5. Seeds,
6. Pease.
7. Wheat,
8. Barley;

in which the land would have rest for feeding, three years in eight, instead of two in six as in the other,"

"With Mr. England, at Bingham:

1. Turnips,
2. Barley,
3. Seed,
4. Seeds,
5. Wheat;

never adding barley after the wheat. Sometimes on tender land, not equal to wheat, drills peas on the ollond, and then, if the land be clean, takes barley, or even wheat, but not without rape cake."

And Mr. Reeve, of Wighton:

1. Turnips
2. Barley,
3. Trefoil, white clover, and ray,
4. Ditto,
5. Wheat, drilled,
6. Turnips,
7. Barley,
8. Clover,
9. Wheat.

It is observed, that "every idea of this most accurate farmer, merits much attention; and this course among the rest: whenever red clover is left a second year, it disappears, and the land is principally covered with ray grass: query if it is not much better, when red clover is the object, never to leave it two years: this is an improvement in Mr. Reeve's intention, but it has not been his general practice." He mucked a barley stubble for vetches, ploughed once for that crop; and then drilled wheat on one other ploughing. The stubble clean as a garden.

Mr. M. Hill has

1. Turnips,
2. Barley,
3. Seeds,
4. Seeds,
5. Wheat,
6. Turnips,
7. Barley,
8. Seeds,
9. Peas, or tares,
10. Wheat.

It is observed that he "has now (1802) on his farm a very fine field of wheat, drilled on a flag of a four years layer: he remarked it, the reporter says, as an instance of confidence in his landlord (Mr. Coke) not to have broken it up sooner at the end of a lease. The same farmer sows cole after winter vetches fed off; eats it off, at Michaelmas; sows rye for spring feed; eats that off, and tills for turnips, getting four green crops to feed on the land in two years." Excellant husbandry, says the writer.

The reporter says, that "the following detail of all the courses pursued by Mr. Dursgate, on his fine farm of Summerfield, is in his opinion, a most satisfactory account of Norfolk husbandry, shewing the very considerable exertions made in that county for the great objects of keeping land clean and in heart: the particulars merit a close examination. These fields contain near 1050 acres."

"*No.* 1.—*Fring Break.*

1797 Summer-fallow.
1798 Wheat manured with half a ton of rape-cake per acre.
1799 Turnips, mucked, and fed with sheep.
1800 Barley.
1801 Clover and ray, mowed.
1802 Ditto fed with sheep.

"*No.* 2.—*Upper end of Cow-close.*

1797 Half summer-fallowed. Half vetches, fed by sheep.
1798 Wheat rape-cake on one-half of it one quarter of a ton; on the other half, one-third of a ton.
1799 Turnips, mucked, and fed with sheep.
1800 Barley.
1801 Trefoil and ray, half of it mowed.
1802 Ditto fed with sheep.

"*No* 3.—*Fox close new broken up fox-covet.*

1797 Oats.
1798 Wheat.
1799 Turnips drawn.
1800 Barley.
1801 Trefoil and ray fed with horses.
1802 Ditto, fed with horses and sheep.

"*No.* 4.—*First Burnt Stock.*

1797 Turnips one quarter of a ton of rape-cake per acre, fed with sheep.
1798 Barley.
1799 Turnips, mucked, and fed with sheep.
1800 Barley.
1801 Trefoil, fed with sheep.
1802 Ditto, ditto.

"*No.* 5.—*Church-Hill.*

1797 Peas, barley, and vetches.
1798 Turnips mucked, and one-quarter of a ton of rape-cake per acre; fed with sheep.
1799 Barley.
1800 Clover, mowed.
1801 Clover fed with sheep.
1802 White peas.

"*No.* 6.—*Black Hurn.*

1797 Ollond, two years, fed with sheep.
1798 Turnips, mucked, and fed with sheep.
1799 Barley.

1800 Trefoil, mowed.
1801 Ditto, fed with sheep.
1802 Vetches.

" *No.* 7.—*First part Cow-close,*

1797 Wheat.
1798 Turnips, one quarter of a ton of rape-cake per acre; fed with sheep.
1799 Barley,
1800 Trefoil, fed with sheep.
1801 Ditto fed with horses.
1802 White peas.

" *No.* 8.—*Stack-yard Break.*

1797 Turnips, mucked, and fed with sheep.
1798 Barley.
1799 Clover and ray, mown.
1800 Ditto, fed with horses and sheep,
1801 White peas.
1802 Wheat; one third of a ton of cake per acre.

" *No.* 9.—*New-pit.*

1797 Turnips, half mucked, and on the other half a quarter of a ton of cake per acre, fed with sheep.
1798 Barley.
1799 Trefoil ray, and white clover, fed with sheep.
1800 Ditto fed with sheep.
1801 White peas.
1802 Barley.

" *No.* 10.—*Hilly-piece.*

1797 Turnips, one-quarter of a ton of cake per acre, and fed with sheep.
1798 Barley.
1799 White clover and ray, fed with sheep.
1800 Ditto, sheep fed.
1801 White pease,
1802 Barley.

" *No.* 11.—*Pound Close.*

1797 Turnips, mucked, and sheep fed.
1798 Barley,
1799 Trefoil, white clover, and ray, sheep fed.
1800 Ditto, sheep fed.
1801 Vetches,
1802 Barley.

" *No.* 12.—*First* 19 *Acres.*

1797 Turnips, mucked, and sheep fed.
1798 Barley.
1799 Clover and ray, mown.
1800 Ditto, sheep fed.
1801 White pease.
1802 Wheat; one-third of a ton of cake per acre.

" *No.* 13.—*First* 14 *Acres.*

1797 Turnips, mucked, sheep fed.
1798 Barley.
1799 Trefoil, white Dutch, and ray, sheep fed.
1800 Ditto, sheep fed.
1801 Vetches, soiled.
1802 Wheat, part mucked, the rest one-third of a ton of cake per acre.

" *No.* 14.—*Second* 14 *Acres.*

1797 Turnips, mucked, and sheep fed.
1798 Barley,
1799 Trefoil, ray, and white clover, sheep fed.
1800 Ditto, sheep fed.
1801 White pease.
1802 Wheat; one-third of a ton of cake per acre.

" *No.* 15.—*Lady Summersby Break.*

1797 Barley, after mucked turnips, and sheep fed,
1798 Clover, ray, and white Dutch, mown.
1799 Ditto, sheep fed.
1800 Pease.
1801 Wheat; one-third of a ton of cake per acre,
1802 Turnips, mucked.

" *No.* 16.—*Saffron-row.*

1797 Barley, after turnips, one-quarter of a ton of cake per acre, and fed with sheep.
1798 Trefoil, ray, and Dutch, mown.
1799 Ditto, sheep fed.
1800 Forty acres of it summer-fallow; 11 of it pease.
1801 Wheat; one-third of a ton of cake per acre,
1802 Turnips, mucked.

" *No.* 17.—*Thoroughfare.*

1797 Barley, after turnips, mucked, and sheep fed.
1798 Clover, ray, and Dutch, mown.
1799 Ditto, sheep fed.
1800 Pease.
1801 Barley.
1802 Turnips, mucked.

" *No.* 18.—*Second Burnt Stock.*

1797 Barley, after wheat.
1798 Trefoil, ray, and Dutch, sheep fed.
1799 Ditto, sheep fed.
1800 Trefoil, and then bastard summer tilth.
1801 Wheat; half of it tathed; half of it manured with cake, one-third of a ton per acre.
1802 Turnips, one-quarter ton cake.

" *No.* 19.—*Eleven Acres.*

1797 Trefoil, ray, and Dutch, sheep feed.
1798 Ditto, sheep fed.

1799 Ditto, ditto.
1800 Vetches, soiled.
1801 Barley.
1802 Turnips; one-quarter of a ton of cake per acre.

"*No.* 20.—*Brick-kiln Breck.*

1797 Clover, ray, and Dutch, mown.
1798 Ditto, sheep fed.
1799 Ditto, 20 acres of it sheep fed; 33 ditto, bastard-fallow.
1800 Wheat, ploughed up 15 acres, and sowed Tartarian oats.
1801 Turnips, mucked; and part of it one-quarter of a ton of cake per acre; sheep fed.
1802 Barley.

"*No.* 21.—*Black Hurn, adjoining.*

1797 Barley, after turnips, one-quarter of a ton of cake per acre; sheep fed.
1798 Trefoil, ray, and Dutch, sheep fed.
1799 Turnips; one-quarter of a ton of cake per acre; sheep fed.
1800 Wheat, drilled, one-quarter of a ton of cake.
1801 Turnips, mucked; sheep fed.
1802 Barley.

"*No.* 22.—*First part Long Snelling.*

1797 Trefoil, ray, and Dutch, sheep fed.
1798 Ditto, sheep fed.
1799 Half vetches, soiled: half summer-fallow.
1800 Wheat; one-third of a ton of cake per acre.
1801 Turnips, mucked part; part caked, one-quarter of a ton per acre; one-half drawn; one-half sheep fed.
1802 Barley.

"*No.* 23.—*Seventeen Acres.*

1797 Trefoil, ray, and Dutch, sheep fed.
1798 Ditto, sheep fed.
1799 Summer-fallow.
1800 Wheat; one-third of a ton of rape-cake per acre.
1801 Turnips; one-fourth of a ton of ditto, sheep fed.
1802 Barley.

"*No.* 24.—*Paddock.*

1797 Trefoil, ray, and Dutch, sheep fed.
1798 Ditto, sheep fed.
1799 Summer-fallow.
1800 Wheat; one-quarter of a ton of cake per acre.
1801 Turnips, mucked, sheep fed.
1802 Barley.

"*No.* 25.—*Home Break.*

1797 Trefoil, ray, and Dutch, one-half fed, on half mown.
1798 Ditto, sheep fed.
1799 Wheat; forty acres of it manured with one-quarter of a ton of cake per acre.
1800 Turnips; forty acres, one-quarter of a ton of cake; twenty acres mucked.
1801 Barley.
1802 Clover; forty acres mown; twenty acres fed horses.

"*No.* 26.—*Ling Piece.*

1797 Layer, second year sheep fed.
1798 Summer-fallow; clayed.
1799 Tartarian oats.
1800 Turnips; one-quarter of a ton of cake per acre.
1381 Barley.
1802 Trefoil, mown.

"*No.* 27.—*Second nineteen acres.*

1797 Trefoil, ray, and Dutch sheep fed.
1798 Summer-fallow.
1798 Wheat; one-quarter of a ton or cake per acre.
1800 Turnips; ditto, sheep fed.
1801 Barley.;
1802 Clover, mowed.

"*No.* 28.—*Fourteen acres adjoining.*

1797 Clover, ray, and Dutch mowed.
1798 Ditto, mown,
1799 Tartarian oats.
1800 Turnips; one quarter of a ton of cake per acre; sheep fed.
1801 Barley.
1802 Trefoil, sheep fed.

"*No.* 29.—*Second long snelling.*

1797 Layer, second year sheep fed.
1798 Summer-fallow.
1799 Wheat: one quarter of a ton of cake per acre; on the other half, one third of a ton.
1800 Turnips, mucked; sheep fed
1801 Barley.
1802 Trefoil, mown.

A finer detail of courses, or of great exertions in excellent management, has not, the writer thinks, been often seen." And that "a singular management which he has practised, has been that of breaking up a one year's layer, and sowing turnips, to the quantity of from twenty to fifty acres in a year, feeding them off with sheep, and then drilling wheat on one earth."

It is added, that part of one of his fields was sum-

mer-fallow, and part pease; the whole then sown with wheat which, was better after the pease than after the fallow; the crop was damaged by the wire worm, against which he has found fallowing no security."

With Mr. Rishton, at Thornham, the old four-shift of

1. Turnips,
2. Barley,
3. Seeds,
4. Wheat.

Clover, one round, and other seeds the next.

At Holm, on rich loam:

1. Turnips,
2. Barley,
3. Clover and ray-grass,
4. Clover, and temp.
5. Wheat,
6. Barley.

Mr. Styleman, at Snettisham:

1. Turnips,
2. Barley,
3. Seeds,
4. Seeds,
5. Pease.
6. Wheat.

It is stated, that "Mr. Saffory thinks the grand point now in Norfolk husbandry is a due change and variation of crops, as beans, carrots, &c."

About Wymondham:

1. Turnips,
2. Barley,
3. Clover; or clover, trefoil, white clover and ray, one year.
4. Wheat,
5. Barley, but with exceptions. If the seeds fail, dibble pease sometimes, and take Wheat after.

At Besthorpe:

1. Turnips,
2. Barley,
3. Clover, &c.
4. Wheat,
5. Barley.

But Mr. Priest leaves out this last crop.

With Mr. Twist, at Bretenham:

1. Turnips,
2. Barley,
3. Trefoil and ray grass,
4. Ditto,
5. Rye, on one or on three earths.

At Acle, on some of the finest wheat land in the county:

1. Turnips,
2. Barley,
3. Clover,
4. Wheat,
5. Pease,
6. Wheat.

And "at Halvergate, also, very fine land in the same course. If clover follows once in four years, it is sure to fail."

The writer remarks, that "thirty years ago, he met with a course in Fleg hundred, which was:

1. Turnips,
2. Barley,
3. Clover, and ray,
4. Ditto.
5. Buck-wheat or pease,
6. Wheat.

And that "it was remarked more than thirty years ago, near Norwich, that the crops of barley, after turnips fed late, were generally bad, which led to a practice that deserves noting; buck-wheat was substituted, which succeeded well, and was followed by wheat; an observation very applicable, he says, to Swedish turnips at present."

On stronger land the *rotations* are "At Thelton, with Mr. Havers, on his drier soils:

1. Turnips,
2. Barley,
3. Clover, once in eight years, the land being sick of it.
4. Wheat dibbled.

But on heavy land:

1. Summer-fallow,
2. Barley,
3. Clover, once in eight years,
4. Wheat dibbled,
5. Beans.

On either soil, in the intermediate course, trefoil, ray, and white suckling, substituted for clover. sometimes left two years; and then pease, on the lighter land, and beans on the heavy—wheat following." And with "Mr. Drake, of Billingford on heavy land:

1. Summer-fallow,
2. Barley,
3. Clover,
4. Wheat,
5. Beans or oats.

But as the land is sick of clover, he does not sow it oftener than once in eight or ten years; using white clover the intermediate round." But "on his light land, the common four-shift husbandry."

With "Mr. Pitts, at Thorpe Abbots, on gravel:

1. Turnips,
2. Barley,
3. Seeds,
4. Wheat, barley, or pease.

But on heavy land:

1. Summer-fallow,
2. Barley,
3. Seeds,
4. Wheat.

Some put in pease or beans on the seeds, and then wheat.

With Mr. Mildred, near Bungay; on his lighter land, the four-shift husbandry; but on the heavy:

1. Summer-fallow,
2. Barley,
3. Seeds,
4. Wheat dibbled,
5. Beans or oats, the former dibbled.

His seeds for change are trefoil and white clover: he does not like ray grass, therefore sows as little as possible."

And "Mr. Burton, of Langley, summer-fallows the strong land at Hempnal, for barley and wheat alternately; taking beans after either, and wheat after the beans."

But "on the sandy and gravelly loams of the hundred of Loddon, the four-shift husbandry: but as the land is sick of clover, they sow it but once in eight years, and sow white clover and trefoil instead of it."

With "Mr. Salter, near Dereham, on land so wet as to require much hollow-draining:

1. Turnips,
2. Barley,
3. Clover,
4. Wheat.

But it does not keep his land free from charlock. In 1776, at Walpole:

1. Fallow,
2. Wheat,
3. Oats,
4. Beans,
5. Wheat.

Mr. Forby's at Fincham, on strong land:

1. Cabbages, dunged for, and worth, on an average, 5l. per acre;
2. Barley, $9\frac{3}{4}$ coombs;
3. Clover, mown twice, produce three tons;
4. Wheat, dibbled, $8\frac{1}{2}$ coombs; has had ten round;
5. Oats, fifteen coombs.

About Harleston, on their good loams of 20s. or 25s. an acre, on a marle bottom, they pursue pretty much this rotation:

1. Fallow,
2. Wheat,
3. Beans,
4. Wheat.

With this variation:

1. Fallow,
2. Wheat,
3. Clover,
4. Beans,
5. Wheat.

The beans all dibbled one row on a furrow; three bushels of Windsor ticks per acre: they used to manure for the wheat after them, but of late have got much into the practice of manuring for the beans, which has succeeded far better, not only for the beans, but with the wheat also. They most approve of ploughing the land for beans in the autumn, and leaving it in order, well water-gripped, for planting, after harrowing, the end of February or beginning of March, on this stale furrow. Crop, from eight to twelve coombs an acre. Dibbling is 6s. 6d. an acre. and hand-hoeing, twice 10s.—5s. each time. They harrow and roll in the clover on the wheat, in the spring. But Mr. Salter, at Winborough, applied summer-fallowing, the first year of his taking his farm, much of which consists of various loams and sands, on a strong marley and clayey bottom, and abounding with springs: but since that, he has never fallowed, and never will.—His expression was, the writer says, "a man is a madman that summer-fallows." He is very regularly in the four-shift course of—

1. Turnips,
2. Barley,
3. Clover,
4. Wheat.

It is observed, that if "clover fails, or on lands where he expects it to fail, winter tares or pease instead of it. His wheat, on layers, all dibbled, and the turnips fed by sheep on the land; on the wettest soils, kept on them only by day, and laying on grass-land at night."

He adds, that on "East Bilney, Brisley, Gressenhall, Stanfield, Betdey, and Mileham, adjoining parishes, the common course is:

1. Turnips,
2. Barley,
3. Clover,
4. Wheat; and some add,
5. Barley.

Also:

1. Summer-fallow,
2. Wheat,
3. Oats,
4. Turnips,
5. Barley,
6. Clover,
7. Wheat.

With "the Rev. Dixon Hoste, on some of the strongest and most tenacious land he has seen in Norfolk:

1. Turnips,
2. Barley, drilled,
3. Clover,
4. Wheat, drilled,
6. Barley, drilled,
7. Tares, &c. as the land is sick of clover,
8. Wheat, drilled.

Recurring thus but once in eight years, the clover stands."

But "at Goodwick, and the neighbouring heavy land parishes, the fourshift husbandry; the turnips on nearly flat lands; there are, however, some summer-fallows for wheat, in which case the course is:

1. Fallow,
2. Wheat,
3. Turnips,
4. Barley,
5. Clover,
6. Wheat.

And with "Mr. Porter, at Watlington, on strong land:

1. Fallow,
2. Wheat,
3. Beans,
4. Wheat.

One-fourth fallow. If fallow is had recourse to, how much better to introduce it thus:

1. Fallow,
2. Barley,
3. Beans,
4. Wheat,
5. Beans,
6. Wheat.

In Marshland the Rotations are:

At Wiginhall, St. Maries:

1. Summer-fallow,
2. Wheat,
3. Beans,
4. Wheat.

This by good farmers; but some go on:-

5. Oats, 6. Barley, or big.

In other cases the rotations are still more exceptionable; corn following corn crops without end.

On "Mr. Saffory's fen farms at Denver Wedney, Fordham, Downham, west side:

1. Pare and burn for cole for sheep; the crop worth 30s. to 40s.
2. Oats, fifteen coombs,
3. Wheat, seven coombs,
4. Summerland cole for sheep, 25s.
5. Oats, fifteen coombs,
6. Laid to ray one bush. white clover 8lb. red ditto 8lb. for three years, fed in general with sheep and beasts, some mown 1½ load an acre.

Sometimes red clover only for one year, ploughed up, and wheat dibbled."

The writer remarks, that there is one circumstance in these rotations that demands attention, and which the practice of Mr. Purdis confirms; which is the necessity of greater variety. It is observed that "he was long in the common system before he struck out a variation; and that he was induced to it, partly from a conviction that the land generally wanted a change."

The writer says, that "for 60 or 70 years, the variations have, upon the whole been very few: all have begun with turnips, followed by barley; then seeds, in which alone have occurred the chief variations, and those, by force of necessity, from failures. If there is a deficiency, (he thinks) it will be found in not having some substitutions of crops for so regular a routine. Mr. Purdis introducing tares, appears (he says) a good idea: pease have been taken by some other farmers; but Mr. Overman's curious observation, that they will not succeed, if taken oftener than once in 11 or 12 years, should be a caution. Chicory followed by winter tares, amongst which some scattered plants rising, would be of no consequence, but rather an advantage, deserves attention. Upon very poor soils, this plant is essential to profit." And another crop he shall take the liberty of naming for loams, is the bean. The notion, in Norfolk, that this is adapted only to strong soils, is very erroneous; it is more profitable on good sands and pretty good sandy loams, than it is on clay; and would yield great crops on soils, wherein it is never found in Norfolk." He adds that "carrots also deserve attention; for turnips have been repeated till the land is sick of them," or in other words till they do not succeed in a profitable manner.

In East Lothian, a district where tillage is conducted to an extensive scale, the following is "the mode of cropping followed by the best farmers in the different parts of the county, and though several exceptions will be met with, it will be found to apply generally.

Upon the coast lands the rotation is on the dry gravelly loams, under a four-course shift, as below:-

1. Turnips, sometimes with, sometimes without, dung.
2. Barley or spring wheat, with grass seeds.
3. Clover, which is generally cut for hay, or given green to farm-stock in the house, and sometimes pastured with ewes and lambs.
4. Wheat or oats, if wheat was taken before, dunged upon the clover ley.

It is remarked by the writer that "after this the rotation again returns and that "upon this description of land, the turnips are for the most part consumed upon the ground with sheep confined by flakes, a mode by which the soil is greatly enriched.—Of late years, however, an improvement has been made in the way of using turnips, upon these lands, that deserves attention. In place of eating the whole upon the field where they grow, a certain proportion is drawn, and either carried home and used for cattle in the house, or given to sheep upon an adjoining stubble or grass field; by this mode a double quantity of land is manured, and, if the winter is wet, the turnip-field is less injured than it would otherwise be, if the whole were consumed where they grow. The quantity drawn and carried off in this manner is from a half to a third of the crop; in some cases five or six drills are taken out, and the same number left. Taking out alternate drills is certainly a preferable mode, and is now pretty generally practised."

But upon deeper loams with a dry bottom:

1. Turnips.
2. Barley, or spring wheat.
3. Pasture.
4. Oats.
5. Beans drilled and horse-hoed,
6. Wheat.

It is stated, that "this rotation requires land of the best quality.—Dung is only once applied during the rotation, and is uniformly given to the turnips.

Upon heavy loams on a retentive bottom:

1. Fallow with dung,
2. Wheat,
3. Beans drilled and horse-hoed,
4. Barley,
5. Clover, which is dunged on the stubble,
6. Oats,
7. Beans drilled,
8. Wheat.

The writer observes, that in "this rotation the land is dunged twice, though not very heavily, a practice that is found to be very beneficial. Beans and wheat alternately are sometimes taken on such soils, but much manure is necessary, where a system of this kind is executed.

Another rotation, on this species of soil is :-

1. Fallow dunged.
2. Wheat with grass-seeds.
3. Pasture, eaten by sheep.
4. Oats.
5. Beans, or a mixture of beans and pease drilled.
6. Wheat or oats.

It is observed, that "the above is a rotation of six, with only one manuring, but the quantity applied is generally greater than in the foregoing rotation, and the pasture being the second after the fallow, and fed off with sheep, compensates in some degree for the want of dung. A rotation is sometimes followed on the best clays, such as is marked in first class of the above.

And on thin clays :-

1. Fallow without dung.
2. Oats with grass seeds, or if the fallow was dunged, wheat.
3. Pasture.
4. Oats.
5. Beans dunged.
6. Wheat.

After which the fallow is repeated, and the rotation returns.

Upon the poorest of these clays, the rotation, commonly followed, is,

1. Fallow dunged.
2. Barley, sometimes oats, with grass-seeds.
3. Clover.
4. Oats.

The writer says, that "on the coast, a considerable portion of what was formerly *link* grounds, covered with bents and other herbage of small value, is now brought under the plough, and profitably employed in raising useful crops. That description of soil is, for the most part, under a rotation of four, as follows :

1. Turnips, with dung or sea ware.
2. Rye or barley with grass-seeds.
3. Clover cut for hay, or pastured.
4. Oats manure on the clover ley.

The reporter says, that "the great bar to the improvement of these sandy soils, arises from the risk to which they are exposed of being blown by high winds, a circumstance which frequently happens, and by which the crops both of turnips and barley, are often greatly injured, sometimes entirely lost. A remedy, he says, has lately been suggested, and put in practice, for that evil which bids fair to be attended with benefit. The season, during which the greatest mischief happens from blowing, is the latter part of the spring and beginning of summer, and the winds by which the blowing is occasioned, are generally from the west and south : to prevent the mischief, to barley and turnips crops, it is proposed to keep barley out of the rotation, and substitute rye in its place, that the ridges of the field shall run in a direction from north to south, and that the three westernmost ridges shall be sown with rye before winter, leaving the three ridges immediately adjoining for turnips, sowing again the next three ridges with rye, and so on, having alternately three ridges of each over the whole field. Where this is practised, the rye, by the time the turnips are sown, has made considerable progress, and from the circumstance of the sides of the ridges being opposed to the wind, breaks its force so much as to prevent it from hurting the turnips. Perhaps alternate ridges of rye and turnips would answer the purpose of shelter more completely, but as some loss would arise from treading the rye in the working of the turnips, and as the latter, if the rye grew to any great height would suffer from the want of a due proportion of light and air, two or three ridges appear to be the proper breadth."

It is stated, that "the above is the rotation generally followed, on the different soils in the middle districts, and coast lands. Upon the deep and well sheltered soils, in the uplands, it is not materially different, except that winter wheat is seldom sown, and spring wheat not at all ; for the generality of that district however, which is a dry gravelly loam, the rotation principally followed is one of four shifts :-

1. Turnips with dung.
2. Barley or oats.
3. Clover.
4. Oats.

But upon heath lands broken up by a two years' fallow, the rotation is generally different from any of the above. Where the soil of these lands is, however, deep, the above rotation is followed ; but when the situation is elevated and the soil thin, as is often the case, the most common rotation is as under :

1. Oats.
2. Clover.
3. Pasture.

It is added that "in this last the land is permitted to remain for a number of years." But that "in some cases the system is different; the second year of the fallow, and after the lime is wrought in, turnips are sown and eaten off with sheep, oats are sown in the spring with grass, and the land afterwards pastured. The last is unquestionably the most profitable rotation, as alone with the value of the turnip crop, which in some cases may be considerable, the land is manured and has its parts consolidated, by the treading of sheep; this last is a circumstance of great importance to soils of a loose texture, as these frequently are."

It is, he says, supposed "by some good farmers, that the rotation upon these new broken uplands, may be lengthened by taking a second crop of oats after the clover and again sowing down with grass seeds. It is supposed that on some of the best of these lands that may be done with advantage; but if the soil be thin and contain few useful principles, the experiment is dangerous, as there is a risk of rendering it useless for the future."

From the rotations that are thus pursued in these grain districts, it is sufficiently evident, that the art of cropping is far from having attained that state which its importance deserves. In different cases bad rotations are still pursued, seemingly, because they have been in use for a great length of time, in the particular situations, though great loss is annually sustained by the practice.

It is time however for farmers in all situations to have a closer attention to this business, and to make trials of other suitable rotations, which they have not been in the habit of employing, as it is only by such attempts that they can derive the greatest possible advantage from their lands. It has indeed been well remarked by a late practical writer, that though perhaps no invariable rules can be laid down for the conducting of this business as much must in all cases depend on the soil, situation, climate and other circumstances of less consequence, the material points to be regarded, would appear to be those of properly suiting the crops to the nature and state of the lands, as well as the kinds of husbandry which are practised, and that of interposing those of the green and root kind between those of grain, in such a manner as that the ground while it continues the least possible time unproductive, may be deprived in the smallest degree of its fertility. By this means the culture of the field may approach that of the garden, and the impoverishing effects of grain crops in succession, be avoided, while the supplies of food both for man and animals may be greatly augmented.

These facts therefore sufficiently shew that the practice of restricting tenants to particular rotations or modes of cropping must be injurious in various respects, and that the only thing that is necessary to guard against, is the successive introduction of corn crops, while effectual care is taken to have the manure afforded by all the sorts of crops returned to the lands.

After this explanation of the nature of cropping lands, it may not be improper to take notice of the distribution of crops on farms of different kinds. It is however a point of great difficulty to ascertain the exact proportions of crops of different sorts that may be the most applicable on tillage farms of different kinds, as much must constantly depend on soil, climate, and situation in regard to markets, as well as the nature of the cultivation and other matter, which have a relation to the particular nature of the farm itself. It has been suggested, that the directing principles in this sort of management should be "that the extent of land in the state of natural and artificial grass be fully adequate to the support of such a number of live stock of different kinds as may be sufficient to supply such a proportion of manure as is necessary for keeping the portion of ground under grain, root, green, or other crops, in the most perfect heart and order. Hence the space of ground to be conducted under grain, root, green, and other arable crops, must constantly be proportioned to the quantity of manure that can be raised by the keeping of different sorts of domestic animals, while the number of the last must be regulated by the amount of the food that can be procured from the grass and green cattle crops, which can be cultivated and preserved for their use during the winter season." As without considerable attention to these different circumstances, it must be impossible, it is supposed, except near large towns, where manures can be obtained at a reasonable rate, to cultivate land to the greatest advantage" or in the most beneficial manner.

It is stated that in the best cultivated parts of the west riding of Yorkshire, the proportionate distribution of crops is in this way, according to the valuable Agricultural Survey of that district, upon a farm situated in the centre of the riding; extent 150 acres, sixty of which were dry turnip soil, and the remainder a mixture of clay with gravel incumbent on a wet bottom.

Distribution of Crops in 1796:

Wheat	30 acres.
Barley	20
Oats	14
Meadow-grass	7
Red clover	14
Pasture	45
Summer fallow and turnips	20
	150

And on a farm in the western part of the same district, extent 80 acres, customary measure of 7840 square yards;

Annual Crops:

3½ acres of oats.
1½ acre of barley.
21 acres of meadow cut for hay.
20 acres pastured with feeding cattle.
30 acres pasture with milch cows, young cattle, and horses.

The proportion in grain is here much too small.

Upon a farm in the centre of the riding; soil, red greet and water shaken, incumbent on clay. Extent 200 statute acres.

Annual distribution of Crops:

43 acres wheat being { 15 acres after fallow. / 15 acres aft. clov. lea. / 13 acres after oats. } seed sown from 2½ to 3 bushels per acre.

16 acres barley after fallow.
10 acres oats.
14 acres beans and peas.
70 acres pasture and meadow.
16 acres clover.
31 acres summer fallow.

200

Upon a farm, extent 78 statute acres, restricted to ploughing more than 40 acres, which is a dry gravelly soil.

Annual distribution of Crops:

18 acres wheat.
8 acres potatoes.
6 acres of oats.
8 acres of peas, cabbages, &c.
27 acres pasture grass.
11 acres meadow loam.

78

Upon a farm where the soil was lime-stone, clay, and moor. Extent 139 statute acres.

Annual distribution of Crops:

Wheat	23 acres.
Barley	9
Oats	23
Beans	5
Meadow	13
Fallow	20
Pasture	47
	139

On a farm, extent 116 statute acres, soil lime-stone and clay.

Annual distribution of Crops:

Wheat	22 acres
Barley	12
Oats	8
Beans	7
Meadow	10
Fallow	13
Pasture	59
	116

The following table contains the rotations of cropping and distributions of crops on different sorts of land in the north riding of Yorkshire, as stated in the Report of that district.

On 100 acres of light soil:

Fields.	1800.	1801.	1802.	1803.	1804.	1805.	1806.	1807.	1808.	1809.
1	Grass-ley, three years old.	Corn	Turnips	Corn	Clover	Corn	Turnips	Corn	Grass-ley	Grass
2	Corn	Turnips	Corn	Clover	Corn	Turnips	Corn	Grass-ley	Grass	Grass
3	Turnips	Corn	Clover	Corn	Turnips	Corn	Grass	Grass	Grass	Corn
4	Corn	Clover	Corn	Turnips	Corn	Grass	Grass	Grass	Corn	Turnips
5	Clover	Corn	Turnips	Corn	Grass	Grass	Grass	Corn	Turnips	Corn
6	Corn	Turnips	Corn	Grass	Grass	Grass	Corn	Turnips	Corn	Clover
7	Turnips	Corn	Grass	Grass	Grass	Corn	Turnips	Corn	Clover	Corn
8	Corn	Grass	Grass	Grass	Corn	Turnips	Corn	Clover	Corn	Turnips
9	Grass	Grass	Grass	Corn	Turnips	Corn	Clover	Corn	Turnips	Corn
10	Grass	Grass	Corn	Turnips	Corn	Clover	Corn	Turnips	Corn	Grass

Annual distribution of Crops:

	A.	R.	P.
Each year there will be of corn,	40	0	0
Turnips,	20	0	0
Temporary grass-ley,	30	0	0
Clover,	10	0	0
Total,	100	0	0

ON ONE HUNDRED AND TWENTY ACRES OF HEAVY SOIL.

Fields.	1800.	1801.	1802.	1803.	1804.	1805.	1806.	1807.	1808.	1809.	1810.	1811.
1	Oats or beans, after grass	Green fallow	Oats or barley	Clover or peas	Wheat	Beans	Grass-ley	Grass	Grass	Grass	Grass	Grass
2	Green fallow	Oats or barley	Clover or peas	Wheat	Beans	Grass-ley.	Grass	Grass	Grass	Grass	Grass	Oats or beans
3	Oats or barley	Clover or peas	Wheat	Beans	Grass-ley	Grass	Grass	Grass	Grass	Grass	Oats or beans	Green fallow
4	Clover or peas	Wheat	Beans	Grass-ley	Grass	Grass	Grass	Grass	Oats or beans	Oats or beans	Green fallow	Oats or barley
5	Wheat	Beans	Grass-ley	Grass	Grass	Grass	Grass	Oats or beans	Green fallow	Green fallow	Oats or barley	Clover or peas
6	Beans	Grass-ley	Grass	Grass	Grass	Grass	Oats or beans	Green fallow	Oats or barley	Oats or barley	Clover or peas	Wheat
7	Grass-ley	Grass	Grass	Grass	Grass	Grass	Green fallow	Oats or barley	Clover or peas	Clover or peas	Wheat	Beans
8	Grass	Grass	Grass	Grass	Grass	Oats or beans	Oats or barley	Clover or peas	Wheat	Wheat	Beans	Grass-ley
9	Grass	Grass	Grass	Grass	Oats or beans	Green fallow	Clover or peas	Wheat	Beans	Beans	Grass-ley	Grass
10	Grass	Grass	Grass	Oats or beans	Green fallow	Oats or barley	Clover or peas	Wheat	Beans	Grass-ley.	Grass	Grass
11	Grass	Grass	Oats or beans	Green fallow	Oats or barley	Clover or peas	Wheat	Beans	Grass-ley	Grass	Grass	Grass
12	Grass	Oats or beans	Green fallow	Oats or barley	Clover or peas	Wheat	Beans	Grass-ley	Grass	Grass	Grass	Grass

Annual distribution of Crops:

	A.	R.	P.
Each year there will be of white corn -	30	0	0
Beans - - - - -	10	0	0
Clover or pease -	10	0	0
Green fallow - -	10	0	0
Grass - - - - -	60	0	0
	120	0	0

On a farm, extent 200 acres, under the convertible system of husbandry, the ground continued three years only in tillage, and then laid to grass for one, two, or more years.

Distribution of Crops:

In states of grass - -	110	acres.
Under fallow crops - - -	30	
In grain crops - - -	60	
	200	

The annual distribution of which may be in this way:

In the state of old sward - - -	20	acres.
Under artificial grasses, as clover, saintfoin, lucern, &c. - - - -	10	
In the state of irrigation or preserved grass	5	
Under different fallow crops - - -	30	
Under wheat and barley, in succession to the fallow crops - - - -	30	
First year's crops of different grasses -	25	
Second ditto - - - - - - -	25	
Third ditto - - - - - - -	25	
In oat and other grain crops after breaking up the grass - - - -	30	
	200	

It is obvious, however, that these proportions must vary according to circumstances, as the facility or difficulty of procuring manure, and the number of live stock that is to be supported.

ROUGHINGS, a term sometimes applied to latter-grass, or aftermath, and sometimes to coarse pastures.

ROUP, the name of a disease in poultry, consisting of a boil or swelling upon the rump, and which is known by the staring, or turning back of the feathers.

The roup if not soon remedied, affects the whole body of the fowl; to prevent which the feathers should be plucked away, the swelling laid open, and the matter pressed out; after which the part should be washed with brine, or salt and water.

ROWEL, in *Farriery*, a kind of issue made in horses for the cure of various disorders, as inward strains, hard swellings, &c.

It is supposed by Mr. Clark of Edinburgh, that in horses they "answer the same purpose as issues in the

human body. The method of introducing them, is he says, by making an incision through the skin, about three-eighths of an inch long, and then separating the skin from the flesh with the finger, or with a blunt horn, all round the orifice, as far as the finger will easily reach, then introducing a piece of leather, very thin, shaped round, about the size of a crown-piece, having a large round hole in the middle of it. Previous to introducing the leather, it should be covered with lint or tow, and dipped in some digestive ointment; a pledget of tow, dipped in the same ointment, should likewise be put in the orifice, in order to keep off the external air. The parts around it soon swell, and this is followed with a plentiful discharge from the orifice, of yellowish serum or lymph; and in two or three days at most there discharges a thick gross white matter: the rowel is then said to suppurate." As they act by revulsion or derivation, "they become, he thinks, of great use in many cases, as they empty the surrounding vessels by a regular slow discharge of their contents, and are even of great service when there is a redundancy or fulness of humours in general, which may require a gradual discharge, in preference to greater evacuations by purging medicines, &c. Rowels should, he says, be placed (especially in some particular cases) as near the affected part as possible; and, at all times, they ought to have a depending orifice, in order to admit of a free discharge of the matter that may be contained in them." But "the parts in which they may be most conveniently inserted, and where they are found to answer the purpose best, are the belly, inside of the thighs, the breast, and outside of the shoulders and hips. They are sometimes, but very injudiciously, he thinks, put in between the jaw bones under the root of the tongue, where they never come to a proper suppuration, on account of the constant motion of the parts in eating, &c. neither do they answer any good purpose from being placed in that situation. In some disorders it is found necessary to put in several of them at once, in order to make a sudden determination from the parts affected; but this should be regulated by the horse's age and strength, and by the circumstances that require their use." It is further remarked by the same writer that "though rowels are found very beneficial in some cases, yet, like a number of other operations common to horses, they sometimes, by the improper use of them, become hurtful to the constitution, and, in some diseases, they frequently, instead of suppurating, become gangrenous. Hence, the cure proves worse than the disease they were intended to remove. Thus, says he, in violent fevers, where they are frequently very injudiciously applied, they never suppurate properly."

On the whole, this is however, considered as an operation of great use "in carrying off rheums, or defluxions from the eyes; in extensive swellings of the glands, &c. about the throat and jaws, which threaten a suffocation; or when the head seems particularly affected, as in the vertigo or staggers, apoplexy, &c.; in recent lameness; swellings of the legs and heels, attended with a discharge of thin ichorous matter, &c.; in large and sudden swellings in any part of the body; or when extravasations of the fluids have taken place, from blows, bruises, &c.; or when a horse has had a severe fall, &c. and in a variety of other cases." As in cases where there is a swelling of the parts without suppuration, the want of a kindly discharge probably arises from the degree of inflammation in the part having advanced beyond the suppurative point, as seems evident from the benefit which almost invariably results from withdrawing the rowel, and employing the common means of abating inflammation; the use of stimulent applications should be avoided.

ROW-*Culture*, that in which the crops are sown in rows or drills and afterwards cultivated according to that system. See *Drill husbandry*.

ROUEN, a term made use of to signify after-grass and winter-grass. It is sometimes written Rowet. See *After-grass*.

ROWEN TREE, a term improperly applied to the mountain ash.

ROWET. See *Rouen*.

ROWETY-*Wool*, a term applied to the young wool of some sorts of sheep, which rises below the old fleece.

ROWT, a term signifying to low as cattle.

ROWTY, a term signifying overrank or too strong.

RUBBERS, a disease in sheep. See *Scab*.

RUBBING-*Post*, a post set up for the purpose of cattle, hogs, or other animals, rubbing themselves upon. Mr. Marshall, in his Rural Economy of Norfolk, says, "it is an excellent custom of the Norfolk farmer to erect *rubbing-posts* in the different parts of the inclosure he is feeding or teathing; they keep the stock from the fences, and furnish them, no doubt, with an agreeable, and perhaps a salutary, amusement.

"Some, he says, he saw draw the crown of a tree, with the lower part of the boughs left on, into the middle of the close: this is less trouble than putting down a post, is easily rolled out of the way of the plough, and seems to be still more agreeable to the cattle." They are useful in hogsties.

RUBEFACIENTS, in *Farriery*, such epispastics and other stimulent applications which excite heat with a degree of inflammation without vesiccation, are thus denominated.

RUBEOLA, in *Farriery*, a term applied to a cutaneous disease, called the measles, to which hogs are subject.

RUBICAN *colour*, in *Horsemanship*, is a bay, sorrel, or black, with a light grey or white upon the flanks, but so that this grey or white is not predominant there.

RUCK, a provincial term, signifying a rude heap or bundle of any thing.

RUD, a term provincially signifying a sort of red ochre. See *Ruddle*.

RUDDLE, a sort of red earthy ochre, or ironstone, of a lax texture, and very easily reduced to powder. It is found in several parts of England, especially in Derbyshire; and is used in marking sheep. See *Raddle*.

RUDSTAKES, a provincial term applied to the stakes to which cattle are tied in the stall.

RULES *for buying horses*. See *Buying Horses*.

RUMINANT, a term generally applied to all those animals which chew the cud. See *Cud.*

It is remarked by Mr. Feron, that "the retrograde motion of the œsophagus in ruminating cattle, such as cows, sheep, goats, &c. renders them capable of bringing up the softened grass from their first stomach. But when these animals fill themselves too full of clover, or of wet grass, or of some other young vegetables, which are liable to run into fermentation, the stomach becomes distended with air, and death frequently ensues." See *Hoven.*

RUNCHES, a term applied to charlock when dry and withered.

RUNNEL, a term used to signify pollard wood.

RUNNET, the acid juice found in the stomachs of calves, that have fed on nothing but milk, and are killed before the digestion is perfect. It also signifies a liquor made by steeping the stomach of a calf in hot water. The latter is the runnet used in making cheese, &c. See *Rennet.*

RUNNEL a term signifying a sort of rill.

RUNNING, a provincial term signifying rennet or the coagulum made use of in cheese making.

RUNNING *Bull*, a term applied to the part of a harrow where the draught is attached in some cases. See *Harrow.*

RUNNING-*Thrush*, in *Farriery*, an inflammation of the sensible frog in a horse's foot. It is sometimes written *Frush. See Thrush.*

RUN *Out*, a provincial term applied to land that is exhausted. It also signifies to *sprout* as corn in a wet harvest; and likewise to *scour* as in the cases of cattle.

RUNRIG, an ancient inconvenient distribution of common field land by which small portions or ridges of land were let to different individuals in a mixed manner.

RUNSH, a term provincially applied to the troublesome weed, wild mustard or charlock.

RUNT, a name given to a small kind of black cattle brought from Wales and Scotland.

It is also a term applied to several species of pigeons: as the Leghorn, Spanish, and Friesland runt, &c. See *Pigeon.*

RUPTURE, in *Farriery*, a preternatural protrusion of the gut, caul, or some other internal parts through the interstices left between the tendinous expansion of the abdominal muscles, for the passage of the blood vessels, nerves, &c. or through some other part. It may be observed that by violent efforts or other accidents, the guts or caul may be forced between the muscles of the belly at the navel, or through the rings of the muscles into the scrotum or cod. The swellings are generally about the size of a man's fist, sometimes much larger, descending to the very hock: they are frequently soft, and yield to the pressure of the hand, so as to return into the cavity of the belly.

It is remarked by Gibson that "when any part of the gut or caul makes its way through the muscles of the lower belly, it is called a rupture; when any part of the guts falls into the scrotum, it is said to be a complete rupture; when at the navel, it is called an umbilical rupture. He once saw, he says, a fine Spanish stone horse with a complete rupture; the swelling was so extremely large, that the gut extended the scrotum down to his hock, which rendered the cure in a great measure impracticable." But this, he thinks, is a case that can seldom happen, from the position of the horse's body. He has also "seen a gelding, where probably some part of the gut or peritoneum had made its way through the vaginal passage, into the membranous parts of the sheath on the right side; for the omentum or caul seldom reaches so low in a horse, his continual horizontal motion throwing it for the most part forward in wrinkles. The swelling was about the size of a goose's egg, a great part of which might be thrust back with the finger into the cavity of the lower belly, but immediately returned in the manner of a flatulent tumour; and perhaps there might be some portion of air along with it. The cure was never attempted, because it was little or no hindrance to the horse in his business, the swelling being generally fuller when he stood still than when he worked. It is however added, that "the most usual ruptures are more upwards, and proceed from strains in working, or from being staked, or gored by bullocks, violent kicks from other horses, very high leaps over gates and hedges; all which things sometimes divide the muscles of the lower belly, and oft-times without piercing or rending the skin, whereby a portion of the intestines, with a part of the peritoneum, and when the wound happens to be forward, part of the caul may also be lodged where these muscles are separated or divided, and so cause a swelling of a proportion and size equal to the rent made in the part." It is likewise added that there are "instances of umbilical ruptures, that have been caused by rowels in the belly, when they have been cut too deep, and perhaps afterwards neglected. It is a very great defect, and few horses with such infirmities can be long useful. But those ruptures, which push out on the sides of the lower belly, where the tunica vaginnalis passes through the rings of the muscles, with the spermatic vessels, into the scrotum; are the most usual "and in geldings they seldom reach further than the first ring, which is a little way above the groin, but when they happen on the sides of the flanks, they are then for the most part owing to such accidents as have been above-mentioned. They generally bunch out about the size of a man's fist, and are fullest when the horse stands still in the stable, especially after feeding and watering, and in broken-winded horses they rise and fall with the agitation of the flanks; they are soft, and yield to the pressure of the hand, and in most of them one may feel the vacuity through which the viscera make their way immediately to the skin. But as there is no absolute cure to be expected in such cases, the safest way is to feed moderately, and in small quantities with small draughts of water, and to use such horses gently. In all beginning ruptures, a fomentation made of oak bark, boiled in equal parts of the sharpest vinegar, and smith's forge water, have been used by farriers for a general application; for in horses, bandages and trusses of any kind are for the most part impracticable."

Where these sorts of diseases are present, except in the second kind, the horse is seldom of much

value, as he is constantly liable to be injured by much exertion. Bartlet advises that on their first appearance, endeavours should be made to return them by the hand; but if the swelling should be hard and painful, in order to relieve the stricture, and relax the parts through which the gut or caul has passed, let a large quantity of blood be immediately taken away, and the part fomented twice or thrice a day, applying over it a poultice made with oatmeal, oil and vinegar, which should be continued till the swelling grows soft and easier, or the gut is returned. In the mean time it would be proper to throw up emollient oily clysters twice a day, and to let the horse's chief diet be boiled barley, scaled malt, or bran.

Should the swelling afterwards return, we apprehend the restringent applications usually recommended on these occasions, will avail little, without a suspensory bandage; so that an ingenious mechanic in that art is chiefly to be relied on, for any future assistance; though it has been observed, that with moderate feeding and gentle exercise, some horses have continued to be very useful under this complaint.

RURAL *Economy*, a term comprehending the improvement of the landed property of a county, whether in the cultivation, or the state of roads, rivers, embankments, &c.

RUSH, a term signifying a tuft, cluster, or knot of plants of the corn or grass kind.

RUSH, the name of a well-known aquatic plant, common in wet lands. These plants always intimate a deepish rich soil, and they thrive most in land that is too wet and cold for most other plants.

It has been observed that plants of the rush kind may be easily removed by preventing the stagnation of moisture near the surface by judicious under or surface draining, and the application of substances of the saline or calcareous kinds, as ashes, lime, drift from the roads and other similar materials, these are best made use of in a dry season in either the autumn or spring, but the latter is probably the best, as these absorbent materials will thereby be made use of at the time such plants begin to shoot and establish themselves, and when there will be the least danger of their operation being lessened or prevented by too great a degree of moisture. It has been stated by Mr. Kent, that in naturally coarse meadows or such as become so in consequence of rushes growing upon them before they have been rendered sufficiently dry by draining, it forms a great improvement to apply a thin coat of sand evenly over the surface of them in the proportion of from twenty to thirty common loads. By this means the sward is rendered much finer, and a much better sort of herbage brought up, white clover being predominant in most cases. And there is still another method that in particular situations may be more easy and convenient, and which has been found to quickly destroy plants of this coarse kind by bringing up those of a finer description. It is a mode that may at first seem singular to those who have not seen its sudden and astonishing effects. It is that of conducting water over the surface of such ground, but in this intention it should not be suffered to have the least degree of stagnation but be conveyed off with as much expedition as possible, by suitable drains being made. Frequent cutting over while in their young growth has also been found useful in destroying them.

RUSHES, a term provincially applied to the wire rush.

RUSSELLED, a term signifying withered or shrivelled as an apple.

RUST, a distemper incident to corn, and generally called mildew. See *Mildew*.

It also signifies the rusting or oxidation of metallic surfaces by which they are often greatly injured. In order to prevent the rust in these cases it has been proposed to mix highly rectified spirits of turpentine with fat oil varnish in the proportion of nearly one half, laying it on with a sponge and keeping it in a place free from dust till dry. All sorts of agricultural tools should be prevented as much as possible from rusting.

RUSTBURN, a term provincially used to signify the troublesome weed rest harrow.

RUTA BAGA, a plant of the turnip kind, which has lately been introduced into field culture with great benefit to the farmer, as affording a supply of green food for the support and fattening of sheep or other live stock, between the common turnip and grass seasons.

This root has been considered by some as a mere variety of the yellow turnip, but it is found to differ very materially from it both in texture and other properties. With respect to the top or stem it has something of the appearance of the rape or cabbage kind, and the bottom or that part of the root bulb which is above the surface of the ground is covered by a thick, green tough cuticle or skin which in some is smooth but in others quite rough, and the internal fleshy part is of a dense close firm consistence having a yellowish tinge nearly similar to that of the horn carrot. It has indeed been suspected by some that there are two varieties of this valuable plant, the one having a *white* and the other a *yellow* root, the latter being considered as much the best; but this seems to have arisen from their having been grown from seed collected in the neighbourhood of plants of the turnip or cole kinds, as is fully shewn in the Surveys of the North Riding of Yorkshire and Nottinghamshire.

The great inducements for the farmer to enter freely into the culture of this root are, according to Mr. Young, "1. If he has the right stock of seed, the root yellow in flesh and rough in coat, it lasts through all frosts, and may be depended on for sheep quite through the month of April, though drawn two months before, and spread on a grass field. 2. It is an excellent and nourishing food for sheep, and also for any sort of cattle. 3. It is equal to potatoes, in keeping *stock* swine; a point of very great consequence. 4. It is, next to carrots, the very best food that can be given to horses. 5. It is sown at a season which leaves ample time in case of a failure, to put in common turnips, or cabbages."

In regard to the soils most proper for this root, those of the good rich loamy kinds are perhaps the best; but it may be grown to advantage on many of those that are too moist and heavy for the common

turnip; where the land has been brought into a tolerably perfect state of pulverization and mellowness, and been well enriched with manure before the seed was put into the ground or the plants set out upon it, as it has been perhaps from the want of this full preparation of the land and the putting in the seed of a bad kind and at too late a period, that cultivators of this useful root have been so frequently disappointed in obtaining good crops.

In regard to the seed it should always be collected from such plants as have been transplanted, and which are the most perfect of their kind, as where this is not the case the cultivator can never be certain of having his plants of the proper sort.

It has indeed been observed by the writer of the East Lothian Report on Agriculture, that "as no dependance can be placed on the seed purchased in the shops, every farmer ought to raise seed for himself; this may, says he, be done with very little trouble, and at no expense; it is only necessary that the seed plants be carefully placed by themselves, and not allowed to be near other plants bearing flowers or seed, while they are in the same state. The danger seems, says he, to result from plants of kinds nearly related to each other, mixing the *farina* of their flowers, when growing to seed. The *ruta baga* seems, he thinks, much liable to some adulteration of this kind, and unless farmers guard against it, by taking the trouble to preserve their own seed, they need hardly expect it genuine."

The quantity or proportion of seed that is made use of where the broadcast method is employed is generally about two pounds to the acre, but where the drill plan is pursued a somewhat smaller proportion may be sufficient, however as it is mostly found difficult to produce a sufficient plant of this crop, it may be advisable never to be too sparing in the article of seed. In all cases new seed is to be constantly preferred, and when the season is hot and dry it may be of utility to have it prepared by steeping a short time before sowing it.

In respect to the time of sowing, as this plant is much slower in its vegetation than that of the common turnip, it ought to be sown or put into the ground at an earlier period, by which circumstance it will not only be more forwarded for the hoe, and more fully fixed or established in the soil, but better protected from the attacks of the fly and the heats of the ensuing summer months. It has been the too common practice of farmers to sow this crop at the same time with that of the common turnip, by which the crops have often failed. But if put in a month or six weeks sooner it will be found more advantageous, as from about the latter end of April to the middle of May, or perhaps a little later in the northern districts, as is shown by the agricultural surveys of these counties. In different places different methods are practised in raising these kinds of crops, sometimes instead of sowing the seed over the land in either the broadcast or drill manner, it is sown upon nursery beds of good rich earth, and after the plants are sufficiently advanced, as where they are about the size of small cabbage plants, they are transplanted into the field and set out on raised drills at the distance of eight or nine inches or more from each other and a foot or more in the rows. The business of transplanting should, if possible, be performed when the weather is in a moist state. And this may perhaps be the best mode of executing the work where such crops are cultivated only to a small extent, but where they are grown upon a more extensive scale the former are probably to be preferred as being more expeditious and convenient as well as more certain of affording a sufficient plant for a full crop.

But from the danger of these crops being destroyed by the ravages of the fly; it has been suggested by Mr. Young that "the best culture of this plant is to sow it where it is to remain, broad-cast, from the 10th of May to the end of the month; and of all others, the best preparation to secure a crop, is that of paring and burning; for the fly being the grand enemy, from its coming so very slowly to the hoe, this operation not only proves by far the best preservative against that enemy, but also pushes the plants on in an accelerated vegetation, and thereby doubly secures the crop. If the seed cannot be thus prepared the next best management is, to sow it after common turnips fed on the land by sheep. If neither method suits, it must be put on well pulverized soil, very amply manured.

On the well cultivated farm of the Earl of Mansfield near Hampstead Middlesex under the management of his judicious bailiff Mr. Middlemiss, the method of culture and expences attending it are these.

Expenses of Cultivation on an acre.	£.	s.	d.
3 Ploughings, at 10*s.* -	1	10	0
3 Harrowings, at 5*s.* -	0	15	0
Cleaning by hand-picking, -	0	10	0
Making up drills, -	0	5	0
Dung and labour in putting it in half only allowed to this crop.	2	10	0
Covering it up in drills -	0	5	0
Seed 2lb. -	0	7	6
Drilling in ditto. -	0	1	0
Horse-hoeing twice -	0	1	8
Hand hoeing twice -	0	12	0
Moulding up rows, -	0	1	0
	6	18	2

In this mode the crop was very good being capable of being let in 1806 at £.12 per acre. The turnips averaging about five pounds each and a large portion rising as high as twelve. The crop was put in upon land that had previously born winter tares.

Under this management the intelligent cultivator has no doubt of raising still larger crops.

In the after-culture of this plant, it is obvious from its advancing more slowly to the hoe, that it must require greater attention to keep it clean and free from weeds than that of the common turnip. The business of hoeing both in the horse and hand methods must therefore be diligently practised, repeating the operations as often as may be sufficient for the purpose, keeping the mould constantly well broken down and applied to the roots of the plants.

The plants of the Swedish turnip, are liable to be

affected by the same causes as those of the common turnip, the fly, especially, being equally if not more prejudicial to these crops than those of the common turnip kind. And besides they are apt to be greatly injured or destroyed by rabbits, hares, and different sorts of birds, both in their tops and roots.

There is much difference in the statements, in regard to the amount of the produce in this sort of crop, but when it is put in at a sufficiently early period, and the ground prepared and managed in the manner that has been stated above, it will probably in general equal if not surpass that of the common turnip. But when it is considered that the flesh of the roots is much more solid, and compact, and abounds more with nutritious matter, the *real* quantity of food which they afford, must probably be much greater.

In the trials of the above cultivator they were found to go one-third further in the fattening of cattle or other animals, than the common turnip. And the Rev. Mr. Close in the ninth volume of the Bath Papers, has recorded an experiment in the transplanted method upon ridges of the same dimensions as those used for the common turnip, that the produce was found after they had sustained the frosts, in the month of March, without either tops or tails, and when perfectly free from dirt to be thirty-two tons on the acre, Mr. Daiken has stated in the Nottinghamshire Report, their advantage in the feeding of horses for a few acres, to have been as high as thirty pounds the acre.

In the experiments of others as detailed in the Agricultural Report of the North Riding of Yorkshire, they have likewise been found in common heavier than those of common turnips, though in appearance from the closeness of their texture, they did not seem to equal them. This is, however, only conjecture, and is quite at variance with what has been the result in other cases where actual weighing and measuring has been had recourse to. In the ordinary cultivation and application of these crops, the quantity of produce on the acre must however be rated considerably lower, as well as their value as food for live stock.

This sort of crop has been found of vast use in the support of sheep and other sorts of live stock, in the more late winter, and early vernal months, where the common turnip is liable to become rotten or run up to seed: as being much more easily preserved in a sound condition, from its greater power of resisting the effects of the season even when taken up as well as while in the ground. In some situations in very severe seasons it is however, sometimes a little injured, when left in the ground through the winter: Mr. Close has however found that by having the tops and tails removed when they first begin to shoot and being stacked, they may be kept till the latter end of May, and later probably if necessary; but which can rarely be the case. In this manner an useful supply of cattle food is provided, for that difficult and harassing period when turnips or other similar sorts get scarce, exhausted, or unfit for being employed, and when the grass is not in a state to be made use of.

It is of course of admirable advantage for the farmer to be well provided with crops of this kind, to the full extent of his live stock, in bringing them through the difficult months of March, April, and the early part of May.

Its application has been to almost all sorts of domestic animals; with neat cattle both in fattening and as an ordinary article of food, it has long been in use, it is said, with much greater effect than the common turnip. It is given after being cut or chopped into small pieces: when given to milch cows, it is found to increase the milk considerably, and render it more rich, as well as to give it a finer colour; but we are afraid it in some measure affects the flavour though some have denied it.

Sheep succeed well upon it, gaining much more while upon it than on the common turnip, but it has been objected to in this application from its hardness being supposed to injure their teeth, when the root is well grown, this is we believe from experience, to be only imaginary.

In the North Riding of Yorkshire, in the store feeding of hogs, it has been found equal to potatoes.

And as a food for labouring horses, it is said to be highly beneficial, as rendering a smaller proportion of oats requisite, not being of so loosening a quality as most other roots. In this application the roots after being washed and having their tails cut off, are put as below, and cut or chopped into large pieces by some sort of sharp tool acting in a high sort of tub or box for the purpose. In some of the northern districts it is given both in its raw state, or boiled and mixed with barley dust or broken corn.

As the roots are liable to be greatly injured by exposure after being cut, for this use as well as that of fattening cattle, not more than are necessary for the daily consumption should be prepared at a time.

After this account of the culture and uses of these turnips, it may be beneficial to state the facts respecting them, as they are found in those districts where they are become an article of almost general growth.

In Hertfordshire according to the survey of that district by the Secretary to the Board, "they have so rapidly made their way, as to be found in the usual management of great numbers of the common farmers; no trivial proof, the writer says, of their observation, knowledge, and good sense." He adds that "Mr. Byde has this year (1804) 25 acres of them; a very regular plant, promising a great produce. He finds that sheep will not touch the common turnip, if they can get at these; but they are apt to break their teeth, from the greater hardness and solidity of the root. He finds that they do not taint the milk of cows, like the common turnip; and are an useful food for horses. He sows them from the 13th of May to the 20th of June. When sown very early, as in May they are so difficult to keep clean, that he prefers June. Mr. Byde reaps better crops of barley after them than after common turnips." And "Mr. Greg, at Westmill, has 25 acres; he has cultivated this crop

for some years, and generally on a large scale. He manures for them with yard-muck, or pulverized rape-cake, from 6 to 20 bushels an acre, according to the soil, usually with about 12, and sows the seed early in May. He states them, from his experience, to be much better than common turnips; as they never rot, let the weather be as severe as it may, nor are they stringy, when consumed late in the spring. He informs him that the barley after them is not so good as after other turnips eat earlier, but much better when those turnips are consumed as late as the Swedish; that they do not cost more in cultivation, yet are of double the value. The farmers sow them very generally, so that few are to be found who sow none. Mr. Whittington, at Broadwater, is a considerable cultivator of this plant. He prefers them to common turnips, and could he have more time for preparation, would substitute them for the greatest part of that crop. He sows soon after the first week in May: for value in feeding, time of consumption, duration, &c. he knows nothing equally valuable. The Rev. Mr. Keate, at Hatfield, is also considerable in this cultivation, and with much success: he has had crops of them for five years. His crop this year amounts to five acres, which he viewed with great pleasure—a fine regular plant, very luxuriant, equally set out, and quite clean. They were well manured with yard-dung, and the land ploughed four times. He sows in the middle of June: they had been hoed at the expense of 7s. per acre: part of the field had yielded a crop of winter tares. They have usually come to a large size on Mr. Keate's farm. He has fed horses with them, entirely to his satisfaction; and cuts the roots with a very simple, effective turnip-slicer; each horse had a bushel every day, with chaff, but no oats; they did their work very well, but in spring-sowing had a few oats added; they throve well, and became fat while they were eating this turnip. Cows also do well on it; nor does it give their milk or butter any taste, but increases their milk considerably. They are excellent also for fattening sheep. The culture is become very general through the country; so that there are few farmers in it who are without a field of this excellent plant." He likewise says that "the Marchioness of Salisbury has many acres in great perfection, and finds them of incomparable use. But Mr. Stephenson remarks, that their most important use is so late in the spring, that it is difficult to introduce them in a regular course, and sow spring corn in time: he thinks them rather applicable to a few fields out of a regular rotation for sowing some other crop than barley or oats after them; such, for instance, as winter tares. He may add, buck-wheat also. Cows do very well on Swedish turnips without hay, and give much milk; and these roots last longer for sheep in consumption than an equal quantity of common turnips, but the sheep do not thrive equally. Mr. Deerman, of Astwich, is a great friend to them; but observes, that they throw the land out of course, as they are most useful so late in the season, that spring corn cannot be sown after them, he thinks, the best way is to sow common turnips for the next crop, by which means also the land would be brought into remarkably high order. Mr. Marsh, his neighbour, makes the same observation, but has, however, always sown spring-corn after them."

It is further stated that "Mr. Clarke, of Sandridgbury, has cultivated them eight or nine years with great success; generally 20 to 25 acres. He sows the last week in May, and finds no difficulty with the succeeding crop, which is always barley, and as good as any, and often the best on his farm. He has eat them so late as the 6th of May. Mr. Cotton, at Hempstead, cultivates, and has the highest opinion of them; and has only one objection to them—their slow growth, which retards their hoeing. His corn grown after them is good. Mr. Pickford, at Market-street, has 30 acres this year, a beautifully regular crop. He has from experience a great opinion of them, when applied to the fatting of oxen and sheep, and to the feeding of hogs; in which last application he thinks them superior to potatoes. He saw above 500 hogs on his farm. On finding these roots so profitable, he grew no more potatoes." But Mr. Chapman, of Hitchin, is of opinion that this root demands a richer and stronger soil than the chalks and loams about Hitchin; for they have been cultivated some years, dunged for, and twice hoed, but the success has not been great. The farmers entertain a high opinion of them." And Mr. Hale, of King's Walden, has cultivated them four years; he sows them the latter end of May broad-cast; hoes them twice always, picks charlock by hand, and uses all for sheep and lambs; they have been very valuable indeed. In the spring, 1800, he could have sold the crop, eight acres, at 10l. per acre. In the beginning of March, common turnips being over, 200 sheep, and 200 lambs, and 140 other sheep, were kept on them near seven weeks. The same field was to have been sown with barley, and ploughed twice, but being late, was sown with Swedish turnips again, and the crop, without manure, except two cart-loads of pigeon's dung, was in every respect as good as the other. This year the land was ploughed once, and sown with white oats, and the crop was equal to full eight quarters per acre. Last year he had fifteen acres, and this year eleven, of this root. Mr. Roberts, the steward, who has a farm himself, has nine acres this year, and intends never to be without them; being perfectly convinced that they are a most useful crop." The writer has not seen many finer crops than Mr. Hale's, and all the parts of a full yellow colour. Lord Clarendon has five or six acres every year, and finds them of capital use. His Lordship sows in May, on land upon which, in autumn, the dung was ploughed in, as he thinks it very essential for this crop; he stirs the land in April, and ploughs it in May for sowing: he sows three pounds per acre: they are hand-hoed twice; he first uses them in the beginning of March: he did not eat them last year until the 24th April, and had a large barley crop after them. They run very much to top, more than common turnips; and if his Lordship had none, he would buy them for the spring at a much greater price than common. He feeds first with ewes and lambs, and then store-sheep follow and eat clean.

Good barley always grows after them. He has only gravels to sow them on. Mr. Parker, at Munden, has also cultivated them four years: he has twenty acres this year, and had sixteen last year; and as many the year before. The yellow fleshed turnip is much the best. He sows in May, hand-hoes twice, and has always very good crops. He feeds them on the land with sheep; and draws them for horses, for which stock they are very useful: he uses them also for beast of all sorts; they are of prodigious utility in point of duration, and excellent, late in the spring, for straw-fed beasts. He grows as good spring-corn after them as after common turnips; but manures for them rather higher than for other sorts. They are best on loamy land; do well on good gravel; but, on very sharp gravel, they should not be sown. His twenty-acred field this year, for such an extent, is the finest crop that the writer ever saw, the Earl of Winchilsea's at Burley, alone excepted; yet this crop is from the second sowing in June. Mr. Calvert, at Albury, has had them four years; has now seven or eight acres: he sows them at the end of May; and finds that there is not any thing so good for every animal for which he has tried them. He once gave a few to some fatting wethers that were at common turnips, and after eating them, they would not take again to the common turnips without much starving. He has had Swedish turnips and common turnips on each side of them in the same field, and sheep turned into the field would not touch the common turnip, but seized on the Swedish immediately. The yellow fleshed is much superior to the white; and the rough coated to the smooth skins. His present plan is, to assign two fields, well situated for the cattle and sheep, and to have one every year under Swedish, and the other in common turnips, to follow each other, by which means no inconvenience will result from not getting the Swedish off in time for barley. But Mr. Hill, of Whittle; thinks they injure the land; by late keeping and running to seed. However Mr. Foster, of Royston, has a high opinion of them; and obsreves that they are peculiarly valuable in a chalk district, where turnips *must* be fed very early, or the barley crop lost; Swedish then come in when most wanted."

The able writer concludes on these statements that the plant "where the soil is not sufficiently rich may probably give way; but as to the more common objection of some, that barley cannot follow, not to speak of the success with which so many others sow that grain, it may be observed that the right system, where the objection has really some foundation, is hinted at in the preceding notes: common turnips, winter tares, or buck-wheat, may properly succeed; and this double fallow can scarcely fail of answering in the uncommon degree of cleanness, which must be the consequence. Another plan is, to draw such as would remain too late, and strew them on grass for cattle or sheep." The objection, is therefore, in any case, easily remedied, he thinks.

And in the Survey of Norfolk, Mr. Walker of Harpley has cultivated them for some years with great success, generally has from 20 to 30 acres; feeds them off with sheep and bullocks, and can depend on them when common turnips are all rotten. This crop in 1800 notwithstanding the draught was very fine. And Mr. Coke of Holthham, has 30 acres this year, has cultivated them several years with the greatest success and esteems them as a very valuable acquisition.

"Mr. Syble of South Walsham, had last year a crop of these roots which came to a good size, but they were so hard that no stock which he tried liked them.

"Mr. H. Blythe of Burnham, had a field of them last year and found them of great use in the spring; this year he has ten acres."

Upon the whole as the objections to this root on the score of its being difficult to take up, and of its hurtful and inconvenient effects in remaining upon the land to so late a period, seem not well founded or capable of being readily obviated, there can be no doubt but that it must be found of great advantage on most farms where much live stock is kept, as a food to succeed that of the common turnip late in the spring when scarcely any other sorts are to be had in plenty.

RYE, a species of corn much cultivated in some of the northern districts. It is a sort of crop that approaches the nearest to that of wheat of any that is at present in cultivation. There are two varieties of this grain the *winter* and *spring rye* or what is often distinguished into the *black* and *white* or Dantzic sort, but the former is the largest and the most plump and hardy, consequently the most frequently grown by the farmer, however the spring kind may often be employed with success and advantage. This kind of grain is so capable of sustaining the effects of the weather, that when sown in the autumn it is seldom injured by the most severe winters; it is likewise more early in the spring than wheat, and though not equally valuable is more certain of producing a good crop in general than that grain is.

This sort of crop is capable of being grown on most kinds of land, but the light dry sandy soils that cannot be converted to the purpose of wheat or barley, are probably the only ones on which it can be cultivated to advantage, from being the most adapted to it, and from few of them being so light or poor as not to afford good crops.

It can of course only be introduced with success on such lands, as are incapable of producing other sorts of corn to advantage. And from fowls being less fond of it, than most other sorts of grain, it may be the most proper to be cultivated on those portions of ground that are situated close around the farm houses and yards.

This crop is mostly grown after early fed turnips, clover, peas, and other similar products as well as after naked fallows.

In particular cases, when grown on the cold and heavy kinds of soil the grain is found to be much later in becoming ripe than on such as are dry and light.

This sort of crop, as in that of wheat) requires the land to be brought into a tolerable state of mellowness, and to be perfectly cleared from weeds. In many districts where intended to stand for a crop, it is the custom to put it in upon some sort of fallow, but where it is only to be fed off by sheep seldom more than one ploughing is given, the land being broken up and fallowed for turnips, immediately after the green rye has been sufficiently eaten down by sheep or other animals. And it is the practice in some places to apply manure immediately for this crop; but where the soil is in a suitable state of tillage, and has not previously been too much exhausted by the growth of grain crops, it may be more proper especially where it is not to be fed off, to defer the application of the manure, in order that it may be employed for the turnip or other green crop, that is to succeed it, the use of manure being apt to bring up weeds and render it difficult to be kept clean.

In respect to the times of sowing this sort of grain it is in general pretty much the same as those for wheat where a crop is intended, but when cultivated for green food for animals, it may be advantageous to sow it more early, as in August and September, but it may be sown in October and during the winter months until the beginning of March in particular cases, as where the early sowings have failed or there is an intention of having a succession of this feed for sheep. In which cases, according to Mr. Bannister, it is usually sown on one ploughing on a wheat or other stubble where the field is to come in course for turnips the following year.

And the above writer says that the general allowance of seed where the crop is designed to remain for grain, is in most situations from about two bushels to two and an half; but when the intention is to feed it off, three or even more may be a better proportion, as the plants in such cases should stand considerably thicker upon the ground, in order that the largest possible quantity of green food may be provided for the animals. And as the vegetation of this sort of crop is rather slow, it may be proper to put it into the ground when it is in a tolerably dry condition, otherwise much of it may perish, especially in wet seasons, and where the land is rather heavy.

It is stated in the Report of Yorkshire, that it was formerly a prevailing custom to blend several other sorts of seed with that of rye, and the practice still continues in some districts, in respect to wheat and winter tares, but it is by no means either adviseable or useful in Mr. Donaldson's opinion, since in the first case, the rye is in a state fit for reaping long before the wheat, consequently much loss must be sustained by the farmer, and in the latter it is mostly in a state to be cut as green food, some weeks before the tares, and becomes ripe at much too early a period for them.

In cases where wheat is blended with rye, it is often termed meslin the proportion of the latter to that of the former being regulated by the nature of the soil, and the opinion of the grower, the general principle being that of giving the largest proportion of rye to the lightest kinds of ground.

In those cases where this crop is grown for the purpose of the grain, it will be necessary to keep it as clean as possible in the early stages of its growth by horse and hand weedings, and hoeings according as it is sown, when they may appear requisite; but where the intention is merely that of affording a supply of green food, for the use of sheep or other animals in the more early spring months, no further culture will be wanted after the crop has been put into the ground. This sort of crop is known to be ready to cut by the straw of the stems becoming of a yellowish colour, the ears hanging down in a bending manner, and the grain feeling hard and in a plump and full condition.

In the poor sandy soils of Suffolk good crops of this sort are seldom produced, and on those of a better quality the produce is rarely more than from two to three quarters, on the acre. But in the North Riding of Yorkshire, it is stated by the able author of the Agricultural Report of that district, to amount to from three to six quarters to the acre of land.

In cases where this sort of grain is free from weeds and cut when the weather is fine, it may be secured in the stack as fast as the reaping proceeds without its being indangered by it.

The straw of this sort of grain is found to be superior to that of wheat, for the purpose of thatch as well as for the use of the collar makers who require much of it.

It is sometimes also the practice of farmers where rye is intended to stand for a crop, to feed it with sheep in the early spring, as in the beginning of March, but this should never be done except where the crop is very luxuriant and at so early a period as that there may not be any danger of destroying the new formed ear of the grain.

This kind of crop is also cultivated in particular cases, as where the ground is sufficiently light and dry to be turned down as a manure; where this is the case the crop should always be turned in while in its most green and succulent state, and when the weather is moderately dry, in order that it may be more quickly reduced by putrefaction into a manure.

And in the more southern districts it is not unfrequently grown for the purposes of the tanners who have recourse to it in the preparation of leather.

The most usual application of this crop is as a green food for sheep in the early spring before the turnip crops are ready. When grown in this view it is necessary, the author of Practical Agriculture says, to "have attention to different circumstances in order to derive the utmost advantage from the crops. As this grain begins to shoot out or spindle as it is termed by farmers, much earlier than wheat, care should be taken that the feeding of it down is begun at a sufficiently early period before the ear is formed in the *hose*, as the latter end of February or beginning of March, otherwise the stem or blade becomes firm and sticky, and the succession of green feed after the first eating extremely small. Indeed this may be done

earlier than the first of these periods, in cases where the season is mild and open, and persevered in till the end of April. In all cases it is however advisable, he thinks, to let the crop be so advanced in its growth as to cover the ground tolerably before the sheep are turned in. As this sort of green food is said to have much effect in promoting the flow of milk in such ewes as have lambs, probably from its succulency and its stimulant properties being applied immediately after the severity of the winter season, when the bodies of animals are known to be more capable of being excited by the action of stimuli, and when there is scarcely any other sort of green feed that can lessen its operation by being taken along with it, the culture of it must be the most advantageous, he supposes, where sheep husbandry is extensively combined with that of tillage, especially that department of it which relates to the feeding of lambs. As by this means from the quantity of succulent nutritious food that is provided, the lambs are prevented from being stinted in their growth while young, which is a matter of the utmost importance in their future feeding." And he adds that in thus feeding the "crop off by sheep it will constantly be necessary to keep the fields properly divided by means of hurdles, as in this way the loss of food will be much less, and some parts will become fresh while the others are eating down," which are advantages not to be disregarded in such cases.

Mr. Bannister however thinks, that "notwithstanding what has been urged in favour of a rye pasture, it is scarcely worth the while of any farmer to attempt the cultivation of this grain, who does not keep large numbers of ewes and lambs, for as the seed usually fetches a high price, every advantage attending the crop will be more than balanced by the superior charges in the cultivation, except in the instance above mentioned, where no expense should be spared to maintain the lambs in a thriving way and to prevent their growing hard and sticky as the butchers term it, for if lambs once sink in flesh, it is beyond the art of man to restore them to their former thriving state."

This grain is much used in the distilleries in districts where it can be procured in large quantity, and also by the gingerbread bakers.

Mr. Marshall, in his Rural Economy of Yorkshire, observes, that "before the use of lime was prevalent, much rye was grown on the lighter lands upon the margin of the vale, and in the Moor-lands scarcely any other crops than rye and oats were attempted. Now, rye is principally confined to the Moor-land-dales; and even there the alteration of soils by lime has been such that wheat is become the more prevalent crop.

Nevertheless, on light sandy Moor-land soils rye is generally more profitable than wheat; and the bread which is made from a mixture of the two grains is here esteemed more wholesome to persons in general, than that which is made from wheat alone."

RYE-GRASS. See *Ray-Grass*.

RYELAND *Sheep*, a breed of fine-woolled sheep, originally met with in the greatest perfection in a district of Herefordshire, termed the Ryelands. See *Sheep*.

S

SABULOUS, in *Farriery*, a term applied to that gritty or sandy matter which often washes away by the kidneys, and settles in the urine.

SACCHARINE, a term applied to such substances as contain sugar. The matters in which this substance is abundant are in general highly nutritious and useful in the fattening of animals. See *Sugar*.

SACCHARINE-*Matter*, the sweet substance found in many sorts of plants and fruits; and which is obtained from the sugar cane, for different economical purposes. It is a material that is found to afford much nourishment to different sorts of live-stock, in its state of combination in various kinds of vegetable productions, as those plants that contain it in a large proportion, are mostly found highly beneficial in that application, as is exemplified in the carrot, parsnip, beet, and many plants of the grass kind. How far the process of fattening animals may depend upon this property has not yet been shown by any satisfactory experiments, but it would seem to be in some measure connected with it.

There is a saccharine process taking place in the germination or sprouting of seeds, by which saccharine matter is elaborated, and evolved, probably, for the support of the young plant until it has established itself firmly in the soil by means of its roots. In the well known operation of malting there is also a considerable evolution of saccharine matter, which probably serves to give the liquor a body as well as strength, and by that means renders it more nutritious. In many other cases the formation of saccharine matter is likewise equally evident. It also exists in large proportions in the sap juice of many vegetables.

SADDLE, a kind of stuffed seat, fixed on the back of the horse, for the convenience and security of the rider, There are different sorts of saddles in use, but which are well known. According to Mr. John Lawrence, "the English saddle has been highly improved within the last twenty or thirty years; not only in respect to symmetry, fitness and beauty, but of ease both to the rider and the horse. But nothing has contributed so much in the modern saddle, to the ease and convenience of the rider, as the forward projection of the pads, where the knees rest, and the situation of the skirts, or flaps, above and below the knee. It is true, the knees are apt to be galled in a long journey, by the stirrup-leathers, which are now placed without the long flap; but they may be occasionally drawn beneath it. The saddle is secured by two girths only, and those placed exactly one over the other, appearing as if single."

SADDLE-*backed*, in *Horsemanship*, a name given to a horse that has a hollow back, which is hard to fit with a saddle, his reins being low, and his head and neck raised, so as to require a saddle to be made on purpose.

SADDLE-GALLED, in *Farriery*, a bruise produced by means of the saddle. When a horse's back is hurt or fretted in this way it may be cured by bathing the part with urine, or a saturnine wash.

SAFFRON, a plant which according to Martyn has a roundish bulbous root, as large as a small nutmeg, which is a little compressed at the bottom, and is covered with a coarse brown netted skin; from the bottom of this bulb are sent out many long fibres, which strike pretty deep into the ground, and from the upper part of the root come out the flowers, which together with the young leaves whose tops just appear are closely wrapped about by a thin spatha or sheath, which parts within the ground, and opens on one side. The tube of the flower is very long, arising immediately from the bulb without any foot stalk, and at the top is divided into six ovate obtuse segments, which are equal, of a purple-blue colour. In the bottom of the tube is situated a roundish germ,

half the length of the petal crowned, with three oblong golden stigmas, which spread as under each way, and which when carefully picked and pressed together into cakes constitute the saffron of the shops. It is a perennial plant which flowers in October, and the leaves keep growing all the winter, but it never produces any seeds in this climate.

This is a plant that was formerly much cultivated for the above purpose, but at present it is, we believe, but little attended to by the farmer, though it is probably still grown in small quantities in Cambridgeshire, to which district it has removed from Saffron Walden in Essex, where it was perhaps first cultivated. It was however grown at an early period in Herefordshire.

It is remarked by the editor of Miller's Dictionary that in the first of these counties the quantity of land under saffron has been gradually lessening during the last twenty or twenty-five years, owing, as it is thought, at first, to the lowness of the price occasioned by the great importation of foreign saffron. It is now confined to two or three parishes only, of which Stapleford is one, and if some means are not used to encourage it, the cultivation of saffron will probably soon be entirely lost in this country. But whether saffron be of any national consequence he is not a competent judge, he only knows that when the culture is entirely dropped it will be no easy matter to revive it. Formerly the superiority of English saffron was much celebrated, but lately it has been depreciated. This is not owing to our commodity being inferior to what it was, for it has at all times come out of the hands of the growers pure and genuine, but perhaps the foreign dealers are not wise enough to leave off their old sophistications with bastard saffron, or saf flower, marygolds, &c. and if so their commodity coming from a warmer climate may have the superiority; he only knows that if the foreign saffron can be afforded cheaper it will be encouraged without attending to its quality, and that he has very lately experienced a very sensible difference between the foreign and English saffron greatly to the advantage of the latter.

The manner of growing it in the extensive tract of ground between Saffron-Walden and Cambridge, is this, according to Sir James Douglas.

The greatest part of this tract is an open level country, with few inclosures; and in which the custom is, as in most other places, to crop two years and let the land lie fallow the third. It is always planted upon fallow ground; and, all other things being the same, they prefer that which has borne barley the year before. The grounds for this use are seldom above three acres, or less than one; and in choosing them the principal thing which is had regard to is, that they be well exposed, the soil not poor, nor a very stiff clay, but good dry mould, such as commonly lies upon chalk, and is of an hazel colour; though if every thing else answers, the colour of the mould is not of much consequence.

However Bradley in his Treatise on Husbandry and gardening says, that he has found it succeed well in land of the common heath kind, where the surface had been pared and burnt, and that by his direction some acres had been planted with success on such sort of ground, which was scarcely worth one shilling the acre. The ashes in these cases he considers as a sufficient manure. But this sort of soil does not seem to have fully answered in the culture of the saffron plant, as no mention is made of it afterwards.

About the beginning of April the land is carefully ploughed, the furrows being drawn much closer together, and deeper, if the soil will allow it, than is done for any kind of corn; and, accordingly, the charge is greater. And about five weeks afterwards, at any time in the month of May, between twenty and thirty loads of dung are laid upon each acre; and, having spread it with great care, it is ploughed in as before; the shortest rotten dung is the best; and the farmers, who have the conveniency of making it, spare no pains to make it good, being sure of a proportionable price for it. About Midsummer a third ploughing is given, and between every sixteen feet and a half or pole in breadth, a broad furrow or trench is left, which serves both as a boundary to the several parcels, where there are several proprietors to one inclosure, and to throw the weeds in at the proper season.

The fencing in of the grounds is likewise necessary, and is most commonly, though not always, done before planting. The fences consist of what is termed dead hedges, or hurdles so as to keep out not only cattle of all sorts, but especially hares which would otherwise feed on the saffron leaves during the winter.

In respect to the weather the hottest summers are always the best: and where there are gentle showers from time to time, there can hardly miss being a plentiful crop, where the extreme cold, snow, or rain of the preceding winter have not prejudiced the heads or bulbs of the plants.

The next business in this sort of culture is planting or setting the roots: the only instrument used for which is a narrow spade, commonly termed a spit-shovel.

In respect to the time of planting it is commonly in July, a little sooner or later, according as the weather answers. The method is this: one man with his spit-shovel raises between three and four inches of earth, and throws it before him about six or more inches: two persons, generally women, following with heads or bulbs, place them in the farthest edge of the treuch, which he makes at about three inches distance from each other, as soon as the digger or spitter has gone once the breadth of the ridge he begins at the other side, and digging, as before, covers the roots last set, and makes the same room for the setters to place a new row, at the same distance from the first as they are from one another: thus they proceed till a whole ridge is planted; and the only nicety in digging is, to leave some part of the first stratum of earth untouched, to lie under the roots, and, in setting, to place the roots directly upon their bottoms.

With regard to the roots formerly, when they were very dear, they did not plant them so thick as they do now, and that they have always some regard to the

size of the roots, placing the large ones at a greater distance than the smaller ones.

The quantity of roots planted in an acre is generally about sixteen quarters, or one hundred and twenty-eight bushels; which, according to the distances left between them, as before assigned, and supposing all to be an inch in diameter one with another, ought to amount to three hundred and ninety-two thousand and forty in number.

From the time that the roots are planted, till about the beginning of September, or sometimes later, there is no more labour about them; but as they then begin to spire, and are ready to show themselves above ground, which is known by digging a few out of the earth, the ground must be carefully pared with a sharp hoe, and the weeds, &c. raked into the furrows, otherwise they would hinder the growth of the plants. In a little time afterwards the saffron flowers appear.

These flowers are gathered both before and after they are full blown; and the most proper time for this is early in the morning. The owners of the saffron get together a sufficient number of hands, who place themselves in different parts of the field, pull off the whole flowers, and throw handful by handful into a basket, and so continue till all the flowers are gathered, which is commonly about ten or eleven o'clock. Having then carried home all they have got, they immediately spread them upon a large table, and begin picking out the filaments or chives, and together with them a pretty long proportion of the style itself, or string to which they are joined; the rest of the flower they throw away as useless. The next morning they return into the field again, whether it be wet or dry weather; and so on daily, even on Sundays, till the whole crop be gathered. The stigmas or chives being all thus picked out of the flowers, the next labour is to dry them on a kiln, which is built upon a thick plank, that it may be removed from place to place, supported by four short legs; the outside having eight pieces of wood about three inches thick, in form of a quadrangular frame, about twelve inches square at the bottom of the inside, and twenty-two inches at top; which is likewise equal to the perpendicular height of it. On the foreside is left a hole about eight inches square and four inches above the plank, through which the fire is put in. Over all the rest laths are laid pretty thick, close to one another, and nailed to the frame already mentioned: and then plastered over on both sides, as also the planks at bottom very thick, to serve for an hearth. Over the mouth or widest part goes an hair-cloth, fixed to the sides of the kiln; and likewise to two rollers or moveable pieces of wood, which are turned by wedges or screws, in order to stretch the cloth. Instead of the hair-cloth, many people use a net work, or iron wire, with which it is observed that the saffron dries sooner and with a less quantity of fuel: but the difficulty in preserving the saffron from burning makes the hair-cloth be preferred by the nicest judges in drying.

The kiln is placed in a light part of the house; and the work is begun by laying five or six sheets of white paper on the hair cloth, upon which is spread the wet saffron between two and three inches thick: this is covered with other sheets of paper, and over these they lay a coarse blanket five or six times doubled; or instead of it a canvas pillow filled with straw; and, after the fire has been lighted for some time, the whole is covered with a board, having a large weight upon it.

At first a pretty strong heat is given to make the chives sweat, as their expression is; and in this if they do not use a great deal of care, they are in danger of scorching, and consequently of spoiling all that is on the kiln.

When it has been thus dried about an hour, they take off the board, blanket, and upper papers, and take the saffron off from that which lies next it; raising at the same time the edges of the cake with a knife: then, laying on the paper again, they slide in another board between the hair-cloth and under papers, and turn both papers and saffron upside down, afterward covering them as before.

The same heat is continued for an hour longer; then the cake is examined again, freeing it from the papers, and turning it: then covered and the weight laid on as before. If nothing happens amiss during these first two hours the danger is said to be over; as there is nothing more to do but to keep a gentle fire, and to turn the cakes every half hour, till thoroughly dry: for the doing which properly full twenty-four hours are necessary.

In drying the layers of plump chives nothing more is used; but towards the latter end of the crop, when these come to be smaller, the cake is sprinkled with a little small beer, to make it sweat as it ought: and it is now supposed that using two linen cloths next the cake, instead of the two innermost papers, is of some advantage in drying: but this practice is followed only by few.

The fire may be made of any kind of fuel: but that which smokes the least is best; and charcoal for that reason is preferred to any other.

In respect to the quantity of saffron a first crop will produce, it is very uncertain; sometimes five or six pounds of wet chives are got from one crop; sometimes not above one or two, and sometimes not enough to make it worth while to gather and dry it. But it is always to be observed, that about five pounds of wet saffron go to make one pound of dry, for the first three weeks of the crop; and six pounds during the last week; and now when the heads are planted very thick, two pounds of dried saffron may at a medium be allowed to an acre for the first crop, and twenty-four pounds for the two remaining; the third being considerably larger than the second.

In order to obtain these, there is only a repetition to be made every year of the labour of hoeing, gathering, picking, and drying, in the same manner as before, without the addition of any thing new; except that the cattle are let into the field, after the leaves are decayed, to feed upon the weeds: or they are perhaps mown for the same use.

About the Midsummer after the third crop is gathered, the roots must all be taken up and transplanted. To take up the saffron heads, or break up the ground, as the term is, they sometimes plough it, sometimes use a forked kind of hoe, called a pattock, and then the ground is harrowed once or twice over; during all which time of ploughing or digging, and harrowing, fifteen or more people will find work enough to follow and gather the heads, as they are turned up.

They are next to be carried to the house in sacks, and there cleaned and raised: this labour consists in cleaning the roots thoroughly from the earth, and from the remains of old roots, old involucra, and excrescences; and thus they become fit to be planted in new ground immediately, or to be kept for some time without danger of spoiling. The quantity of roots taken up, in proportion to those which were planted, is uncertain; but, at a medium, it may be said, that, allowing for all the accidents which happen to them in the ground, and in breaking up, from each acre, may be had twenty-four quarters of clean roots, all fit to be planted. The owners are sure to choose for their own use the largest, plumpest, and most fleshy roots; but approve least of all the long-pointed ones, which they call spickets, or spickards, for very small round or flat roots are sometimes observed to flower. This is the whole culture which is requisite. With respect to the charges and profits which may be expected from this sort of culture the following was the computation for one acre of ground, before the late rises in the price of labour and the value of land; which is of course much below what the present expenses would be:

	£.	s.	d.
Rent for three years -	3	0	0
Ploughing for three years -	0	18	0
Dunging - - -	3	12	0
Hedging - - -	1	16	0
Spitting and setting the heads -	1	12	0
Weeding or paring the ground -	1	4	0
Gathering and picking the flowers -	6	10	0
Drying the flowers - -	1	6	0
Instruments of labour for three years, with the kiln, about - -	0	10	0
Ploughing the ground once, and harrowing twice - - -	0	12	0
Gathering the saffron heads -	1	0	0
Raising the heads - -	1	12	0
Total charge £.	23	12	0

This calculation is made upon the supposition that an acre of ground yields twenty-six pounds of net saffron in three years; which is stated only as a mean quantity between the greatest and the least; and therefore the price of saffron must be judged accordingly, which cannot be done better than by fixing it at thirty shillings per pound; since, in plentiful years, it is sold at twenty, and is sometimes worth three or four pounds: at this rate, twenty-six pounds of saffron are worth thirty-nine pounds: and the net profit of an acre of ground, producing saffron, will, in three years, amount to fifteen pounds thirteen shillings, or about five pounds four shillings yearly. And this, it is supposed, may be considered the net profit of an acre of saffron where all the labour is paid for in ready money; but as the planter often does much of the work some of the expenses may be saved. He may of course expect to clear five pounds, besides supporting his family part of the year.

But such calculations must be liable to great inaccuracy. Nothing is said concerning the charges in buying, or profits in selling the saffron heads; as in large tracts of ground these must, it is supposed, at length balance each other, while the quantity of ground planted yearly continues the same.

Common Meadow SAFFRON, a plant of the poison-weed kind (*Colchicum autumnale*,) which has a bulbous root about the size and shape of the tulip, but not so sharp, pointed at the top, the skin or cover is also of a darker colour, these bulbs are renewed every year, for those which produce the flowers decay, and new roots are formed above. The flowers come out in autumn, they arise with long slender tubes from the root about four inches high shaped like those of saffron, but larger; the number of flowers is generally from two to seven or eight; in March the green leaves appear, these are commonly four to a full grown root, they are folded over each other below, but spread open above the ground, standing crosswise; they are of a deep green, and when fully grown are five or six inches long, and one and a half broad. The seed vessel comes out from between the leaves in April, and the seeds ripen in May, soon after which the leaves decay.

The seeds lie buried all winter within the bulb but in spring they grow up on a fruit stalk and are ripe about the time of hay harvest.

According to Mr. Carpenter, in his Treatise on Agriculture, it is most frequently found in spongy lands inclined to moisture, and is a very pernicious and deadly plant, scarcely noticed by the farmers in general, but it is well known by others to prove fatal both to cattle, deer and fawns, when eaten by them in its different states; and is more especially poisonous in a *withering state*, like the branches of box or yew universally known to destroy almost every species of the brute creation. And as prevention is preferable to cure, he advises and entreats every farmer totally to extirpate it from his premises, by drawing the roots and branches in the same way as docks, observing to destroy them immediately, as by first chopping, bruising and then burying them very deep under ground or burning, them, that cattle may not devour a particle of so destructive a plant. He asserts that two grains of this root is certain and speedy death to any human being.

However, according to Dr. Woodville, in his Medical Botany, no cattle eat it. He says that he had a pasture where there were several horses and which was eaten down pretty bare, the grass was closely cropped, even under the leaves, but not a leaf of the Meadow Saffron was bitten.

There are several varieties of this plant.

It is added by Mr. Carpenter that the symptoms of the effects of the malady caused by cattle eating this

plant are generally, difficulty in breathing and in discharging urine, which is very high coloured, the body costive, and excrements hard and knotty, with dimness of sight and a general loss of the limbs. When the beast offers to stand he staggers, and then tumbles, and dies with a great swelling all over the body, which on opening the lungs are apparently distended, and in a state of mortification. The most preferable means to be used to effect a cure in these cases are, he thinks, by honey and other operating remedies, where the disorder is taken in time.

He strongly advises noblemen, gentlemen, and farmers, strictly to observe the above directions, as many cattle, deer, and fawns, may be preserved from an unexpected death by it, the real cause of which is almost unknown, and consequently unaccounted for, by those concerned in endeavouring to administer remedies to these most profitable, useful, and innocent animals.

SAGE-CHEESE, that sort of cheese which is made by the mean of an infusion of sage, so as to render it of different colours.—See *Cheese* and *Dairying*.

SAIM, a term provincially applied to hogs-lard.

SAINFOIN, a species of plant of the artificial grass kind frequently made use of for the food of cattle, either fresh or when dried; it is sometimes called holy-hay, or wholesome hay, from its excellent nutritive quality. It rises in the stem from one to two feet in height, and has tufts of red flowers of three, four, or five inches in length.

It is a kind of plant which though it has been less attended to than that of clover is not by any means less beneficial to the farmer. It is in fact, with the great advantage of being more durable, on the poorer, thinner, and more light sorts of soil, especially where of a calcareous nature, what the clover is upon those of the more strong, deep, and heavy descriptions. And in addition to these advantages it possesses those of being equally suited to the use of pasturage, as that of being made into hay, while in the former application it is asserted not to have the injurious quality of *hoving* the animals that feed upon it, as is frequently the case with the red or broad clover. Besides its lasting or abiding quality on soils of the poor thin infertile sorts, in elevated, exposed situations where other grass herbage can scarcely at all or with very great difficulty be provided, renders it of vast utility in furnishing food for different sorts of live stock, but particularly that of sheep.

The value of this plant is indeed so great that in some parts of the island the farmers could not pay their rents, if it were not for the growth of it. It is supposed by Mr. Young that upon soils proper for this grass no farmer can sow too much of it, as no other application of the land will pay him nearly so well. It is contended that on poor soils not worth more than from 2*s*. 6*d*. to 5*s*. the acre, a ton and a half, and even two tons and a half of hay, or a ton at least, may be afforded at one mowing, besides a considerable after grass. And that the use of hay is become now so general that such products can never want a market. Such management on such lands must consequently always render them beneficial to their cultivators. It is added that the products and profit of such land in tillage or sheep husbandry are very inconsiderable to what they afford under the culture of this plant.

In districts where natural meadows and pastures are scarce, the culture of this plant is also an object of great importance to the farmer in the view of hay, and should of course be more particularly attended to.

This plant will make a much greater increase in poor ground than any other of the natural grasses and which is owing to its having a long perpendicular root of the tap-kind, which sinks to a great depth to attract its nourishment. The length of the root is very considerable, in many cases extending to several feet.

It has been a general opinion among farmers, that this plant never succeeds well in any land where there is not an under stratum of stone, or chalk, or some other hard material, to stop its running down, as otherwise it is apt to spend itself in root, and come to nothing. This is however an evident error, as the more and the larger the roots planted are, the more nourishment they receive and the better they thrive.

It is found that this plant always succeeds best where its roots run deep, and that the best crops of all are produced upon lands where there is no hard under-soil to obstruct their passage. An under-soil of clay may however kill the plants, by retaining the moisture, and thereby chilling or rotting their roots.

The long root of this plant has also near the surface, many horizontal roots issuing from it, which extend themselves every way; and there are others of the same kind sent off all the way down, as the root descends but they grow shorter and shorter as it passes.

It has been proved that any dry sort of soil may be made to produce this valuable and useful plant, though it be ever so poor, but still that the richest and best land will produce the best crops of it. But Mr. Kent thinks that the soils most suited to the culture of this sort of grass are those of the chalky loam, and light sandy or gravelly kinds, or almost any of those of a mixed quality, provided they be not too wet, and have a rocky or hard calcareous bottom to check the roots at the depth of a foot or fifteen inches below the surface, which he, notwithstanding the above, conceives necessary, as the plants are apt to exhaust themselves in running down. And for this reason he considers it as improper for being sown where there is great depth of mould or soil. It is a plant that is asserted by Mr. Marshall to afford a large produce even on those soils which are of the poorest quality, and that on such as are of a more rich and friable nature it frequently produces abundant crops. Still, he conceives, that it is only in the calcareous soils, as the dry chalk and limestone, or such as have been well impregnated with that sort of matter that it succeeds in a perfect manner or becomes durable.

With respect to the tillage or preparation of the ground which is requisite, it cannot be made too clean or too fine before the seed is sown, of course it generally succeeds best after turnips or other similar crops, which require a fine clean culture while they are growing. It often, however answers well on lands that have not undergone so high a degree of preparation especially where they are quite free from the roots

and seeds of weeds, as these are the points to be chiefly regarded in this culture.

It has, however, been much too general a notion that this plant is only capable of being grown to advantage on soils of the limestone or chalky kinds, as by this means many extensive tracts are excluded from its culture in different parts, in which it might be found highly useful to the farmer. That it will succeed in lands where it has not been thought proper, is certain from various trials, though experiments are still wanting to show to what extent its culture may be admitted in different sorts of land with success and advantage.

In respect to the seed, it is the best practice for the cultivator to select it from the best and most abiding plants in his particular soil, as such as is purchased from the seed shops can rarely be depended upon. A certain method of knowing the goodness of the seed is, by sowing a number of the seeds, and seeing how many plants are produced by them. But the external signs of the seeds being good are, that the husk is of a bright colour, and the kernel plump, of a light grey or blue colour, and sometimes of a shining black. The seed may be good, though the husk be black, as that is owing sometimes to the letting it receive the wet in the field, and not to its being half rotted in the heap.

If the kernel be cut across, and appear greenish and fresh, it is a certain sign that it is good. But if it be of a yellowish-colour, and friable, and looks thin and pitted, they are bad signs. But others observe that the best seed is that which is plump, heavy, bright, and of a yellowish red colour, and that it should always be sown while quite fresh, as that which is old, or that has been long kept, never vegetates in a perfect manner. In purchasing seed of this sort it is in general from about three to five shillings the bushel.

In regard to the proper proportion or quantity of seed, it is obvious that it must be different according to the particular circumstances and nature of the soil, as well as the method of culture that is practised and the time of sowing.

In the broadcast method, which is that mostly employed, about four bushels are in general a sufficient proportion, though less is frequently given, but on such soils as are proper for this plant it is always necessary to have a full proportion of seed. By some however a much smaller quantity is made use of. And where the drill system is had recourse to a still smaller proportion is used, as from two to two and a half, or three bushels.

With respect to the season of sowing this sort of grass-seed, it may be observed that the earlier it can be put into the soil in the spring, the better, as from the greater moisture of such soils there will be a greater probability of their vegetating in a perfect manner. Where the sowing is executed at a late period, and dry weather succeeds, Mr. Bannister thinks that much of the seed would be prevented from growing, and the young plants be more exposed to the destruction of the fly, therefore, according to this writer "the sowing of sainfoin seed ought never to be deferred longer than the beginning of March, and that it is still better to complete this work in February."

Some, however, suppose it may be deferred to the middle of March without injury.

This is a sort of grass that may be sown either alone or with any of the spring-corn crops, but with barley after turnips is supposed the best method.

It may likewise be sown with buckwheat where the land is suitable, with success.

And some advise its being sown with about half the quantity of barley, which is usually sown for a full crop, as it may shade and keep it moist during the first summer, and at the same time not injure it, from the crop being lighter, which is sometimes the case. Where the barley is drilled the sainfoin may afterwards be put in, in the same manner but in a contrary direction. If sown over the wheat it should be harrowed in, and afterwards rolled. In whatever method it is sown, as the seeds are larger than those of many other grasses, they should be covered in with more care, and to a somewhat greater depth. By some the ploughing the seed in with a very thin or shallow furrow is recommended. In most cases, especially in all the more light sorts of land in which this sort of crop is grown, the use of the roller may be necessary immediately after the seed is put into the ground. It is the practice in some districts to sow a small portion of clover seed with this crop, with the idea of increasing the first year's produce; but as plants of different kinds seldom answer well when grown together, from there being a continual contest in their growth for an ascendancy, it is perhaps a better method to increase the proportion of the seed, without mixing it with that of other sorts. It is however, supposed by Mr. Marshall that such a practice is beneficial in ultimately procuring a fine clean crop of sainfoin upon the land.

It is a sort of crop that grows in so perfect a manner in the broadcast method, that there can seldom be any necessity for having recourse to the drill. It may however be cultivated in the latter mode with much success. And in Norfolk it is the practice with some cultivators to have it drilled at 9 inches across the barley crops which have been sown in the same way.

It has been observed, that in Lincolnshire where this plant is much grown, "the common allowance of seed is five bushels to an acre, and that a gentleman south of Lincoln advises the planting a small quantity of trefoil with it (about four pounds on an acre). The reason for which is, that in that exposed country, the young plants suffer more by the sun in summer, than by the frost in winter. Of course the trefoil, coming to perfection the first year, and living only three, will be a shelter for the young plants, during the first year or two, and die off when the sainfoin wants its room. This system is said to be well supported by practice: but rye-grass should on no account be sowed with it; that being, when left for fodder, a great impoverisher of ground."

It is added that "sainfoin is observed to get to perfection in three years, lasts good four or five, and then dwindles during four or five more. Its first crops are from one to two loads; its second stage from three to four loads, and it dwindles down again to one.—Last summer, which was remarkably dry, did very well with this grass.

"It has been sown with barley, with wheat, and without corn in the spring. It has likewise been drilled according to Mr. Tull's directions, in beds, with treble rows, and in equi-distant rows. The horse-hoed beds were good, as far as they went: the others, drilled at a foot distance, gave so much room for weeds to come up, that the success was very moderate; which indeed would have been the case with the former, had not the horse-hoe cleared them. On the whole, as far as the experience and observation of the writer reach, he would never choose to drill his seed, but to sow it in the broadcast-way, on land very fine, with a good quantity of seed."

According to the author of the Rural Economy of Gloucester, on the Cotswold Hills: where this plant is extensively grown, and where the calcareous rubble, which forms the sub-soil, is in some places two or three feet deep; and the rock, below, mostly open; "the roots have, he says, been traced, in stone quarters, to ten, some will say twenty feet. Here the sainfoin flourishes luxuriantly. But in other places the rock rises, in flat horizontal seams, too near the surface: there the sainfoin is weaker, and goes off sooner. It is said to have been cultivated upon these hills upwards of one hundred and fifty years." And in "the established practice, it is generally sown with barley after turnips."

The period of sowing it in this district is from the middle to the end of March. And the quantity of seed in proportion to the state of the land, where the soil is foul, a larger allowance is made than where the contrary is the case, but in general from one bushel to three is employed on the acre. The advocates for sainfoin, suppose a bushel is sufficient, provided the land be perfectly clean. And that the plants by being thin become stronger and more productive of herbage.

In the Agricultural Survey of the county of Norfolk, it is stated by Mr. Young that "Mr. Allen, at Stanhow, had very fine sainfoin on a rich loamy sand, on a clay marle bottom, worth 16*s.* an acre. The common crop was two tons per acre. And that in 1792, Mr. Bevan, at Riddlesworth, sowed two bushels an acre of sainfoin, and six pounds of clover and trefoil, to give a crop the first year. But that in "1802, it got full of rubbish, did not answer, and was ploughed up after four or five years. The method he intends to pursue is, it is said, to turnip his land for two years, both fed off with sheep, and to lay down with buck-wheat in June; sowing four bushels of sainfoin per acre: he did this some years ago, and it is now the best sainfoin on his farm. He has now 28 acres under the second crop of turnips, to be thus laid down." And he "has sown sainfoin with rye to good effect. Mr. Ward, of West Harling, has also done the same, and got fine crops." It is further stated, that "Mr. M. Hill sowed sainfoin on a deep gravel, and it gave, in the third year, one load and a half per acre; from the repeated failure of seeds he has been induced to lay down this spring 48 acres. The barley drilled first at six inches and then sainfoin at the same distance: three bushels an acre each, looks very promising. The writer adds that the Earl of Albemarle made an experiment with this plant. "Taking into his own hands an immense farm of 4000 acres, with 3000 sheep, and wishing to provide all sorts of food as early as possible, he ventured to sow a field in extremely bad order, with sainfoin alone in June: the foulness of the land such, that his lordship's hope was not sanguine. This was in 1801, and the crop this year, 1802, was among the very finest he had ever seen, at least two tons and a half per acre. The result is remarkable, and will, he thinks, certainly bring to the reader's mind the husbandry of sowing sainfoin among couch in Gloucestershire, mentioned by Mr. Marshall, in his Rural Economy of that district."

It is further remarked, that "at Holkham there is much gravel, in some places to the depth of above twelve feet, the surface a thin covering of sand; no chalk or marle beneath, at any known depth. The writer was solicitous to ascertain whether this soil would do for sainfoin; Mr. Coke assured him that it succeeded very well on it, but it is to be remembered, he says, that the whole country has been marled." He adds that "Mr. Overman and Mr. Coke drill sainfoin before drilling barley, in the contrary direction to that in which the barley is to be drilled, the rows at six inches and three quarters, seed three bushels an acre, and perfectly regular; much more so than the generality of broad-cast crops." And further that "Mr. Pitt's father and grand-father both tried sainfoin upon very deep and dry gravels; there are some pits 15 or 20 feet deep; but it did not answer. And Mr. H. Blythe, of Burnham, has a very fine plant three years old, from drilling, three bushels of seed per acre, at six inches three-quarter rows; it is common to sow from four to five. This field before produced little or nothing, and was over-run by rabbits and game. He gave a clean summer-fallow for drilled oats, and drilled the sainfoin across the oats."

And in the Hertfordshire Report on Agriculture by the same writer, it is observed, that "he has rarely seen finer sainfoin than some small pieces on Mr. Clarke's farm at Sandridgbury. The soil is a good flinty loam on a chalk bottom. He, Mr. Clarke, thinks the price of corn of late has been too high for this grass to answer on any good soil; but he has a neighbour, Mr. Thrale, another tenant of Lord Spencer's, who sows it on an extensive scale." He adds that "about the neighbourhood of Hitchin, they sow four bushels with oats on clean land. It lasts on white land ten years, but on gravel seven or eight years; and produces two loads an acre, while in vigour, and even more, but one and a half on an

average. The farmers give it to horses, and break it up with oats, sowing them always on one ploughing." And "Mr. Sedgwick considers this cultivation as the best for chalk hills. Four bushels of sainfoin are sown per acre with barley, after turnips. The grass lasts ten years, and produces sometimes from one quarter of a load to two loads per acre. He ashes it every second year. It is the best hay to sell or use. They rarely cut it for seed, but know it is beneficial to the crop. It will flourish well on the same land again in three, four, or five years." It is also stated "to succeed well at Munden, and especially on a soil of an adhesive nature, on chalk: they sow four bushels. This grass lasts seven or eight years, and sometimes longer; and produces two loads per acre." And "Mr. Russel, at Cheshunt, sowed sainfoin 40 years since on a strong gravel, and it answered well; and there are still some plants remaining. Mr. Calvert, at Albury, also knows some plants that are 50 years old."

In the after-management of this sort of grass much attention is necessary, as upon its being properly performed the success of the crops in a great measure depends. Two practices have been principally advised in its culture which are diametrically opposite to each other; the first of which is that of its being constantly cut for hay in the first year of its growth, and which is supported by a great number of the most experienced cultivators; while others contend that it is a much more beneficial method neither to have it cut or pastured in the autumn of the first season. On which the author of a late practical work suggests that "it is probable that both practices may be proper under different circumstances, as in the richer sorts of soils, where this plant mostly affords a tolerable crop when sown alone the first year, it may be mown with propriety and without much injury being done to the plants, but in those of the thinner and more poor kinds, where the crops are in general the first season but thin on the ground, and light, it may be advantageous to let them remain without being cut or fed down by stock, as in this way it may spread more, and form a better and more close sward in the following year." In such cases the seed, according to Mr. Young, will probably be worth five pounds the acre, while the straw is good horse-fodder, and the plants not at all injured at the time.

"By the plants in this case being suffered to seed, besides the advantage just mentioned, they will have acquired a great vigour of growth and the succeeding crop be greatly increased from the shedding of the seeds." But that "in all cases in the succeeding summers a crop of hay may be taken, and the after-grass be fed down with any sorts of stock but sheep, till towards December, care being taken that they do not eat it in too close a manner, as where that is the case, from the largeness of the roots, they may be in danger of injuring the crowns of the plants. In the following autumns there will however be less risk in this respect, and sheep as well as cattle stock may, he supposes, be turned in and kept upon the pastures till they are well eaten down, being always careful to shut them up as early as possible in the beginning of the year." This is the opinion of Mr. Kent. And it is supposed that "as this sort of herbage is considered to be improved in its taste by being nipped by the frost, it may be a proper practice not to turn upon these lays too early in the autumnal season. With this intention it may be advisable to defer it till the latter end of September, when this sort of rouen or after-grass will be found to have much effect in promoting the flow of milk in cows, as well as in forwarding the condition of fattening-beasts; great store of feed being still left for sheep. But with this sort of stock they should not be too closely fed down, or the sheep remain too long upon them, as much injury may be sustained by it. It has been suggested that all sorts of cattle stock should be removed by the beginning of the year from these rouens, as much harm might be done by their continuing longer. It is supposed by some cultivators of this plant that the application of manure upon sainfoin lays is of very great utility when put upon them in the latter end of the second autumn after they have been laid down. And that for this purpose peat-ashes are the best material that can be made use of where they can be procured in sufficient quantity. And other sorts of ashes are likewise found beneficial where these cannot be had. They should be applied so as to form a thin, even, regular dressing over the whole surface of the crop. In this view soot has also been found of great utility when spread evenly over such lays about the beginning of January, in the proportion of about twenty-five or thirty bushels to the statute acre. And malt-dust has been employed in the same way with great success and advantage, as shown by Mr. Bannister in his Synopsis of Husbandry. And it is supposed that where those sorts of top-dressings can be applied every third or fourth year, the sainfoin crops, when well established in the soils, may be preserved in a state of vigorous growth for ten or fifteen years, or more, and the land be considerably improved by the roots striking so deeply into it. The sainfoin plant usually attains its perfect growth about the third year of its growth, and begins to decline towards the eighth or tenth if not well assisted by manure in the manner which has been just stated. Some however suppose peat ashes to be hurtful in wearing out the sainfoin, as seen below.

In respect to the amount of crops of this kind, or the quantity of produce which is afforded, it must of course be liable to much variation, according to the nature of the soil, and the care that has been bestowed in the preparation and after-management; but on a medium of soils and cultivation it may probably be estimated at from about one and a half to two tons the acre. And on the poorer and thinner stapled sorts of land it will perhaps seldom afford less than from a ton to a ton and half on the acre.

In regard to the frequency of the cutting those sorts of crops it is probable that on the thinner sorts of soils it can seldom be done more than once, but on those of the deeper sorts two crops may some-

times be taken, in the same manner as with those of the clover kind, but care is always necessary in these cases, that the future growth of the plants be not injured by this means.

With respect to the application or use of this sort of crop it is various according to circumstances. In its green succulent state it is highly useful for all sorts of live stock, though some conceive that when given to milch cows the milk is not so well flavoured as when feeding on the natural grasses. It is found that when made into hay it is an extremely hearty and nutritious fodder for working horses and other sorts of domestic animals.

In some cases it is also a profitable application of this sort of grass to mow it while in its green state, before it comes into flower, for the purpose of soiling horses and other sorts of cattle in the stalls, in the manner that is practised with clover, lucerne, and some other succulent green crops.

But the most general application of it is in hay, which it affords of the best and most nutritious quality, both for horses and other sorts of cattle stock.

It is remarked by Mr. D. Hamel, that this sort of crop "may be mowed before it is in bloom, for it is then admirable food for horned cattle; and when cut thus early it yields a second crop, which makes ample amends for what was lost by not letting the first come to its full worth. This early cutting is likewise, he says, attended with another benefit, which is, that it purges cattle, in the beginning of the summer, and thereby free them from disorders occasioned by the winter's cold or dry food." But that if the weather be rainy, it may be left standing till it is in bloom; when it still is excellent fodder for cows. But care must be taken in making it into hay that the flowers do not drop off, as they are very apt to do: for cattle are so fond of these flowers that they often induce them to eat the rest of the plant. And that if the rain continue, the sainfoin may be left standing till some of its seeds are formed, and the crop will then be the more plentiful; not only because it will have attained its full growth, but likewise because its leaves, being more substantial diminish less in drying. It is not indeed then, he says, quite so sweet as before; but horses eat it readily, because they love to feel between their teeth the seeds, which now begin to be formed." He adds, that Mr. Tull says this fodder is so excellent that horses need no oats when they are fed with it. He affirms that he kept a team of horses with it a whole year in good plight, without giving them any oats, though they were worked hard all the time. He states that he fattened sheep with it in less time than others which were fed with corn. But that the hay of this plant can never be so good as when it is cultivated with the horse-hoe; for in the common husbandry it blossoms almost as soon as it is out of the ground. And if the season continues still rainy, it may be more advisable to let the sainfoin remain standing than to run the hazard of having it rot upon the ground: for then the seed will ripen, and nearly make up for the loss of the fodder, not only because it will fetch a good price, but also because two bushels of it will go as far in feeding of horses as three bushels of oats; and cattle in general, as well as poultry, are extremely fond of it.

It is further stated that the first of these sorts of sainfoin-hay, cut before the bloom, is Mr. Tull's virgin-hay, which, he says, is the best beyond comparison, and has not its equal, except lucerne. He gives the next place to the second sort, cut whilst in bloom, and says that an acre of land well cultivated, may yield three tons of this blossomed-hay: and he esteems the third sort, which he calls the full grown, many degrees inferior to either of the former, though it yields a greater crop, because it has grown to its full bulk, and shrinks but little in drying." It is supposed, "that even the sainfoin that has yielded its seed may be cut down and dried; and when other fodder is scarce, it will be better food for horses and large cattle, than the coarse hay of flowed meadows, or any kind of straw.

In regard to the method of bringing it into the state or condition of hay, it differs but little from that employed for clover and other similar crops. It is cut immediately on its coming into full blossom, and as it remains but a short time in this state, as much expedition as possible should be employed both in mowing and making the produce into hay. It is remarked by the author of the Synopsis of Husbandry, who resides in a district where the culture of this sort of grass is frequent, that of all other grasses, it requires the least pains in making; when the season is favourable, the hay-makers may follow the scythe, and having turned over the swarths, throw them into wind-rows the succeeding day after the grass is mown, when it may be immediately formed into cocks, and the whole crop be fit for carting in a week after it is mown; and though it may appear very green, and the stack when made take on or acquire a considerable degree of heat, there is no danger to be apprehended, provided the weather has been fair during the hay making; as it is so far from taking harm by heating in the stack that the contrary state is the most to be feared; and for this reason great care is necessary not to suffer the fodder to continue long either in the swarth or in grass-cocks, lest the sun and wind should dry it up too fast, and by exhaling its juices prevent the heating in the stack, and thereby render it of little value. In order to preserve its succulence, in some places they put a number of these grass-cocks together, so as to form large cocks of a size to contain a load in each, and finish the stacks out of the cocks.

And it is likewise a practice with many farmers, where the crop is slight, to turn the swarths, and then run them into cocks with a three pronged barley fork, following with a wooden dew-rake the head of which is of sufficient width to cover the ground occupied by three or four swarths, in this manner proceeding with the utmost dispatch, saving a deal of labour and expense" in the business.

Where this sort of crop is let stand for seed, it should remain on the land till the husks become of

a somewhat brownish colour, and the seeds are perfectly plump and firm, as by these means they will not only be better in their quality, but be in less danger of being injured in the field from the very short time that it will be necessary for them to remain, and also less in danger of being hurt by heating when laid up for future use.

It has been stated, that it requires some experience to know of what degree of ripeness it is best to cut the seeded sainfoin; because all its seed do not ripen at the same time. Some ears blossom before others; every ear begins blossoming at its lower part, and continues to blow gradually upwards for many days; so that before the flower is gone off at the top, the seeds are almost filled at the bottom. By this mean if the cutting be deferred till the top seeds are quite ripe, the lower, which are the best, would shed and be lost. The best time, therefore, to cut it is when the greatest part of the seed is well filled, the first blown ripe, and the last blown beginning to be full. The unripe seeds will ripen after cutting, and be, in all respects, as good as those that were ripe before. Some, for want of observing this, have suffered their sainfoin seed to stand till all of it has shed, and been lost in cutting. And that sainfoin should never be cut in the heat of the day, while the sun shines out; for then much, even of the unripe seed, will shed in mowing. The right time for this work is the morning or the evening, when the dew has rendered the plants supple. When the weather is fine and clear, the sainfoin will soon dry sufficiently in the swaths, without turning them; but if any rain has fallen, and there is a necessity for turning them, it should be done very gently, while they are moist, and not two swaths together, as in the other hay made of sainfoin before it has seeded. If the swaths are turned with the handle of the rake it is best to raise up the ear-sides first, and let the stub-side rest on the ground in turning, but if it is done with the teeth of the rake let the stub-side be lifted up, and the ears rested on the earth. If it be cocked at all, the sooner it is done the better; because if the swaths are dry much of the seed will be lost in separating them; the ears being entangled together. When moist, the seeds stick fast in the ear, but when dry, it drops out with the least touch or shaking.

It is, however, the best practice, as soon as the proper degree of maturity has been attained by the crop, that it should be mown in as short a time as it can possibly be made convenient, and remain exposed in the swath until the upper surface is fully dried, when it must be wholly turned over, but in a very careful manner, so as to prevent the seeds from shedding and being lost, as much as the nature of the work may admit of.

When this side has been rendered perfectly dry and crisp in the same way as the other, the crop should either be threshed out upon cloths in the field where it is grown, or laid up in stacks to be afterwards performed when the farmer has more leisure and convenience for the work.

But the work of threshing out the seeds in this kind of crop is much less troublesome and expensive than in that of the clover kind. In cases where threshing machines are in use, the business may be executed with great ease and facility in that mode. It has, however, been observed by a late writer, that "when the season is favourable the practice of threshing it out in the first way is probably the most beneficial, as the stems or haulm may be laid up for the purpose of fodder in the stack."

As the threshing in the field cannot be done but in very fine weather, and while the sun shines in the middle of the day; the best manner of performing it is to have a large sheet pegged down to the ground, for two men to thresh on with their flails, while two others bring them fresh supplies in a smaller sheet, and two more clear away the hay that has been threshed. The seed is emptied out of the larger sheet, and riddled through a large sieve, to separate it from the chaff and broken stalks; after which it is put into sacks, and carried into the barn to be winnowed. Care should be taken not to let the hay get wet, as in that case it would be spoiled.

It is a very important, but difficult matter, to keep the seed that has been threshed in the field, without becoming wet. If it be winnowed immediately, and only a little of it laid amidst a great heap, or put into a sack, it will ferment to such a degree, in a few days, that the greatest part of it will lose its vegetative quality. During that fermentation it will be very hot, and smell sour. Spreading it upon a barn floor, though but seven or eight inches thick, will answer no end, unless it be frequently and regularly turned, until the heating is over: but even this will not make its colour keep so bright as that which is well housed, well dried, and threshed in the winter. This last, laid up and unthreshed, will keep without any danger of spoiling, because it does not lie close enough to heat. The best way to preserve the seed threshed in the field is to lay a layer of straw upon a barn floor, and upon that a thin layer of seed, then another layer of straw, and another layer of seed, and so on alternately. By this means the seed mixing with the straw will be kept well, and come out in the spring with as green a colour as when it was put in.

In respect to the produce in seed, it is said to be usually "from about four to five coombs in some districts, but in others it will probably be much less, especially on the shallower sorts of sainfoin soils." But this must obviously be liable to great variation from season, &c.

There can be no doubt from the facts that have been given above, but that this is a crop of vast utility and benefit to the farmer, not only in providing an abundant supply of good fodder for the support of different sorts of live stock, but of good feed for the latter part of the autumnal season, in those soils that are well adapted to its cultivation and growth, as it has been seen to be capable of affording a very large produce even on those thin poor sorts of land, that under other circumstances yield only a very scanty produce either of herbage or hay. And in such as are of the better and more

fertile kinds, the quantity of crop is inconceivably abundant.

On these grounds it has been suggested by a practical writer, that "its culture should be extended to all those extensive tracts of lands in different parts of the kingdom, that afford little or nothing under other systems of husbandry or modes of cropping, and which are not adapted to the growth of clover. This, he thinks, is particularly desirable, as it is an artificial grass, that succeeds well in the ordinary methods of sowing, without the trouble or expense of either the drill or the hoe.

And Mr. Young, in the fourth volume of his Eastern Tour, observes that it seems extremely probable from different trials that have been made with this plant, that it is not by any means so confined in respect to soil as has been generally supposed, though there can be little doubt but that it answers best on those of the calcareous, dry, loamy kinds. But "on such as have had occasionally applications of lime, it has been known to succeed in a perfect manner" according to Mr. Marshall in his Rural Economy of the Southern Counties.

The most detrimental and unfavourable sorts of land for the culture and growth of this kind of grass are all those where there is much retention of moisture, or where it remains upon them in a stagnant wet or spongy state. In order to the healthy growth of this plant, a state of considerable dryness is essentially necessary in the soil.

The most material inconvenience to which this kind of crop is exposed is from the rising of coarse grasses and weeds of different kinds, as it is these that in a great measure limit the duration of the plants, and not that of their age; the advantage of a proper and clean preparation of the land previous to its being sown, is therefore sufficiently evident. Where, notwithstanding every precaution, such grasses come up so as to injure the sainfoin plants, Mr. Young says that harrowing has been had recourse to with a degree of success when performed to such an extent as to leave the surface of the ground in nearly the state as if it had been ploughed.

It has been remarked by the cultivators of this valuable plant in the Isle of Thanet, that where the crop takes, it is very advantageous to the farmer; yielding him for many years plenty of excellent fodder, upon land which would otherwise, perhaps, scarcely yield him any profit at all; and besides, when it begins to fail, if proper care be taken, the land when broken up will be found greatly refreshed, and in a better condition to bear tillage and a succession of other crops.

It is the practice with the farmers there, when they intend breaking up a sainfoin lay, to feed it the last three or four years: mowing it at this time, they think, hurts and exhausts the land too much.

"In 1784 Mr. Coke had 400 acres, an extent to which he carried this excellent grass in order to be able to feed off all his turnips by the end of March, avoiding thereby the common evil of permitting them to run up to blossom, for supporting the flock in April, by which the succeeding barley is always materially damaged, he found the object well answered. The hay was given in well contrived racks on wheels, in which both the hay, and the sheep's head, while feeding, are under cover from rain. A space sown with winter tares received the sheep in May if the layers were not ready for them."

The same excellent cultivator then made an experiment on this grass: "ten acres were sown with an addition of white clover, ten with trefoil, ten with red clover, and ten with sainfoin only. The result was, that the white clover division turned out the best, the sainfoin alone the next best, then trefoil, and the red clover much the worst."

But "some years after that period, he tried ray-grass, and approved of it much better than any other plant for this purpose, observing that it kept down the blubber-grass, so apt to come with sainfoin, but from the time of the drill husbandry being adopted he has left off all additions, the regularity of the crop being so great that all spaces are filled, and the cleanness of the land being trusted to against the blubber."

And "Sir M. Folkes has given much attention to sainfoin but not with success, he has prepared for it by two crops of turnips in succession, both fed on the land by sheep, yet twitch and blubber-grass overran the crop in a few years, and some in that case has been spoiled in three or four; he has been careful not to feed it with sheep, and he has harrowed it the third year severely cross and cross, and from corner to corner, yet without destroying the blubber. By reason of this circumstance the culture does not flourish at all; when broken up it is fallowed for wheat and the crop generally good."

In Hertfordshire "Mr. Doo, at Bygrave, finds sainfoin advantageous to mow for five or six years; he then feeds it with sheep three, four, or five years, till it has got a good turf for paring and burning.

In Norfolk "Mr. Overman, of Burnham, has broken up sainfoin layers, and suffered much losses by the red-worm, that he was fearful of sowing corn upon the last field he ploughed. He therefore ploughed it before winter, and summer-fallowed it without manure. After this he sowed barley which crop the writer viewed and found very fine, not having suffered the least attack. He remarked that the ploughing before winter probably contributed to the destruction of the worm, as well as the summer tillage.

"Mr. Overman broke up another field by thorough fallowing for turnips, the crop very good; he then sowed pease, the crop middling, turnips again bad; then barley which was much eaten by the red-worm. This followed by winter tares, now (1802) on the ground and a bad crop.

"Mr. Coke of Holkham pared and burnt a sainfoin lay, intending turnips, but changing his mind sowed wheat, and the red worm ate half of it. This shows that this operation is not in all cases effective against that destructive animal.

"Mr. Rishton, of Thornham, broke up a sainfoin ley 11 years old, by a bastard summer-fallow for oats; the wire-worm ate up the crop; he then laid on 10 loads an acre of dung, and sowed turnips, which came

to nothing (eaten also, the writer supposes, by the worm); then barley, and got 15 coombs an acre; then pease 10 coombs an acre; and this year (1802) a great crop of wheat.

"Mr. Bloomfield, at Harpley, broke up a sainfoin lay in 1802, by one ploughing, and got a fine tilth for wheat by much scarifying."

Mr. Parker, of Hertfordshire, "broke up a field of this grass by a summer-fallow, and sowed wheat, which the red-worm ate up; he then fallowed the land again, and sowed it with turnips. And he broke up another field for Swedish turnips, and had a fine crop, after which he sowed oats." It is stated as the opinion of the Rev. Mr. Dove, that it is more profitable to break it up after six or seven years, as the land will then give better crops than after the moss has impoverished it, as he has known some left fourteen or fifteen. The land will yield it again, he thinks, after ten or twelve years. It should, he says, be manured every second year, with forty bushels of soot, or sixty of peat ashes.

A singular idea is stated to prevail about Berkhamstead, which is that ashes wear out sainfoin. And that Mr. Rooper has experienced it. It there commonly lasts fourteen or fifteen years, but if not carefully preserved from sheep not more than six or seven.

SALLENDERS, in *Farriery*, a disease in horses, consisting in cracks in the bending of the hough, or of the skin under the knee, and occasions a lameness behind. It is of the same nature as the mallenders. This disease is cured in the same manner as that. See *Mallenders*.

SALT, a substance of the saline kind, which has been said to be found useful as a manure, and a food or condiment in the support or fattening of domestic animals.

In the former of these applications there has been much difference of opinion in respect to its effects, some contending that it is highly beneficial, while others think that it is of little if any advantage. There are likewise others who have supposed it to be useful when laid on land in small proportions, while on large ones it has an injurious effect; having in the former case a tendency to promote putrefaction, while in the latter it may retard it by its antiseptic property. It has also been supposed to produce much benefit by the power which it possesses of destroying snails, grubs, and other similar animals that may be in the ground.

It is observed by Doctor Darwin, that "as it is a stimulus which possesses no nourishment, but may excite the vegetable absorbent vessels into greater action, it may in a certain quantity increase their growth, by their taking up more nourishment in a given time, and performing their circulations and secretions with greater energy. In a greater quantity its stimulus may be so great as to act as an immediate poison on vegetables, and destroy the motions of the vessels by exhausting their irritability."

It has been remarked by the Rev. Mr. Cartwright, in an able Paper in the fourth Volume of the Communications to the Board of Agriculture, that "at present the use of salt as a manure is a subject on which the public opinion is much divided; its advocates, he says, reasoning from the striking effects of salt water on the marshes which are occasionally irrigated by the sea at spring tides, conclude that the fertilizing virtue of such irrigation is owing to its saline quality, without taking into consideration the quantity of animal and vegetable matter which sea water (particularly near the coast, and where rivers disembogue themselves) must necessarily hold in solution."

But that "those who maintain a contrary opinion, considering salt merely as an antiseptic, satisfy themselves that it is impossible that any thing can be friendly to vegetation which retards putrefaction, a process indispensable in substances that are to be the food of plants. To get over this difficulty it has been conjectured, nay there have not been wanting those (and of great name too), he says, who have even attempted to prove that salt in small quantities accelerates, as in large quantities it is known to resist, putrefaction; a doctrine to which, however, he shall not willingly yield his assent, till he can be persuaded that effects are not, in all cases, proportionate to their causes. The operation of every cause is, and must, he contends, be uniform; and when, to appearance, it is not so, some other cause obtrudes itself, too subtile for our observation, which operating at the same time with the primary cause, joins in giving a result, which not being able to account for, we consider as anomalous." He thinks, "that theorists should be at variance with each other is not to be wondered at, for having the wide field of imagination and conjecture before them to expatiate in, it is reasonable to conclude, indeed it is unavoidable, that some of them must lose their way. But what shall we say to the disagreement and inconsistency which prevail on this subject amongst practical farmers? Nothing, says he, indeed, can be more contradictory than the different reports that have been made on the effects of salt, as a manure, by those who have even brought it to the test of actual experiment. As there is no reason to question the veracity of the reporters, we must look for the grounds of their disagreement in some predominating circumstance or other, which at the time escaped their observation. Indeed, the success or failure of an agricultural experiment depends so frequently on causes which can neither be controlled nor foreseen, and so foreign from those which were expected to operate, that it is not to be wondered at if the repetition of the very same experiment gives oftentimes a different result" to the inquirer.

But, he says, "as it is not the business of this paper to support a theory, but to detail what has been practised; not to contend for an opinion, but to state facts; the few observations which may be hazarded will be such only as are required merely in explanation of occurrences as they arise. He shall endeavour to give, therefore, as simple a relation as possible of the experiments he has tried, to ascertain the advantages or disadvantages which may attend the use of salt as a manure, and also when mixed with the food of animals," and employed in that way.

In regard to the first of these objects, it is stated that the soil on which his trials were made was a ferruginous sand, brought to a due texture and consistence by a liberal covering of pond-mud. Of this soil, in its improved state, he means by the accession of pond-mud (for having been used merely as a nursery for raising forest trees previous to these experiments, the nursery-man had not, he says, thought it necessary to make use of any other manure), the subsequent analysis is given:

	Grains.
"400 grains gave of siliceous sand of different degrees of fineness about	280
Of finely divided matter, which appeared in the form of clay	104
Loss in water	16
	400

The 104 grains of finely divided matter contained of carbonate of lime	18
Of oxide of iron	7
Loss by incineration (most probably from vegetable decomposing matter)	17

The remainder principally silex and alumine."

It is added "that there was no indications of either gypsum or phosphate of lime." And from this analysis it will appear, he thinks, "that these experiments could not, perhaps, have been tried on a soil better adapted to give impartial results; for of its component parts there is no ingredient (the oxide of iron possibly excepted) of sufficient activity to augment or restrain the peculiar energies of the substances employed" in the business.

It is stated that "on the 14th of April 1804, a certain portion of this soil was laid out in beds one yard wide, and forty long. Of these, twenty-five were manured (the first excepted)" in the following manner:

No. 1. No manure.
2. Salt, $\frac{1}{4}$ peck.
3. Lime, one bushel.
4. Soot, one peck.
5. Wood-ashes, two pecks.
6. Saw-dust, three bushels.
7. Malt-dust, two pecks.
8. Peat, three bushels.
9. Decayed leaves, three bushels.
10. Fresh dung, three bushels.
11. Chandler's graves, nine pounds.
12. Salt, lime.
13. Salt, lime, sulphuric acid.
14. Salt, lime, peat.
15. Salt, lime, dung.
16. Salt, lime, gypsum, peat.
17. Salt, soot.

N. B. The quantities of each ingredient the same as when used singly.

No. 18. Salt, wood-ashes.
19. Salt, saw-dust.
20. Salt, malt-dust.
21. Salt, peat.
22. Salt, peat, bone-dust.
23. Salt, decayed leaves.
24. Salt, peat-ashes.
25. Salt, chandler's graves,

N. B. The quantities of each ingredient the same as when used singly.

And "that on the same day the whole was planted with potatoes, a single row in each bed; and, that the general experiment might be conducted with all possible accuracy, each bed received the same number of sets." That "on the 14th of May (a few days after the plants appeared above ground) the whole was carefully examined, and the comparative excellence of each row (as far at least as could be judged of by appearances) was as carefully registered. The best row was decidedly No. 7, malt-dust, after which they followed" in order as below.

No. 11. Chandler's graves.
16. Salt, lime, gypsum, peat.
25. Salt, graves.
20. Salt, malt-dust.
9. Decayed leaves.
4. Soot.
2. Salt.
1. No manure.
5. Wood-ashes.
8. Peat.
13. Salt, lime, sulphuric acid.
14. Salt, lime, peat.
17. Salt, soot.
18. Salt, wood-ashes.
21. Salt, peat.
22. Salt, peat, bone-dust.
23. Salt, decayed leaves.
3. Lime.
6. Saw-dust.
10. Fresh dung.
12. Salt, lime.
15. Salt, lime, dung.
24. Salt, peat-ashes.
19. Salt, saw dust.

Further, that "on the 28th of May, fourteen days afterwards, the apparent vigour of the plants was in the following order:

No. 7. Malt-dust.
11. Chandler's graves.
4. Soot.
8. Peat.
16. Salt, lime, gypsum, peat.
17. Salt, soot.
20. Salt, malt-dust.
21. Salt, peat.
23. Salt, decayed leaves.
25. Salt, graves.
1. No manure.

No. 2. Salt.
5. Wood-ashes.
9. Decayed leaves.
13. Salt, lime, sulphuric acid.
14. Salt, lime, peat.
18. Salt, wood-ashes.
24. Salt, peat-ashes.
10. Fresh dung.
3. Lime.
22. Salt, peat, bone-dust.
19. Salt, saw-dust.
15. Salt, lime, dung.
12. Salt, lime.
6. Saw-dust.

And that "on the 21st of September, the potatoes were taken up, when the produce of each row was in succession as follows:

No. 17.	Salt and soot produced	240
11.	Chandler's graves	220
18.	Salt, wood-ashes	217
16.	Salt, gypsum, peat, lime	201
15.	Salt, lime, dung	199
2.	Salt	198
25.	Salt, graves	195
4.	Soot.	192
10.	Fresh dung	192
20.	Salt, malt-dust	189
5.	Wood-ashes.	187
23.	Salt, decayed leaves	187
24.	Salt, peat-ashes	185
7.	Malt-dust	184
14.	Salt, lime, peat	183
19.	Salt, saw-dust	180
22.	Salt, peat, bone-dust	178
9.	Decayed leaves	175
13.	Salt, lime, sulphuric acid	175
21.	Salt, peat	171
12.	Salt, lime	167
8.	Peat	159
1.	No manure	157
6.	Saw-dust	155
3.	Lime	150

It is here stated as singular "that of ten different manures, most of which are of known and acknowledged efficacy, salt, a manure hitherto of an ambiguous character, is superior to them all, one only excepted!" And that "when used in combination with other substances, it is only unsuccessfully applied in union with that one, namely, chandler's graves, no other manure seemingly being injured by it. Possibly its deteriorating effects on chandler's graves may, says he, be owing to its antiseptic property, which retards the putrefactive process by which animal substances undergo the changes necessary to qualify them to become the food of plants. This, however, he cannot, from any appearance in the soil when the plants were taken up, assert to have been the case." And the extraordinary effects of salt, when combined with soot, are, he observes, strikingly singular. There is no reason to suppose these effects were produced by any known chemical agency of soot or salt on each other. Were he to guess at the producing cause, he should conjecture it to be that property of saline substances by which they attract moisture from the atmosphere; for he observed those beds, where salt had been used, were visibly and palpably moister than the rest, even for weeks after the salt had been applied, and this appearance continued till rain fell, when, of course, the distinction ceased. This property of attracting moisture had greater influence, possibly, on the soot than on any of the other manures, as soot, from its acrid and dry nature, may, he thinks, be supposed to require a greater proportion of water to dilute it than those substances which contain water already. It may be proper to observe, that on those beds where salt had been used, the plants were obviously of a paler green than on the rest, though not less luxuriant, a circumstance which he thought worth noticing, and which he considered, though erroneously (as appeared by the event) to indicate a want of vigour, which would be felt in the crop. It was observable also that where salt was applied, whether by itself, or in combination, the roots were free from that scabbiness which oftentimes infects potatoes, and from which none of the other beds (and there were in the field nearly forty more than what made part of these experiments) were altogether exempt." This circumstance deserves the notice of the practical farmer.

It is further noticed by the same writer, that "two sets of experiments, and with the same proportions of manures, were tried with turnips and buck-wheat, on a soil the poorest he could meet with, which produced only a dwarf heath and lichen, and which he had pared off. The poverty of this soil will appear, he says, by the following analysis:

400 grains gave of siliceous sand	320
Of finely divided matter, which appeared as brown mould.	68
Loss in water"	12
	400

And that "the finely divided matter lost by incineration nearly half its weight, which shows it contained a great deal of vegetable matter. The residuum, principally a mixture of aluminous and siliceous earths, coloured red by oxide of iron, and containing very little calcareous matter. There were no indications of either gypsum or phosphate of lime, he says, in it."

"On July the 6th, 1804, the pieces set apart for each set of experiments were respectively sown with turnips and buck-wheat. On the 26th, No. 1, 2, 4, 5, 6, 7, 19, 20, 21, 22, 24, 25, showed little or no marks of vegetation. The remainder were merely in the seed leaf." And that "on the 16th of August, 4 only were alive and in rough leaf, namely,

No. 12. Salt and lime.
13. Salt, lime, and sulphuric acid.
14. Salt, lime, peat.
16. Salt, lime, gypsum, peat."

It is added that "these four maintained a sickly existence, till the middle of September, shortly after which they all disappeared." And it is remarked, that the appearances of the turnips and buck-wheat were so nearly uniform, he has not thought it necessary to notice the trifling variations between them, which could not have been done without entering into a minute detail, equally tedious and uninteresting to the inquirer.

It is suggested that "though no decisive conclusion can probably be drawn from these two sets of experiments respecting the advantages or disadvantages of salt as a manure, on such a soil as he has described, because other manures of acknowledged efficacy shared the same fate with the salt, yet this inference may, he thinks, be drawn from them (and that not an unimportant one) namely, that a due texture and consistence in the soil is as necessary to the existence and health of vegetables, as the pabulum they are sustained by; and this appears evidently by the superiority (such as it was) of those plants where the manure contributed in any degree to improve that texture and consistence. This is, he contends, fully shown by an adjoining field which within these few years was in a great part in a state of uncultivated nature, equally barren as the spot he has been speaking of; it is, however, now brought into cultivation, and into a decent state of fertility, chiefly from its texture having been improved by a thick coating of marly clay."

These facts and experiments show the effects of salt in a more favourable light as a manure, than it has been hitherto generally considered in; and the intelligent writer suggests that if its beneficial properties were more perfectly demonstrated the attention of the legislature would devise some measure without prejudice to the revenue by which it might be employed for the purposes of husbandry.

In a communication from Davies Giddy, esq. President of the Penzance Agricultural Society, and inserted in the twenty-seventh Volume of the Annals of Agriculture, some interesting experiments on the use of sea salt in the culture of turnips, are detailed. They are enabled to make use of this substance as a manure from the extensive pilchard fishery established on the coast. Salt is frequently imported for curing fish at 9d. or 9½d. the bushel of eighty-four pounds, and what remains after it has been once or sometimes twice used in preserving the pilchards, is usually sold at about the same price to the neighbouring farmers. Though some animal oil is united to the salt, that which has been the least used is universally preferred, and found the most effectual. It is supposed perhaps difficult to determine whether the whole efficacy of the salt in producing plentiful, and as it would seem, certain crops of turnips, can be imputed to its virtues as a manure, or whether part of the effect may not be owing to the destruction of slugs.

The Report is thus stated by the Rev. John Allen, and Mr. Sickler, two members of the Society: "At Michaelmas 1790, Mr. Sickler entered on an estate so much impoverished by the former tenant as scarcely to return the seed.

"1791—In the spring of this year Mr. Sickler prepared two acres for turnips, which had borne seven crops of oats in succession.

"The last crop did not produce nine bushels on an acre.

"In the first week of April the earth from the ditches was carried into the field, and laid in four piles, each received three cart-loads of sea-shell, sand and five bushels of salt. The earth from another ditch chiefly consisting of the decayed soil, which had been taken off the ground in former tillage, was placed in three more piles, and each of these received also three cart loads of sand, but no salt on account of the apparent richness of the earth. Half the field was manured with the four first piles, but the three last not being sufficient for the other half, what remained was sown with salt, at the rate of ten bushels to an acre.

"The part of the field where salt had been used, either mixed with earth, or alone, produced about half a crop of turnips, but the crop totally failed where there was no salt. In the spring following, white oats were sown and produced a crop of forty-five bushels to an acre.

"1792—Three acres which in 1791 had borne a crop of wheat, not exceeding twelve bushels on an acre, were ploughed before Christmas, and brought into fine tilth by Midsummer following. On each acre were sown twenty bushels of salt, excepting that two ridges towards the middle of the field were purposely left without any manure; on these two ridges the turnips totally failed, but the remainder of the field produced a plentiful crop.

"1793—Four acres of land completely worn out by successive tillages were ploughed before Christmas, three acres were sown with salt, at the rate of twenty-five bushels, and the remaining acre with eighteen bushels without any other manure, the crop was in general a good one, but visibly best where the greatest quantity of salt had been used.

"Crops of turnips have been raised with equal success by the use of salt, since that time, and in the severe winter of 1794, 95, it was observed that these turnips were much less injured by the frost than others similarly treated and cultivated in the common way."

"When salt is used in the quantity of twenty or twenty-five bushels to an acre the turnips should not be sown till at least three weeks after the salt. Clover sown with barley after turnips raised by the use of salt, has never failed to produce an abundant crop of hay the year following."

It is suggested in the Report, that "if the observation can be depended on of turnips being less injured by frost, when they are manured with salt than when they are cultivated in the usual manner it must indicate an extraordinary degree of health and vigour in the plant, but a single observation is obviously insufficient to establish such a fact."

It is also suggested by Mr. Jay, after observing that "the nature of the soil, and perhaps the season should

be regarded as that may possibly account for certain proportions of salt succeeding much better in some instances than in others. That a gentleman in New England has published some facts from which it appears that the subject merits attention.

"In June 1786, he salted one bed of his onions, one bed of his carrots, and one bed of his early turnips: laying the salt under the surface in the centre of the intervals between the rows, at some distance from the roots that the salt might have time to be dissolved and altered before the fibrous roots should reach it. The carrots of the salted bed evidently grew much larger and better than the rest, but he could not perceive that the salt was at all beneficial to the onions or to the turnips." And further, that according to Mr. Ford's experiments in salting flax ground, salt seems to be highly beneficial to that crop. He spreads the salt at the time of sowing the seed, and thinks that the quantity of salt should be *double* to that of the seed; from three acres of flax salted he had fifty bushels of seed, and an excellent crop of flax. Mr. Elliot tells us of *five* bushels of salt, being applied to one acre of flax, which is a much larger proportion, and that it had an extraordinary effect; and also of a crop of wheat increased by salt.

The trials of Mr. Fenna in Cheshire, with this substance as a manure in various modes of application, do not however appear to have been so successful, though they seem to have been made with much care and attention.

On Fallow.

July 1st, 1797. Experiments on a fallow for wheat being once ploughed, and that before Christmas last, full of grass and weeds, owing to the continual wet weather.

		A.	R.	P.		lbs.		Bu.	lbs.
3	butts	0	2	4	sown with	85½	of salt, that is,	2	50 per acre.
2	ditto adjoining	0	1	26	unsown				
3	next ditto	0	2	35	sown with	89	of ditto	2	11
2	ditto	0	1	35	unsown				
3	ditto	0	2	5	sown with	130	of ditto	4	20
2	ditto	0	1	13	unsown				
3	ditto	0	3	74	sown with	193	of ditto	7	25
3	ditto	0	1	7	unsown				
3	ditto	3	1	34	sown with	175	of ditto	6	42
3	ditto	0	1	17	unsown				
3	ditto	0	1	13	sown with	195	of ditto	10	25

Observations.

July 12th, 1797. Some few of the weeds have perished, but no other evident alteration compared with those unsown, and none at all upon those sown with small quantities. Ploughed under between the 7th and 14th July, the weather being rather drying, but still showery.

July 12th. Salt sown on the same fallow being twice ploughed, the weather drying.

	A.	R.	P.		lbs.		Bu.	lbs.
1 butt	0	0	22	sown with	76½	of salt, that is,	9	49 per acre.
1 ditto	0	0	18	sown with	78¼	of ditto	12	21
1 ditto	0	0	33	sown with	109	of ditto	9	34

Observations.

"Some few snails perished by the application the day following. No other perceptible alteration has yet taken place. August 28th. Has been harrowed and ploughed a third time." It is stated that "a man sowing from a seed hopper, common stride and full hand, twice over the same ground, will sow from 10 to 12 bushels per acre.

"Oct. 1st, 1797. Sowed another butt in the same fallow with salt, immediately before its being sown with wheat, and ploughed in therewith, being after the rate of 10 bushels per acre.

"No visible advantage has been seen in any of the above through the winter, or at spring, nor any perceptible advantage as the crop advanced to maturity; neither could the reapers, nor any other viewers, distinguish the least appearance in favour of salt, compared with the butts unsalted.

On Pastures.

"June 30th. Sowed 0 a. 0 r. 17 p. of pasture with 4lbs. 4oz. of salt (being rye grass and clover of the second years growth, soil pretty good upon marl.)

"Sowed 0 a. 0 r. 13 p. with salt (2lbs. 12oz. being pasture of several years' growth, full of wild or natural clover; soil deeper and warmer than the former.

"July 1st. Sowed 0 a. 0 r. 35 p. with 17¼lbs. of salt, being pasture of the third year's growth; soil open, upon sand productive of fern.

"December 1st, 1797. Sowed part of a butt with salt, after the rate of 15 bushels per acre.

"Dec. 1st. Sowed 8 lbs. on salt on part of a rough meadow, having nearly its whole summer's growth of sour grass, which the cattle would not eat, and has been usually burnt off at spring.

Observations.

"July 12th. No evident alteration compared with the adjoining land. August 28th, continues unaltered.

In spring 1798, not forwarder, nor anywise preferable to the adjoining butts of ground which were not salted.

"Some thistles and some little of the fern damaged, but not destroyed. The rough or sour grass being in a withered, or dead state, though sown with fine salt when dewy, was not affected thereby, neither did the cattle prefer it to the other not salted."

On Mowing.

"July 27th. Sowed 39½ lbs. of salt upon 0 a. 0 r. 14 p. a cold peaty meadow (herbage indifferent intermixed with rushes), immediately after the hay being caried off, the weather dry. N. B. 8 bushels per acre.

Observations.

"July 25th. The weather broke and much rain has since followed, but no visible alteration has yet taken place. August 27th. This is not a sufficient quantity to destroy the herbage, nor has any advantage yet appeared. Neither has the spring nor the crop of hay grass shewn any thing preferable to the unsalted parts adjoining.

On Hay.

"August 13th. Scattered 3 lbs. of salt in a ton of new hay at the time of housing, being a little weathered. This hay appeared less mouldy, and on that account was better than the same unsalted, but would not compare with the like hay which had not been weathered and not salted.

On Weeds and Brambles.

"June 30th, 1797. Applied 4 oz. of salt to 4 weed-wiss (in Gerrard's History of Plants called genistella tinctoris, dyer's weed, or bastard broom) tufts, or roots, occupying a space 12 inches in diameter, in equal quantities. The ground being wet with almost continual rains for a month past.

Observations.

"July 1st. Began to droop. July 12th, dead. August 28th, three of them are rotted away, and their place growing over with grass; the other has its woody substance yet standing, though dead. These sprang up from the old roots this spring 1798, and have continued in the same flourishing state as they were before the application of salt. July 1798.

"1797, July 1st. Applied 7 lbs. of salt to a number of the hard kind of rush tufts, or bogs in the pasture.

Observations.

"The cows found it the next day, and collected as much as they could together, with every blade of grass growing amongst the rushes. Some few of the rushes were bit off in consequence of their search; the remainder did not die, nor suffer any apparent damage from the application, August 28th. It has been found, by subsequent trials, that the cows take this, in the act of licking the grains of salt with their tongues, and that where the grains have been dissolved, the herbage is not preferable, on account of its having been salted.

"1797, July 12th. 10lbs. used upon a poor furze, or gorsey bank, chiefly clay soil, being then almost totally overgrown about 12 or 16 inches high; in quantity about 80 square yards; the weather dry.

Observations.

The cows found this and stole all that they could get at, together with any decent herbage with which it was intermixed. Some little of the gorse has perished, but is far from being destroyed.

"Aug. 28. the whole recovered at the return of spring (1798), and so continues.

"July 12th, 1797. Used lbs. of salt upon a number of weed-wiss, or bastard broom, tufts, or roots (the four salted the 30th ult. being dead), the weather dry.

Observations.

"July 27th. They are in part destroyed. The cows found this and collected as much as they possibly could, without eating the weed, which is very bitter." It is observed, that "these retained their verdure much longer than those salted in wet weather. —August 28th, not yet destroyed, but much hurt. These like the former recovered at spring 1798, and so continue (July 1798.)"

"1797, July 12th. Used 10lbs. of salt upon more rush tufts or roots in the pasture, a greater quantity to each.

Observations.

"The cows found it in a short time, and selected every grass from amongst the rushes, together with as much of the salt as they could. Some of the rushes suffered in the pursuit, being bitten off and thinned.—Aug. 28th. The rush roots are too deep to be destroyed. Grass, and other herbage near, has suffered. These in 1798, are not to be distinguished from the others not salted.

"1797, Aug. 25th. Used 6lbs. upon 15 square yards of ground almost totally overgrown with hengorse (in Gerrard's History of plants called *ononis, sive resta bovis*, cammock, or rest harrow), a pernicious woody shrub infesting clay soils, being then in full flower, and beginning to set its seed pods: the weather showery.—August 28th, the leaves and flowers are dying. The branches died soon after, but the roots sent out fresh ones at the return of spring, which still continue. This being upwards of 30 bushels to the acre, destroyed the intermixed grass, which became brown and lifeless till the approach of winter, when it began to recover, and the whole was covered by the spring; but no better herbage than the adjoining; nor has it any time since been preferable, July 1798. This quantity was not sufficient to leave the ground quite bare. Though the herbage was killed, it never totally disappeared. If a lesser quantity would have done so, it might have been serviceable for destroying the sward, previous to the making of a lay fallow. Salt has been used from 15 to 20 bushels per acre, upon small patches of nettles in deep soiled pasture, which were fretted awhile, but afterwards recovered without any visible alteration" in their growth.

It is observed, that "it has likewise been tried (1798) in various proportions, and at different times, upon a turnip fallow, without any good effect. It was sown upon a weedy part of the turnips to the amount of 10 bushels per acre; after they were up in three or four rough leaves, these were fretted; but the greatest part of both weeds and turnips recovered, with little variation from the other (rather worse if either). How salt would act upon worms, or what is called the fly, is not known, as the crops were not plagued with them this last year; probably it would have a good effect; for salt water was tried upon worms on a gooseberry bush, without fretting the tree much, the worms soon after died; but, as this was only one instance, perhaps a change of weather, or some other cause, might occasion their death. This experiment is intended to be repeated both on turnips and on gooseberries" in future.

It is added by the writer, that *with cut straw* salt has been tried, mixed and immediately given, put together and left to ferment, and sprinkled with salt and water; in every case it is refused by the cattle.

And that "*in manure*, salt mixed with dung, in various proportions and in different sorts, is not discoverable from the same sort, set on without salt.

"On the 3d of January 1798, 67 lbs. of salt were mixed in 2 square yards of tough peaty parings, cut from the sides and bottoms of an open peaty drain, and made in a heap of that size. The remainder of the same parings were made in another heap, and mixed up with a quantity of horse-dung of proportionate value, allowing the salt to be worth 6*d.* and the dung to be worth 2*s.* per square yard. Both sorts were examined by Sir Robert S. Cotton, the beginning of August last, at which time the admixture with salt remained in a dead tough state, without any rotten or saponaceous particles in it; the blades of grass in the middle of the heap, though dead, had not lost their colour. No weed or any vegetable had grown upon this heap; but the other mixed with dung was covered with weeds, and on opening was found much reduced and pulverized; and after one good turning and mixing, was set upon the ground in good condition, in November last: the other has since been twice turned, and remains in the heap unrotted at this day, March 1799. From hence it may be concluded, that salt acts not as a septic on vegetable substances, but, on the contrary, preserves them in a dead state, and acts as a preventative to putrefaction; this is perhaps more fully proved by the common method of preserving kidney, or French beans, when ripe enough for the table, which are kept the year round for culinary purposes, in pots between layers of dry salt."

The writer states, that "from the foregoing experiments it may be concluded, that salt may be of service to agriculture in the preparation of fallows, in rainy seasons unfavourable to the plough; but in this case great quantities must be used to have the desired effect; perhaps less than 50 bushels to each acre would be insufficient; this quantity would not destroy vegetation for more than two months, as appears from the first experiment with *weed-wiss*, where something more than that quantity was used; this quantity might destroy the weeds, but would not reduce it, if in a tough or soddy state, as appears from the last experiment in manures, where the quantity used is equal to 240 bushels per acre, allowing it to penetrate the surface of the fallow, in an equal degree, only three inches deep." And that "perhaps it would be more beneficial, used in small quantities with hay, at the time of housing or stacking, which, if weathered or damp, might prevent it in some degree from moulding, and, if green and in large quantities, might act as as a preventative to overheating and firing." But that "as an assistant, or stimulus, to the vegetable system, it appears, he says, through all the foregoing experiments, to be quite destitute of every good property, and unworthy of notice as a manure in any kind of process." And that "such is the opinion of several of the neighbouring farmers who have viewed the different applications, and who have, without exception, concurred in the report" which is here made.

It is advised by Dr. Darwin, that when salt is made use of as a manure, as it has a tendency to induce disease by its excessive stimulant power, it should be employed a little before the time that the plant would acquire that part of its growth which is wanted. But though this may be done in the garden, it cannot be well extended to the field.

It is conceived by Dr. Anderson, that "there is no substance yet known which is so much relished by the whole order of *gramenivorous* animals, as common salt. The wild creatures of the desert are so fond of it, that wherever they discover a bank of earth impregnated with a small proportion of salt, they come to it ever after regularly to lick the saline earth, as they would to a pool of water for drink, were there none other near; so that when a hunter in America discovers such a *lick*, as such places are there called, he reckons himself sure of obtaining

plenty of game, by lying in wait near it, and shooting them as they approach, until the whole beasts that have discovered it are killed." And "it is also admitted, he says, by all those who have tried the experiment, that salt, given along with the food of domestic animals [except fowls to which salt is a certain poison], tends very much to promote their health and accelerate their feeding; and although some persons, who have been at a loss to account for the manner in which this stimulant could act as a nutritious substance, have affected to disregard this fact, yet no one has been able to bring the slightest shew of evidence, to invalidate the strong proofs that have been adduced in support of it; though, unfortunately for this country, few experiments, of this kind have been tried in it. In fact we have no reason to suppose that salt acts in the smallest degree as a nutritious substance, or of *itself* tends to fatten any animal; but that merely by acting as a condiment, it whets the appetite, and gives the creature to which it is probably administered a strong relish for its proper food, so as to induce it to eat in a *given* time a greater quantity than it would have done, and thus greatly to augment, as has been above explained, its feeding quality beyond what it otherwise could have had. In this way, he thinks, it is not perhaps an extravagant position to say that by a proper use of common salt, the same quantity of forage might, on many occasions, be made to go twice as far as it could have gone in feeding animals, had the salt been withheld from them. If so, and let those, says he, who are inclined to withhold their assent to this position, prove, by a set of experiments fairly conducted, that it is erroneous; till then, the unvarying testimony of the few who have tried it, confirming the position, ought to be relied on. If so, then, he still says, we have here laid open to our view an easy mode of augmenting the produce of our fields to an amazing extent: for, if the same quantity of forage can be made to go, not twice as far, but one twentieth part only farther than it now does, it would be the same thing as adding one twentieth part to the aggregate produce of meat for beasts, throughout the whole kingdom."

It has been suggested by a writer in the first volume of the Memoirs of the Royal Academy of Sciences at Paris, which is inserted in the 24th volume of Young's Annals, that vast advantage may be derived from the use of salt, in promoting improvements in land as well as increasing the number of cattle.

"The farmer, he says, who has more than an ordinary stock of working cattle, reaps a double advantage, the one by having his work done in season, the other by enriching a greater proportion of his land by means of their additional manure. The only difficulty is how to maintain an increased number without increasing the expense; this, he asserts, may be done by the use of salt, and advances the three following propositions:

"1. That salt given with the food of cattle augments the nourishment of that food.

"2. That in proportion to the quantity of salt eaten by cattle, the effects of that augmentation will be perceivable.

"3. That no ill consequences will follow from excess of salt eaten by cattle, even though it should be given them without stint.

These propositions he endeavours to support by unquestionable facts.

"In the jurisdiction of Arle in the county of Provence, there is, says he, a district called the Craw, extending in length about six leagues, and in breadth about three, the whole surface of which is covered with small rough stones, and not a tree or bush to be seen in the whole district except here and there upon the borders; yet on this spot so seemingly sterile, by the free use of salt, more numerous flocks of sheep are bred and reared than upon any other common, of equal extent throughout the whole kingdom. And what is no less remarkable, the sheep are healthier, hardier, and endure the severity of the winter with less loss, though they have fewer sheep cots for covering, than those bred and fed on more copious pastures, and that besides have the advantage of more convenient shelter. Add to this that the wool of the flocks bred and brought up in the Craw is not only the finest in the whole country, but bears the highest price of any in France. From hence he concludes, that it is to the unlimited use of salt that these surprising effects are to be ascribed, for it frequently happens that the Craw is so burnt up in the summer, that the poor animals are forced to turn up the very stones to come at the few blades of grass that grow round them, and yet none perish for want of food: let every excellence therefore that can reasonably be supposed inherent in the herbage be allowed to it yet the quantity of it is so small that without the abundant use of salt, a fourth part of the sheep kept in Craw could not subsist in it.

"But as a still farther demonstration that this astonishing effect is solely to be attributed to salt, we have, says the writer, in Languedoc, on the borders of the Rhone, a spot of the same kind of stoney land, in every respect similar to that of the Craw, yet for want of free use of salt, that in Languedoc does not maintain the tenth part of the number of sheep that are brought up in the Craw, though in other respects it is no ways inferior, their wines and other fruits produced in the borders of both being in their goodness and other essential qualities, equal."

Having proved his first proposition incontrovertibly, he proceeds to prove the second, to recommend an easy experiment, which it is in every farmer's power to make, and that is to give one half of his cattle salt, and to the other half none. By this simple trial, in less than a month the difference will be discernible; the cattle to which the salt is given will shew it in their looks, in the sleekness of their coats, in their growth, and in their strength and firmness of labour. He adds, that with little more than half their usual food all these effects will be produced.

To establish his third proposition, he "appeals to the practice about Arles, where the cattle have as much

salt as they will eat, and none are so healthy or thrive so fast as those that eat most of it.

It is of course supposed that there can be no doubt of the good effects of salt, in the feeding or fattening of cattle; but the manner of giving it to the labouring cattle is not clearly explained. It is stated, that in eight days, a stock of three hundred ate fifteen pounds of salt, being one pound to every score; and it would seem that the whole quantity was given in one day, as the farmer is cautioned against letting the sheep drink on the day the salt is given, suggesting at the same time how much it sharpens their appetites.

The experiments of Mr. Cartwright in respect to the effects of salt, when mixed with the food of animals, has not, he says, been extended to sheep, "as he did not apprehend that a few limited experiments would either throw new light upon a subject which has already been sufficiently discussed, as applied to those animals, or furnish the public with facts of which it is not already in possession. His experiments have, therefore, he says, been confined to hogs and cows."

It is stated, that "on July 23d, 1804, three hogs of the same litter, about eight months old, were put up to fatten. Their respective weights were as follow:

No. 1. 44 lbs.
2. 47 lbs.
3. 40 lbs.

And that "from the 23d of July till the 7th of August, they were fed with barley-meal mixed up with water, during which time they consumed three bushels and a half of barley, and gained in weight as follows:

No. 1. 12 lbs.
2. 10 lbs.
3. 5 lbs.

But that "from the 3d of August to the 21st, they had salt mixed with their food, of which they consumed one quarter of a pound per day. The food consumed was four bushels; they had gained upon the last weighing, as under:

No. 1. 18 lbs.
2. 22 lbs.
3. 14 lbs.

However, that "from the 21st of August to the 3d of September, the salt was discontinued, in which time they eat four bushels and a half of barley-meal, and their increase of weight was:

No. 1. 24 lbs.
2. 21 lbs.
3. 21 lbs.

But "from the 3d of September to the 17th, they had salt as before, and their consumption of food was the same as during the last fortnight, namely, four bushels and a half of barley-meal. Their gain of weight was,

No. 1. 31 lbs.
2. 19 lbs.
3. 19 lbs. They were then slaughtered."

It is remarked, that "it did not appear that the salt had any operation either in promoting thirst, or stimulating their appetites, the consumption of food being nearly the same whether salted or not, neither does it appear that the salt had any influence on their fattening; perhaps the quantity allowed them was too little; and yet he should think not, as there was enough to make their whole mass of food sufficiently savory to the human taste."

He remarks, that "in trying this experiment he did not confine one parcel of hogs to salt, and another to unsalted food. This mode of trying experiments is always, he says, uncertain, as there will be frequently particular habits and tendencies in the individual animals which will vary the results, and prevent their being uniform. The fairest way, and that which is the least liable to error, is, he thinks, to compare each animal with himself, by feeding him at one period with one kind of food, and then for an equal period with another. If this principle which he has proceeded upon be right, there is nothing in these experiments to encourage the practice of administering salt to hogs with a view, at least, to increase their tendency to fatten; how far it may contribute to keep them in health is a different question, and on which years of experience may probably be necessary to decide."

It is stated, that "on the 9th of October 1804, his experiments on cows commenced. On that day two Welch heifers, one of which had calved about five months, the other three, were confined to the house, and fed with hay for the space of one fortnight. The hay they consumed during that time was four hundred weight nineteen pounds, and the milk they produced was thirty-six gallons three quarts. They had then for the next fortnight salt mixed with their hay, the hay being first slightly moistened with water, and the salt sprinkled over it; in which time they consumed four hundred weight forty-two pounds of hay, and seven pounds of salt. The milk produced was thirty-seven gallons. For the next fortnight, namely, from the sixth to the twentieth of November, the salt was omitted, and their food was four hundred weight and one quarter of hay, and two hundred weight and a half of cabbages. The produce of milk in that space of time was fifty-four gallons three quarts. From the twentieth of November, their food was the same as before, with the addition of half a pound of salt per day. The produce of milk was fifty-seven gallons one quart.

He here says, it will be recollected that salt seemed to have no tendency to promote thirst, or to increase appetite in the hogs; yet on the cows its effects in one respect was very perceptible, for during the period they had salt they drank three gallons a day each more than at other times." It is therefore supposed that "salt may possibly promote digestion (notwithstanding its antisceptic quality), by stimulating the salival glands, and the glands yielding the

gastric juice, and by inducing an increased discharge of their respective fluids, so necessary to the solubility of the different substances received into the stomach, before they can be admitted into the lacteals."

It is suggested, that "though there may be nothing in the foregoing experiments to lead us to suppose that salt has any otherwise a tendency to promote a disposition in animals to fatten than as it may contribute to their health, by aiding their digestion; yet it is probable that, when administered to animals yielding milk, it may contribute in some small degree to increase that secretion; and this it may do by promoting thirst, which induces the animal to drink copiously, in consequence of which the secretion of milk as well as all other secretions of the fluids, may be augmented. Perhaps also, it may have a stimulating influence on the lacteals themselves." But that "after all, admitting these experiments to prove that salt increases in some small degree the production of milk, when that increased quantity is balanced against the price of the salt, the dairy-man will find himself no gainer, he thinks, by such means."

But notwithstanding "there does not seem any thing in these experiments, either with hogs, or cows, to encourage the practice of giving salt to animals with a view to increase their disposition to fatten, yet it would be temerity, the writer thinks, to affirm that it is entirely useless. From the avidity with which most, if not all kinds of graminivorous animals, whether in a state of domestication or otherwise, are known to eat salt, whenever it comes in their way, it is reasonable to conclude that the propensity has not been implanted in them in vain. But from whatever cause its salutary effects may be supposed to proceed, whether (as was hinted at before) from its promoting digestion, and an increased secretion of fluids, or from any other action it may have on the animal œconomy, it must be left to an experimenter more successful than he has been to ascertain the matter in a more perfect manner."

With regard to sheep, it is well known that salt has long been made use of with advantage in preserving the health and condition of the animal. And that the inconvenience of wet, moist, and otherwise unfavourable land for sheep, may, in a great measure be obviated, by having recourse to the giving of salt to the animals.

It is indeed the common management in almost every country but this. The proper mode of giving it is in shallow troughs, being allowed as much as they will take, which is in common but very little, though they are extremely fond of it. Under unfavourable seasons, and where the soil, food, and climate are not well suited to them, the use of this material has been found of great service.

However, in Mr. Fena's different trials with this material for sheep, whether scattered in different parts of their pasture, or sprinkled upon other portions, the animals do not seem to have been much attracted by it, as they scarce did any thing more than smell to it, and quit the place where it had been deposited. This might however arise from their natural timidity, or their want of being accustomed to it, as many animals are shy in taking new sorts of food, till they get a sort of taste for them. This is the case with oil, cake and some others.

It has been suggested by Baron Schultz, in the first volume of Communications to the Board of Agriculture, that it destroys the *Fasciola Hepatica* or fluke worm in sheep. And for this purpose some have recommended, according to Dr. Darwin, one ounce of salt to be given every day dissolved in water; but that it is probable that it might be used with greater advantage if hay was moistened with the solution, which would thus at the same time supply them with better nourishment than generally falls to the lot of those diseased sheep, on the supposition that they would eat it.

As they take it readily in the manner that has been mentioned above, it may answer the intention in that very convenient method.

SALT-MARSH, pasture-land lying near the sea, and sometimes overflowed by the water of it.

It has been observed, that "horses and black cattle thrive better, and get flesh and fat sooner, in salt marshes than in fresh water meadows or upland pastures; though the reason of it has not been fully assigned.

According to some, it is supposed that "the air of the sea whets their appetites; that the pasture is rich and nourishing; and that the herbs produced by the lands near the sea are more conducive to the health of herbaceous animals, than such as grow on upland pastures, whether natural or artificial. But may we not rather attribute the thriving of cattle on these marshes to the saline particles with which the earth as well as its produce, is, when near the sea, strongly impregnated? Perhaps even the dews have their portion of salt; but of this the writer has made no experiment, therefore mentions it only as a probable conjecture. He is fully of opinion, that the saline particles only with which the grass is impregnated in the above-mentioned marshes, cause cattle to thrive in them in the manner they are known to do. These salts purge away the foul humours which the beasts have contracted, either by inactivity, or by being overheated in labour; by which means they are better disposed to be nourished by the aliment they receive." But "it may perhaps be objected, that if the grass of these marshes is apt to purge cattle, this very purging, by being long continued, will be a means of preventing their growing fat. To this it is answered, that the cattle take with their food every day nearly the same quantity of these purgative particles: but that the quantity of salt, which at their being first put into the marsh will have that effect, will cease producing it when they are by custom habituated to take a daily portion of it, as is evident in many cases." The writer suggests, that "as it is not convenient to every one to send their cattle to a salt-marsh, that it would be happy if a method could be substituted that would nearly answer the same purpose?" He does not think this impossible; "perhaps, says he, if common salt water was to be laid in the fields for the horses to lick as often as they pleased, they would thrive much better; were he to say, he knew it would have that effect, it would, he says, be no presumption. Cattle, he adds, are

naturally fond of salt, and if left at their liberty, will take no more of it than what does them good. With this help, our fresh-water meadows and upland natural and artificial pastures, would, he thinks, yield us a greater profit, and of course be worth more both to the land-owner, and farmer."

In support of this practice, the writer asserts that in the inland parts of Switzerland, when their horses and cattle have endured the hardships of a long and severe winter, they turn them in the spring loose into the mountains, laying salt here and there upon the rocks, for them to resort to when they please; and of this they are so fond, that when the farmers want to catch their horses, they take some salt in their hats, as we do oats in a sieve, to allure them. And experience has, he says, long convinced them, that the salt thus laid in their way answers a very good purpose: their cattle are more healthy in general than ours, and they attribute it almost to this alone. And he states, that "in the provinces of Munster and Connaught, in Ireland, they also very frequently lay salt on slates, for the benefit of their horses when at grass, which they find, does the cattle great service."

It is likewise suggested that the use of this substance is extremely proper when cattle are turned into clover, lucerne, or cole-seed to feed: it is well known, that, on these occasions, they are very apt, unless great care is taken, to be surfeited, which the salt would prevent, and thereby greatly accelerate the fattening of the cattle, and make it much safer to the farmer. And the writer concludes by observing that lucerne, cut green and given to horses, has the same effect upon them as a salt-marsh. The lucerne at first, and for several days, is in a great degree diuretic to them; after which they thrive upon it surprisingly, and in a very short time they get in high order.

It is stated by Mr. Curtis of Lynn, Norfolk, in the fourth volume of Communications to the Board of Agriculture that he had "a neighbour who, by embankment, converted about four hundred acres of salt-marsh into a more profitable course. After the sea was excluded from its accustomed depredations, the land was immediately ploughed up and sown with oats, but scarcely a single grain was seen to vegetate. In the same summer it was afterwards sown with cole seed; but here, he says, one disappointment trod on the heels of another, though rather in a less degree; particular spots here and there produced a very decent crop, but the quantity was insufficient to defray the expense. In the month of August following, the whole of it was again sown with the same seed. This second crop, in a great measure, not only compensated for the former failures, but was a happy presage of ensuing profit. In the following autumn, after this crop was reaped, the whole of the land was sown with wheat, and in the ensuing spring, when it might be about four inches high, it was all laid down with grass-seeds; but whether the defect proceeded from the greatness of the crop, or from the seeds themselves falling into the interstices of the grass of the wheat, which prevented its arrival at the soil, cannot now be known; it is only certain that scarcely one-fourth of the land proved fit for pasturage. That portion of it was, and continues, extremely fine; but the other has ever since been coarse and unproductive. The proprietor being an old man, with a tolerable share of the characteristic obstinacy of declining life, has ever since (a period of about eighteen years) consigned its produce solely to nature's operations. It has constantly been fed with sheep and bullocks, and from the fine and prolific state of that portion that succeeded, there is not the slightest doubt but that the whole might be converted into the best of pasture. It has lately become the property of another, who will probably profit by the errors of his predecessor. The soil is a silt; and the grass-seeds with which it was sown, were a composition of hay-seeds, cow-grass, narrow-leafed plantain, and white clover. When land is fresh recovered from the sea, he conceives (provided flooding is not practicable) that it ought to remain a whole year before it is consigned to tillage; as it will take that period, at least, to expel the salts sufficiently for corn to vegetate. He knew, he says, a gentleman who sowed a piece of arable land with turnips, and in the ploughing, preceding the sowing of the seed, he dressed the land with refuse salt. The consequence was, that on thirty-six acres of land he had not twenty turnips, though the same seed sown on the rest of the farm evinced not the smallest failure." Some however have supposed the use of salt as manure favourable to the growth of turnips, as may be seen in the preceding article. It is probable that too large a quantity was applied at one time.

These sorts of land have been long celebrated for the power which they possess in restoring such horses as have been prematurely worn out and reduced by hard labour or improper management.

It has been remarked that horses often grow fat on the best salt-marshes, when they are eaten so bare, or burnt up in dry weather, that scarcely any grass is to be seen on them. In winter some never house them, but let them run abroad and take their chance in the open fields, where there are neither trees nor hedges to cover them, and yet they seldom suffer any thing from the extremity of the weather; nor, unless the ground be covered deep with snow, do they allow them any dry forage. Yet these for the most part appear in good condition even in the months of December and January, when they have nothing to feed on but the roots. Besides all the water they have to drink is for the most part brackish, which at first is not very agreeable to horses that have not been used to it, but afterwards they come to relish it as well as any other. The greatest danger on the marsh grounds is from the deep ditches made to take off the spring tides, some of which have their bottoms full of a kind of loam ingendered by the weed which comes into them in great plenty at high water. And if a horse that is a stranger to these grounds happen, in leaping, or any other way, to step into one of them, he may run the hazard of being lost unless he be discovered in time. Sometimes horses have been washed away with the spring tides by going too near the dykes, but these accidents seldom happen, not only because

the marsh-men are always upon the watch at such times, but most horses have sagacity enough to avoid the danger.

SALVING *Sheep*, the dressing them with tar and grease.

It is a practice which was formerly considered as indispensable to the health and safety of sheep, but which in the southern parts of the kingdom, according to the Survey of Northumberland, it is not in use; and in some of the less exposed northern districts it is wholly disregarded, even with some of the hill sheep farmers; it is now said to be laid aside without any inconvenience being sustained on the account. In respect to the material which is employed in this district, it is a mixture of 1½lb. of butter with four quarts of tar, well incorporated by being put together while warm. This quantity is sufficient for twenty-four sheep. In Perthshire in the north of Scotland, according to Dr. Robinson the composition now in use is likewise tar and butter. Some take two Scotch pints of tar to a stone of butter; others only five stone of tar to that weight; and others in various proportions between these extremes. This quantity suffices for laying fifty-five or sixty sheep, at the rate of three or four pence each according as there is more or less tar in the mixture. Formerly shepherds used tobacco juice, and soap, and in some cases chamberley; but these are laid aside as less efficacious. This sort of business is in some places done in November. In Perthshire the store masters smear their lambs about the beginning of October, and if the weather be favourable they continue their work without intermission till all the sheep they intend be smeared. In some places they smear only the weaker sheep, in other places the whole. One man smears twenty or twenty-four in a day, leaving about an inch betwixt every shed of the wool. In regard to the benefit expected from this practice, it is that it makes the sheep hardier and warmer, that it cleans them from vermin and cutaneous distempers, and that it prevents their losing the wool. They contend further, that the wool pays very nearly the whole expense; the same number of fleeces of smeared and white wool bringing an equal sum in the market, because what the smeared wool wants in quality it has in weight; and lastly it is urged, that the more butter there is in the composition, the grain of the wool is softer, and more silky; that by the practice of smearing, the young sheep are raised on the bone; are preferred in the market and fetch a better price. However, notwithstanding all these arguments, in favour of smearing, others condemn the practice totally. "There is little doubt that it forms a crust about the animal's body, and contributes to defend it from the cold, and thus it may be proper in a stormy situation, while it is unnecessary where there is plenty of shelter." See *Sheep*.

In Argyleshire, according to the Report of that district, "the curing or salving the sheep with tar and butter, in October, is a general practice; but some smear them more than others, according to the difference of situations. All smear the lambs and tups, and some smear all except the old wedders. The purpose of it is to defend from the cold, scab, and vermin, and to increase the quantity and mend the quality of the wool. Different people mix the ingredients in different proportions from three to four pounds (English) of butter, and one Scotch pint of tar, is considered as a proper allowance for nine or ten sheep. The more butter and the less tar, the more the wool will be meliorated.

In the Roxburgh Report, it is stated, many allow only two pounds of butter to the pint of tar, or a stone of 24lb. to the 12 pints, which is very hurtful to the wool. The most approved mixture is three and half pounds (English) of butter to the Scotch pint of tar. The better the butter is the further the salve will go. The best is that which appears yellowish and rises when rubbed against a board with the finger, as this washes better out of the wool. It is found that two pints of butter-milk, added to six Scotch pints of tar, and its proportion of butter will smear four sheep more than the same quantity of tar and butter will do by themselves. If the butter-milk be a week or two old, it is so much the better. It makes the tar and butter incorporate more closely, renders the salve firm, and draws much finer upon the thigh than without it. The salve thus prepared it fit for immediate use.

Mr. Richardson says "that there is reason to believe that a mixture of tobacco-liquor and spirits of turpentine with a little brimstone, answers fully as well as tar and butter, for the great object of smearing, which is that of killing the vermin and preventing the scab. Something similar to this is practised in the parish of Lochlee in August, the lambs are smeared in autumn with tobacco juice. As tar is not easily procured, sometimes it may be of consequence to the farmer to know that such things may be used as a substitute for butter; but the butter, when it can be got is better."

But though smearing or salving is thought here to be of absolute necessity, it may perhaps be doubted whether it might not be dispensed with, or at least done in an easier way. In Wales this practice is unknown, though the country is colder than this. And it has been given up in other districts, as seen above.

The writer of the above Report says, that "the store masters however speak of its utility with confidence founded they say upon experience. If this be well ascertained, it would be improper to give up the practice. But even in the supposition that it ought to be continued, some think that the operation might be performed when the sheep are shorn (which would be attended with much less expense and trouble), with butter or oil and a decoction of tobacco-juice, oak bark, or broom, without any mixture of tar so hurtful to the wool. This decoction would kill the vermin and their eggs, and the butter or oil would improve the wool, the natural and sufficient clothing of the animal. If the practice cannot be given up now it probably may hereafter when the breed is more naturalized to our climate."

It is observed "in the Statistical Account (of Linton), 1,135. that Columella and Celsus anciently prescribed oil for improving the wool. A few years ago, a farmer in

Selkirkshire being unsuccessful in the competition for the premium granted for the best wool smeared next season with butter only without tar, and easily gained the premium. This experienced farmer thinks tar of no use but to kill the vermin, which may be effected with other materials that will not hurt the wool.

SAM, provincially to curdle milk for cheese, or set the curd for it.

SAMPHIRE, a plant which is often found on land in the vicinity of the sea shores, and which is troublesome to extirpate.

SAND, a well known substance of the fossil kind found in minute concretions, forming together a sort of powder, the particles of which have all a tendency to one determinate shape, and appear regular, though more or less complete concretions; not to be dissolved or disunited by water, or formed into a coherent mass by means of it, but retaining their original forms, transparent, vitrifiable by extreme heat, and when pure not dissoluble in, or effervescing with acids.

In the state of nature they are variously blended and intermixed with other materials, particularly with flakes of talc, &c. and according to these and their different colours, are subdivided into several kinds, as red, white, &c. And from their having in some cases as soils, a degree of tenacity or heaviness, while in others they are light, and without any cohesion, they have been further distinguished by farmers into *heavy* and *blowing* sands. See *Soil*.

Dr. Lister has divided the sands of this country into two classes: first, the sharp or rags and, consisting of small transparent pebbles, naturally found on the mountains, and not calcinable: these he farther divides into fine and coarse, and subdivides each, according to the colours, into white, grey, reddish, brown, &c. Second, the soft, or smooth, which he subdivides into that with flat particles broken from lime-stones, that with silver-like particles, and that with gold-like particles.

The great use of sand is in making clayey earth more fertile, and fit to support vegetables, &c. as these earths alone are liable to coalesce, and gather into hard coherent masses; as is apparent in clay; and earth when thus embodied, and, as it were, glued together, is not disposed to nourish vegetables: but if with such earth, sand, &c. that in such hard particles as are not dissolvable in water, but still retain their figures, be intermixed, they will keep the pores of the earth open, and the earth itself loose and friable, and by that means nourish plants in a more perfect manner. Grounds that are of a sandy or gravelly nature, readily admit both of heat and moisture; but they are liable to these inconveniences, that they let them pass away again with equal expedition; they are of course extremely apt to burn in dry hot seasons, but have the property of quickly recovering with the least rain. They have likewise the property of being more early than the more heavy sorts of land.

Common sand is a very good addition by way of manure to all sorts of clay lands as it renders them more open and loose. The best sand for the farmer's use is that which is washed by rains from roads, or hills, or that which is taken from the beds of rivers: the common sand that is dug in pits never answers well. Sand mixed with dung is much better than laid on alone: and very fine manure is made by covering the bottom of sheep folds with several loads of sand every week, which are to be taken away, and laid on cold stiff lands, impregnated as they are with the dung and urine of the sheep.

Besides clay land there is another sort of ground very improveable by sand, which is that of the black foggy land on which bushes and sedge grow naturally, and which is cut into turf, in some places. Six hundred loads of sand being laid upon an acre of this land, according to the Cheshire measure, which is nearly double the statute acre, was found to meliorate it so much, that without ploughing, it yielded good crops of oats or tares, though before it would have produced scarce any thing. If after this crop is taken off, the land be well dunged, and laid down for grass, it yields large crops of sweet hay.

It is observed that once sanding this sort of land will improve it for a great number of years; and that some land in Cheshire has been, by this means, rendered of twelve times its former value to the owner. The bogs of Ireland, when drained, have been rendered very fruitful land, by mixing sand in this manner among the earth of which they consist. Add to this, that in all these boggy lands, the burning them, or firing their own turf upon them, is also a great advantage. The common peat, or turf ashes, mixed with the sand for these purposes, add greatly to its virtue.

In the wet coarse rushy-bottomed lands it is also said to have a great effect in destroying such coarse plants, and in bringing the sward into a fine state of herbage. It should be spread out over the surface in an even manner, but not too thickly. The sea sand, which, is thrown up in creeks and other places, is very rich and proper for this purpose. In the western parts of England which lie upon the sea coasts, very great advantage is made of it. The fragments of sea shells, which are always in great abundance in this sand, add to its virtues; it being always the more esteemed by farmers, the more of these fragments there are among it. The sand of this sort which is used as manure in different parts of the kingdom is of three kinds: that about Plymouth, and some other of the southern coasts, is of a blue grey colour like ashes, which is probably owing to the shells of muscles, and other fish of that or the like colour, being broken and mixed with it in great quantity. Westward, near the Land's-end, the sea sand is very white; and about the isles of Scilly it is very glistening, with small particles of talc; on the coasts of the North-sea the sand is yellowish, brown, or reddish, and contains so great a quantity of fragments of cockle shells, that it seems to be chiefly composed of them. That sort of sea sand is accounted best, which is of a reddish colour: the next in value to this is the blueish; and the white is the worst. This kind of sand is the best when taken up from under the water, or from sand banks, which are covered by every tide. And it is remarked that "the small grained sand is the most sudden in its operation, and is therefore best for the tenant who is only to take three or four crops; but that the coarse or large-

grained sand is much better for the landlord, as the good it does lasts many years." Where sand is dredged out of the sea, it is usually much dearer than where it is taken from sand banks. See *Sea-sand*.

In the northern parts of Lancashire the more light sorts of land in the vicinity of the sea shores, are in many cases much improved by the application of sea-sand upon them. The practice is to lay it on in a pretty thick manner, in order that it may be well incorporated with the soil, by the different ploughings before the wheat is sown. In this way large crops are often afforded, and the effects of the dressing lasts several years. It is likewise found very beneficial when applied thinly over the surface of grass lands in rendering the herbage more fine and sweet. It is a substance that might in many situations be much more extensively made use of than has hitherto been the case.

Shelly-SAND, a sort of calcareous sand found in large banks or beds in many situations on the borders of the sea.

It is observed by Dr. Anderson, in his Essays on Rural Affairs, that on many parts of the sea coast great beds of shells are to be found which have been broken into such small parts as to assume the appearance of sand. And that this is a rich and valuable manure that deserves to be highly prized by those who are within reach of it; but it is too often neglected and unobserved, as this kind of sand has on many occasions very much the appearance of ordinary sand.

It is stated that this may readily be discovered by pouring a little aqua fortis or any other mineral acid upon the sand you wish to examine. The author here properly suggests, that many persons make this trial with *vinegar* instead of the mineral acids, but which ought never to be done, as it often happens that vinegar makes no sensible effervescence with calcareous substances. He would therefore advise every country gentleman to keep a phial of aqua fortis or muriatic acid always by him for making trials of calcareous substances; the expense is next to nothing; And he is persuaded from the want of it alone, many persons have failed to make discoveries of calcareous matters that might have been of high importance to themselves and families.

If it contain shells, an effervescence will, he says, ensue, and the proportion of calcareous matter contained in any sort of sand may be ascertained by a proper process. "Nor ought this trial ever to be omitted before the sand is employed as a manure; because a very small proportion of shells will make it effervesce violently, so that the degree of effervescence is no proof of its purity, and because the proportion of shells varies in all possible degrees. It is added that if the shells are broken into very small fragments, and if the proportion of sand be inconsiderable, it will be nearly as valuable as lime, and may be driven to a greater distance with profit. If the proportion of ordinary sand be very great, the expense in using it will be greater, as the quantity must be considerably increased. But as it may for the most part be procured at little expense, those who are possessed of it, are usually able to employ it in great quantities, in which case it will produce amazing effects, especially upon strong clay lands or others that are very heavy.

"It is likewise supposed that a much smaller quantity of calcareous matter in this state will produce a more sensible effect than when it is in any sort of earthy marl, because it admits of being more equally spread upon the ground and more intimately mixed with the soil; those therefore who are upon the sea coast, ought to search for it with care, as they will usually obtain an invaluable treasure when they discover it. The writer suggests that this sort of sand is much more common on the east coasts of Scotland than is usually imagined. All along the coasts of Fife, especially about St. Andrews, the sand upon the shore, is, he says, richly impregnated with shells, but it has never there been employed as a manure. On the north coast of Aberdeenshire shelly sand abounds, and has been of late employed as a manure with the greatest success by a gentleman distinguished for his knowledge and public spirit in that corner. It is likewise found in Banffshire, where it has been applied with the highest success. And all along the coast of Sutherland and Caithness, the sands upon the shore consist almost entirely of shells. He thinks that these treasures will enrich posterity, although they are at present in a great measure neglected. He mentions them here to induce his countrymen not to neglect a treasure of such inestimable value. But on the west coasts of Scotland, and among the island, shelly sand much more abounds, and its effects as a manure are much more generally known than on the east coasts, so that it is there universally employed as the most efficacious manure with which they are acquainted. Its effects upon some of their heathy mossy soils, appear to be in some cases little short of enchantment.

"And he asserts that the ingenious Mr. Craik in Dumfriesshire employed this manure for a longer time and in great quantities than any other person in Scotland, and has been highly benefited by it."

Farmers in many places in the southern parts of the island might probably avail themselves of similar advantages, if they were attentive to examine the creeks, and bays of the sea coasts.

It is stated in the Agricultural Report of Argyleshire, that the shell-sand found in many of the bays in that district, "has been long used as a manure for corn and meadow lands, which it greatly meliorates.

"By this manure not only the quantity of grass is greatly increased, but its quality also mended. It answers well on any soil, but particularly on stiff clay, and on mossy and spongy land, as (besides its effect as a manure) it destroys the tenacity of their parts, and helps to pulverize the one and drain the other. Its value as a manure depends on the proportion which the shell bears to the sand; which in some places is greater, and in others less. The best sand is found on some of the islands, particularly in Oronsay, from which it is frequently carried to the continent. Perhaps this is the best and cheapest manure that we have for hay-meadows. There is also a bank of good sand on Elan-Davar, at the mouth of Campbelton harbour. The shores of Kilfinan in Cowal, also abound in shell-sand. Even sea-sand

which does not appear to have any mixture of shells, is found to be beneficial, especially to moss or clay grounds; some of the farmers in Kintyre apply it to such lands with great advantage. On the shore of Dunaverty, in Kintyre, and in some other places, some coral is thrown ashore; which proves an excellent and lasting manure, but the quantity is not so considerable as to be of any extensive service."

SAND-*Cracks*, in *Farriery*, a defect in horse's feet. They consist of a separation of the fibres of the hoof in a perpendicular direction. If they extend to the coronet, they are extremely troublesome to cure. Those horses are most liable to them that have either strong and brittle hoofs, or narrow heels. And blood horses are said to be more subject to them than horses of inferior kinds.

In the management of them, according to Mr. Denny, "the part around the crack must be rasped thin. The firing iron should then be drawn above and below it to the extent of the fissure, in order to prevent its extension. The iron should also be carried over the crack, by which means a slight degree of moisture will exude, and glue up the part; which may be covered with some of the following ointment, spread on tow, and secured by a bandage."

Take of Ointment of marsh-mallow, two ounces;
Common turpentine, one ounce.
Mix them together.

And he adds "that the horse must have a bar shoe, which will rest firmly on the frog, and be hollowed in the part which is opposite to the seat of the disease, so that no pressure may be made on that part of the foot. Rest should also be allowed for a few days; and after this only moderate exercise permitted, until the fissure has descended towards the inferior part of the foot." And he further supposes that it may be useful to bathe the coronet and hoof twice a-day with the following, in order to promote the growth of the horn from the coronet.

Take of Ointment of marsh-mallow,
Barbadoes tar, of each three ounces;
Spirit of turpentine, one ounce.
Mix and make the embrocation.

SAND-*Flood*, the covering of land with sandy materials, either by winds or the overflowings of rivers. The first is a sort of disaster incident to the lands of Suffolk, and some other parts of the kingdom, which are sometimes covered with vast quantities of sand, rolling upon them like a deluge from sandy hills in their neighbourhood. Violent winds break through the turf that covers these hills, and then the sand, lying loose and naked, is soon carried down upon the plains, where it covers and buries the grass, and in a very little time destroys the light turf, and mixing itself with the sand underneath, becomes one bed of this dry matter never to be covered with turf again. A large body of sand being thus got together, nothing stops its progress; but at every storm it rolls over more and more ground, so that in a few years it extends itself a vast way, especially where the ground over which it passes, is of the same sandy nature, and only covered with a thin turf. It is observed that in some parts of Suffolk the ground encourages this change so greatly, that a bed of sand thus loosened from a neighbouring hill, and covering only a few acres at first, will ultimately deluge a large quantity, not being arrested by rising grounds or any other means.

It has been suggested that "the best way of stopping its progress is by hedges of furze, planted one over the other; as they become levelled, these, when well kept up, will by degrees stop or divert the progress; and some who have tried it with resolution, after they have had the sand raised twenty feet high, have found it stop its increase, and then, having manured this adventitious soil with dung, found it as good ground as that which made the surface before

It is stated in an early Volume of the Philosophical Transactions that "about Thetford, the villages were wholly destroyed by this means, about ninety years ago, and the branch of the river Ouse, called then Thetford river, so blocked up by it, that very small vessels only could go up it, where very large ones used before. The river has been of great service in stopping its progress into Norfolk, where otherwise its course would have carried it, and its vast spreading side-ways, in proportion to its going forward, would have made it bury great quantities of land in a few years.

"The most probable conjecture as to the cause of this strange sort of deluge in these parts of the kingdom is, that this portion of the county of Suffolk lies east-north-east of a part of the great level of the fens, and is by this exposed to very impetuous winds, which acquire more than ordinary force by their passing over so large a tract of country uninterrupted; the storms seem to be one great cause of the mischief, and the sandy nature of the soil the other. There are old stories, in the country, of suits at law commenced among the farmers, for grounds blown out of the owners' possession; but the people who gain this sort of wandering land are the greatest sufferers. A little sand sprinkled by the winds over a tract of land, where there is a bed of sand under the turf, soon gets through that obstacle; and what was at first only a thin coat of sand, becomes then a deep plain of it, capable of being blown away to the depth of eight, ten, twenty, or more feet, and is carried over every thing in its progress before the winds when once taken up by them.

"It likewise sometimes happens that much mischief is done by sand being conveyed upon lands, by the overflowing of rivers, in the vicinity of the sea or other places. Where the lands thus covered are of the low boggy or swampy kind, the sandy material thus thrown over them may be of considerable advantage, by rendering them more firm and solid, as well as by bringing up a better sort of herbage; but in other cases, as where they are in a state of fine sward and sufficiently firm, much injury must be done by the sand destroying the good grassy surface, and rendering it bare and patchy. In this case it should be removed as soon as possible, and put upon other grounds in the neighbourhood which are suitable for

it, being only left very thin on such swards, and then immediately forced in as much as possible by repeated bush harrowing; and in some cases perhaps, rolling with a heavy roller may be found necessary to bring the surface into a proper condition again."

Where the farmer has any coarse rough lands near, that are much infested with rushes or other similar plants, the sandy substance thus thrown up may be of great advantage when removed upon them, in bringing them into an improved state of sward.

Sand-*lands*, a term used by farmers to signify such grounds as consist wholly or mostly of pure sand. And they have different appearances according to the nature of the sandy material, as white, blackish, reddish, or yellowish, and are very different in the nature and size of the particles, of which they are constituted, some being harsher and some milder, and some very light, seeming to be almost mere dust. The grey, black, and ash-coloured sand-lands are the worst, and are generally found on heaths and commons. Gravelly lands approach much to the nature of these, and those which consist of the largest stones, and are mixed with the harshest sands, are of all the most barren and infertile.

The most suitable sorts of manure for them is either clayey marle, or such clay as will break with the frosts. The dung of neat cattle is also a good manure for such lands, and many use chalk, mud, and the half rotten straw from dung-hills with much advantage. Where these lands are over-run with broom, furze, and such sort of weeds, marle is advised by some to be laid on in great quantities. This is the practice in Staffordshire, and they get rid of these troublesome weeds, and procure good crops of corn, though at a considerable expense in the first instance.

And in addition to the above crops, sand lands of the medium quality are capable of growing barley, clover, wheat, pease, oats, potatoes, carrots, and parsnips.

It is remarked by the author of the Suffolk Report, that "on the sandy districts, the management varies proportionably with the badness of the soil; but in one feature it is universal, that turnips are every where the preparation, the basis for both corn and grass. There is no sand so light that it will not yield by means of dung or fold this crop.

"After turnips barley is generally sown, then grass seeds succeed, but with variations on bad sands; trefoil and ray-grass are chosen because their duration equals the views of the farmer; they are left from two to four years, and when broken up a *bastard*-fallow for rye. The discrimination between good and bad farmers in this arrangement, depends entirely on this point; good ones consider every thing as subservient to sheep, consequently leave their grasses as long as possible; but bad ones, in a hurry for corn, and an immediate advantage, plough too soon. All these sandy districts are invariably sheep farms (rabbits only excepted); the flocks feed in winter on turnips, and in summer on these layers. On the better sands, frequently the layers are broken up, and pease planted to great advantage by hand dibbles, and this is succeeded by a better crop of wheat than when sown on such layers kept bare by feeding all the summer. Two rows are dibbled on each flag, and they come up so regularly as seldom to want hoeing. And it is added that buck wheat forms in some very poor spots a variation; and small pieces of tares are sometimes seen; but the system he has described holds good in general.

"And that in Stamford hundred, on their poorer sand soils they are excellent farmers, as well as on the richer loams: their course is,

"Turnips, barley, trefoil and ray grass, pease dibbled, barley; which is admirable management.

"The most proper crops for arable land of this kind, are white oats, tares, turnips, carrots, and buck wheat. The natural produce, in weeds, is quick-grass, sorrel, broom, furze, fern and heath."

It has been properly suggested by Mr. Middleton, that "on very dry light sands, the great work of tillage, such as ploughing, harrowing, manuring, &c. should be executed as much as possible in damp moist weather or even in rain, especially the last ploughing and harrowing in of the seed. And this practice is stated to have always succeeded on a farm of dry burning land called Dunkirk adjoining the town of Hertford. It is likewise further confirmed in the Agricultural Survey for the County of Gloucester."

It is stated by an old writer, Mortimer, that in Herefordshire, they are much subject to moss growing upon their sand lands, and that they make a great improvement by burning it on the ground, and mixing the ashes with lime, which they plough in. And that they generally sow them with rye after this manure, which yields a very great increase upon them, and brings on a very good kind of grass, if they are laid down after a crop or two.

It has been stated by Mr. Deveral of Nottinghamshire, in the fourth volume of Communications to the Board of Agriculture, in respect to the breaking up and converting of this sort of land to grass, that "he has in his occupation under lease, a field of eight acres of good sand land, worth 24*s.* per acre per annum, which had been in grass fifty years, and was deemed by many not worth ploughing. In 1786, he by permission of the agent, ploughed it up to take some crops, and return it to grass after one fallow. He first sowed it with Poland oats, and had fifty-six bushels (Winchester) per acre; these were cut early, and brush or stubble turnips sown, which were good, and eaten on the land by both sheep and beasts, until the first of May 1787, when he sowed barley, which proved likewise good, producing forty-eight bushels (Winchester) per acre. In 1788, finding the turf not sufficiently reduced, he again sowed Poland oats early, and he had a crop equal to the first, and again good stubble turnips. In 1789 he fallowed and manured with fifteen three-horse carts-loads of manure, and ten quarters of lime per acre; the turnips were unusually good, and fed on the land. In 1790, he sowed barley and grass-seeds; the barley was good, yielding fifty-six bushels per acre. This land has been in grass ever since, and is, he asserts, much improved by ploughing."

And "Mr. Thomas Smith of Oxfordshire began the culture of a field of sandy soil by paring and burning, and sowed it with turnips; but where furze grew he was very unsuccessful; the turnips although they came up, did not grow to be of any service, but when they shut the rough leaf it turned red, and never flourished, which made him suspicious of the land not bearing out. He therefore laid upon it fifty load of dirt per acre, which he procured out of a road lying near, that had been mended with lime stone. This proved useful, but did not make equal to the parts where the turnips grew well. The oats that were sown upon it the spring following, testifying that there wanted somewhat more to be done, and seeing the road dirt had been somewhat useful, and it lying very near, he laid on a quantity the winter following, which proved quite sufficient to rectify this soil, as it bore the year after a good crop of Marlborough peas, the next year wheat, and afterwards winter vetches, succeeded by a good crop of turnips in the same year. It was then sown with oats, and laid down as the other, only with the addition of a bushel of ray-grass to the acre. After this process it proved as useful land as any upon the farm. And when he left it, was worth a guinea per acre."

And in Sussex Mr. Thomas Baldock had a piece of "ground on Burwash Down, a dry bank of poor gravel, sandy top, and the under stratum covered with heath, furze, &c. and very stony, being stubbed and pared, and the turf and stubbings burnt and laid in ridges, was ploughed up, and all the large stones carted off, to the amount of three or four hundred loads, and used for mending the roads. The land was then stirred and turned three times more; fresh stones pulled up and carted off; and now, it being got a good depth (eight or nine inches), the ridges of ashes having been moved, and the ground on which they lay being well and deep-ploughed, and cleared of stones, the ashes were spread over all the ground, with sixteen hundred bushels of very good stone lime. The piece was twelve acres; which was well and deeply harrowed, and lay with a fine deep mould (except the many small stones), like an onion bed. This being the middle of July, it was sown with red and green rooted turnips, which sprung very quick, as in four or five days they made their appearance above ground; early in August they were hoed, and in the middle of September they were again hoed, and then carefully set out to a distance of about sixteen inches. There happened many good showers, and the weather was pretty good to the end of October. This brought them on apace, and before Christmas they appeared a very fine crop. A trial was made, from which it appeared that twenty-five or twenty-six tons grew on each acre of ground. These turnips were fed off by sheep, penned on the ground, and in such a manner as to manure the soil as evenly as possible; some few indeed were carted off; the sheep finished feeding off in April; the ground was kept ploughed after the sheep, and the latter end of May, ploughed again; in June, 1000 bushels of lime were spread over it and ploughed in, and turnips sown in the end of the month. They did well; the crop was very large, and fed off after the 13th November till a little before Lady-day, and ploughed after the sheep as before. Early in April the ground was ploughed, and then sown with barley and seeds; four bushels per acre of barley, and two gallons and a half per acre of trefoil. This crop sprung well, both barley and seeds; the barley was rather short, but yet a pretty good crop, 4½ quarters per acre. The barley being cut and carried off, in the beginning of September, the seeds afforded fine keep for sheep till the middle of October; they then were taken away, and the seeds shut up for the winter. In the next spring and summer, they prospered very much, and produced a fine crop of hay, near two loads per acre, which were cut and hayed the beginning of July. The field was ploughed up as soon as the hay was carried off, stirred again twice, and sown with white wheat in the beginning of October, two bushels per acre. This crop turned out well, three quarters and a half per acre. As now he was very desirous to lay this piece down to grass, he chopped up the stubble, which being carted off in November, the field was ploughed up to lie the winter. In March it was ploughed again; and having a pretty good compost, got previously ready the year before, it was brought up in waggons, and consisted of good fresh mould 200 cart loads, of good farm yard dung 250, and about 100 of very rich soil, consisting of scouring of necessary vaults, soil holes, sweepings, scouring of mud-holes from the wash of the town and ditches, besides some soot and ashes. This compost, and 1000 bushels of lime, laid in a heap the autumn before, were both spread evenly over the ground, and well and deeply harrowed in, and the piece sown with barley two bushels and a half per acre, and this likewise well harrowed in. The seeds were then sown, hay, and most other sorts in great plenty. The barley and seeds came up well and quickly, prospered through the spring, and came on surprisingly, and at harvest the barley was a fine crop, six quarters per acre, and seeds such as he had scarcely ever seen any before, so very thick and strong. The field was fed off till the end of October, then laid up for the winter, and in March following it was fed close with 200 sheep till the beginning of April, and then laid in for mowing. In the beginning of July the grass was mowed and hayed, and it was a most capital crop, near three loads of most excellent hay per acre. The after grass was very great, and fed off with cattle, horses, and sheep. This turned out exceedingly good grass ground, and he has taken five summer crops of hay, since the first, and at a medium more than two loads of hay on an acre. One summer the drought checked it much, and the produce was but little better than a load of hay per acre; one good dressing of compost and lime was put on about two years ago. This piece of poor sandy common, though very expensive, has paid, he thinks, as well or better than any piece of land of which he has minutely taken notice. The twelve years have cost very near sixty pounds per acre, the crops and seeds may be fairly estimated at £.120 per acre; he has little doubt but that the commons on the South of England might turn to a good account if they could be managed in a similar method."

SANDWEED, a name provincially given to the weed sometimes termed *pitch purse*.

SANDY-*lands*. See *Sand Land* and *Soil*.

SANDY-*marle*, that sort in which the clayey part contains an excess of sand. When treated with acids, the residuum or clayey parts is found to contain more than seventy-five hundred weight of sand. Of course chalk and sand are the two prevalent ingredients. In colour it is brownish grey or of a lead colour. It is mostly of a friable and flaky nature; but occasionally forms very hard lumps. It seldom falls readily into pieces in water; but it chips and moulders away by free exposure to the influence of the atmosphere and moisture, though in but a slow and gradual manner. It effervesces with acids, but the residuum after solution is not capable of forming a brick.

SAP, the juice or blood which circulates in the vessels of vegetable plants, and trees.

It is observed by the author of Phytologia that "the sap juice which is absorbed from the earth by the roots of plants, and constitutes their nourishment, is similar to the chyle of animals, and consists of water, sugar, and mucilage, with other transparent solutions, as those of carbon, phosporus, and calcareous earth. And though it has been proved by the experiments of some philosophers, that vegetables can extract or compose all these substances from air and water alone; yet that some materials contribute more to the production of this vegetable chyle or sap juice than others, such as the recrements of dead vegetable and animal substances."

It is stated by Dr. Hooper in his Observations on the Structure and Economy of Plants that "two theories have been applied to the motion of the fluids in vegetables; the advocates of the one maintaining, that the vegetable sap had a circulation analogous to the blood of animals; while others affirmed, that it only ascends in the day, and descends again at night. In order, however, to prove the former, it would be necessary to demonstrate in plants, as in animals, a centre from which the circulation begins, and to which it again returns; but no such centre has ever been discovered by any naturalist." But "as it has been proved that the roots and leaves attract a nutritious juice, and communicate it to the other parts of the plant; it is evident, that it must be carried upward and downward; and from several experiments, it appears, he thinks, as satisfactorily proved as its nature will admit, that the humours attracted by the leaves, descend at night, and those by the root ascend by day; for the leaves by night inhale dew, and seldom perspire vapour, and vice versâ." And he suggests that "it does not appear improbable, although it is not proved by ocular demonstration (which is the only way to ascertain the fact), that a plant is constructed with special vessels for the ascending and descending juices." But, says he, "if a vegetable be not supplied with those special vessels for the ascent and descent of the sap, it must be performed in the same vessels, which at one time must therefore raise, and at another depress it. What would, however, seem to strengthen the opinion of its being thus moved, is, that nature has made no apparent provision whereby the sap might be prevented from decending, in the very same vessels through which it ascends. In the vessels of animals whose office it is to return a fluid, there is an apparatus called valves, which effectually prevent the contained fluid from going back. These valves are intirely wanting in the vessels of vegetables.

"The above idea is to be considered as purely conjectural, but may at some future time be ascertained."

It is further stated that "the experiments which prove that the nutritious juice, taken in by the absorbent vessels of the radicles, ascends through the vessels into the leaves and flowers, &c. the *erection* of flaccid plants, if water be poured on the ground, or if the root only be put into water. And the *colouring* of flowers by putting plants into water impregnated with a colouring principle."

But it is remarked that "although the ascending succous vessels have been seen conveying the coloured fluid, it has never been carried so far as to enable the enquirer to detect whether the fluid was returned by the same or by special vessels; yet he is very much inclined to favour the latter hypothesis" or opinion.

And "that the vessels of plants are endowed with vital power and irritability, and after the manner of animal vessels alternately diminished and augmented in diameter, would appear," he thinks,

"1. From the ascent of the contained fluid.

"For this could not be returned again by the capillary attraction of the radicles, or the heat rarefying the fluids, or the internal villosity of the vessels.

"2. From the increased and diminished motion of the vessels, from various stimuli; for some increase the motion of the fluids, and others diminish it."

It is conceived that "without this contraction and dilatation the very rapid circulation of the common juice or sap of plants could not take place. It is observed that the motion of the sap varies in every plant: this depends upon the irritability of the vessels; thus it is quickest in those plants which are the most irritable, and vice versâ." And "the contraction of the vessels is evident in most of the *euphorbia*; thus, if a branch be cut when fresh, a milky juice will flow out, and continue for some time. It is supposed that the cause of the contraction depends upon the irritability of the fibres composing the vessels; hence it follows, that the efflux of the milky juice will not take place when the vessels of the plant are deprived of that property."

The writer concludes by observing that "the *stimuli* by which the irritable fibres are excited into motion, and diminished and augmented in diameter, are, water, a requisite degree of heat, vital air, light, electric matter, and artificial stimuli, as nitre, sal ammoniac, sulphur, &c."

Dr. Darwin however, after showing the great analogy that exists between the circulation in animals and vegetables, and offering various facts in illustration of it, presents us with the following recapitulation of his theory: "We may, says he, finally conclude,

that the circulation of vegetables is performed like that of animals by the irritability of their vessels to the stimulus of the fluids, which they absorb and protrude; that is, that the extremities of the branching veins of the leaves forcibly absorb the vegetable blood from the extremities of their arteries, which correspond with the pulmonary arteries of animals; and that it is thus pushed on to the foot-stalk of the leaf, where the veins unite, and branching out again take the office of an artery, like the aorta in fish, without perceptible pulsation. The sap or blood in this artery is pushed forwards by that behind it, the motion of which was given by the power of absorption in the pulmonary vein, till it arrives at the extremities of these aortal branches, and is there again forcibly absorbed by the terminations of the correspondent veins, and again pushed forwards to the *caudex gemmæ*, and to the foot-stalk of the leaf, like the blood in the *vena cava* of animals."

And further that "a part of this blood is at the same time forcibly selected and absorbed by the various glands for the purposes of the necessary secretions, excretions, or nutrition; and the sap-juice or chyle and the water, which is acquired by the absorbent vessels, that correspond to the lacteal and lymphatic vessels of animals, is carried, as well as the remainder of the juice or blood, to the foot-stalk of the leaf. Here these absorbent vessels are believed to push their contents into the veins correspondent to the *vena cava* of animals, and which now uniting without the intervention of a heart, assume the name and office of the pulmonary arteries; and branching out upon the leaf expose the returning blood and new sap-juice to the influence of the air. And finally, all this is accomplished by the power of absorption, as in the aortal arteries, and *vena portarum*, of fish, which is excited into action by the irritability of the mouths of these vessels to the stimulus of the fluids which they absorb."

And secondly, that "a circulation of vegetable juices in every respect similar to that in the common leaves above described, exists in the bractes or floral leaves, except that the leaves of the leaf-bud prepare their juices for the production and nourishment of other buds in their bosoms; but these bractes, which are the lungs of the fructification, prepare their juices for the nourishment of the pericarp and its included seeds, but not for that of the corol with its anthers and stigmas, as these in many flowers exist before the production of the floral-leaves, as in *colchicum* and *hamamelis*."

Thirdly, that "another circulation of vegetable juices exists in the sexual parts of flowers, including the nectaries and corols. In the corols the vegetable blood is exposed to the influence of the air, and prepared for the secretion of honey, which is the food or support of the anthers and stigmas. In these the progression and circulation of the fluids must be caused by the power of absorption, which he has shewn to be a greater force than that of the heart of animals."

Fourthly, that "the progress of the fluids imbibed by vegetable lacteals from the earth, and by their lymphatics from the air, and from the surfaces of their internal cells, is evidently begun and carried on by the power of absorption of their terminating mouths, and the annular contraction of their spiral fibres."

Fifthly, that "the wonderful force with which the sap-juice is drank up and protruded in the *umbilical* vessels, which expands and nourishes the buds of trees, and which forms the wires of strawberries above ground, and those of potatoes under ground, with the great variety of bulbs and root-scions, is to be ascribed to this single principle of absorption. Except that some of these long cylindric vessels are evidently composed of a spiral line, and which may by the annular contraction of this spiral line carry the fluids they have absorbed with great force either in a forward or retrograde direction."

And sixthly, he "finally concludes that the branching absorbents of the roots unite at the *caudex* of each bud, before it rises out of the earth and forms a large trunk, which passes up the alburnum of the tree to the upper caudex of the bud at the foot-stalk of the leaf, and may be compared to the *receptaculum chyli* of animals extended to so great a length; and that it there joins the great returning vein, which also is composed of the branching veins of the roots uniting at the lower caudex of the bud, and ascending terminates at the upper caudex of it, where it becomes again branched, and forms the pulmonary artery."

And "the aorta or great artery descends, he supposes, along with the great vein, or *vena cava* above mentioned; and branching in the roots below, and on all other parts of the individual leaf-bud, performs the offices of secretion and nutrition. The pulmonary arteries and veins belong to the leaf; the former exposes the blood to the atmosphere beneath a thin moist pellicle, whence it becomes oxygenated, and probably acquires some warmth, and phosphoric acid, and the spirit of vegetable life. The latter collects the aerated blood by its branches, and conveys it to the upper caudex of the bud, at the foot-stalk of the leaf, where it becomes the aorta or great artery above mentioned." And that "the sides of the long absorbent trunks, or receptacles of chyle, which rise from the lower caudex and terminate in the upper caudex of each bud, as well as the long trunks of the umbilical vessels, evidently consist of a spiral line, as well as those trunks of absorbents, which imbibe aqueous fluids from the air, and a part of their perspirable matter on the surfaces of the leaves. But whether the pulmonary and aortal arteries or great veins consist of a similar structure is not yet, he says, ascertained."

In support of this ingenious hypothesis the results of different experiments made by the writer are given; and the whole is curious and interesting.

Sap-*flow*, a diseased state of vegetables, which according to Dr. Darwin takes place "when the alburnum or sap-wood of trees is wounded in the vernal months, as in birch and maple, and consists of a saccharine and mucilaginous fluid similar to the honey-dew, and which, he says, is often very troublesome, when vines in hot-houses are pruned too late in the season, as the whole branch is liable to bleed to death, owing thus to the loss of the sap-juice, which ought

to be employed in nourishing the buds, and expanding their leaves."

And it is added that "when some perennial plants have risen but a certain height from the ground, if their stems are much wounded, or cut off, the roots are liable to bleed to death from this discharge *umbilical* fluid, or sap-juice, which ought to have nourished and expanded the new buds and foliage; as may be seen in cutting down the *cow parsnip*, *spondylium*, *heracleum* in April; and on this account it has been recommended to mow down thistles, and other weeds, which are troublesome from their numerous increase, early in the spring; as many of them will then die, and the rest be much weakened by the sap-flow, which attends their wounds at that season. The rush may often be treated in this way with advantage."

It is likewise observed that "in respect to trees another period of sap-flow is said to exist, when the new buds are forming after Midsummer.

"Whence wounds at this season also must be injurious. Where this loss of sap-juice occurs in hot-houses, various applications have been recommended by gardeners. The writer suspects that a bit of sponge bound upon the end of the cut branch, or on the wound, by means of some elastic bandage, must be the most certain application; or a wire twisted round the end of the branch cut off, so tightly as to strangulate the whole circulation of juices, and consequently destroy the part above the ligature."

This may suggest to the farmer the mischief of suffering trees or hedge plants to be cut over or cropped at such periods.

SANF, a provincial term applied to the willow, or saflow.

SANFY, a provincial term signifying wet, as land in a rainy season.

SCAB, in *Farriery*, a contagious disease incident to sheep.

It is a cutaneous disease, somewhat like the itch. When mild and the cure attempted in time, washing with tobacco water will often remove it without risk. But sulphur ointment is a still more effectual remedy. However, when the disease is of a more virulent nature, the cure is often attempted by the application of the common blue ointment of the shops, which is composed of quicksilver and hogslard in the proportion of about two ounces of quicksilver to sixteen ounces of lard: a pound of the ointment thus prepared being sufficient for four sheep. The greatest caution should however be constantly taken in applying this ointment, especially with ewes that have lambs, as the latter are often liable to be destroyed by being salivated by it. The best mode of applying it, is very sparingly in sheds at four or five inches apart on the sides and back.

The following form has been advised by sir Joseph Banks: Take one pound of quicksilver, half a pound of Venice turpentine, half a pint of oil of turpentine, four pounds of hogslard: let them be rubbed in a mortar, till the quicksilver is thoroughly incorporated with the other ingredients. It should be applied along the back on the skin in two lines on each side, and in one down the shoulder and between the legs, and the operation should not be performed later than about Michaelmas.

But a more elaborate preparation has been proposed for the cure of this disorder, but which, perhaps, has little if any superiority.

"Take a gallon of soft well or pond water, which divide into two equal parts: in one of these parts dissolve eight ounces of old hard soap; to which when it is dissolved, add two ounces of spirits of hartshorn, and seven ounces of common salt, with four ounces of roll brimstone, beat to a fine powder and sifted; then take the other part of the water, in which put two ounces of tobacco leaf, and one of white hellebore root; boil this second part till you have a strong infusion, after which strain it clear from the leaves and roots." Afterwards "take that part of the water, first mentioned, and set it over the fire; let it boil for about half an hour, keeping it continually stirring with a wooden ladle during that time; in the mean time heat again the other part, in which the tobacco and hellebore were infused; and when it is hot, mix the two parts gradually together over the fire, keeping the mixture continually stirring till it is taken off the fire, which should be in about a quarter of an hour: when it is quite cold, let it be put into a stone bottle, in order to its being kept in a cool place for use.

"This liquor should be used with caution at first, but may afterwards be used more freely. It is best to apply it by shedding the wool on the back and other parts.

"These mixtures should be boiled in well glazed earthen or iron pots."

It is likewise a distemper in horses, often proceeding from their being over-heated.

SCABBARD, in *Horsemanship*, the membranaceous covering, or sheath of the horse.

SCABBED-*Heels*, in *Farriery*, the disease called also the *frush* or *running thrush*. See *Thrush*.

It has been found that sometimes the frush falls away by degrees, by reason of an eating scab which penetrates to the quick, and causes so great an itching that the horse cannot walk without halting; but these sores are not so dangerous as they are troublesome. And that before the horse grows lame, his feet will stink like old rotten cheese, so that you easily discover the nature of the complaint, as you cannot possibly come into the stable without smelling it; and besides the horse will sometimes beat the ground with his feet, by reason of the intenseness of the itching. In order to the cure, it is necessary to pare the frush as near as possible, with a buttress, after which the application of the following ointment may be useful in these cases: boil a pound of honey in a clean glazed pot, over a gentle fire, in a pint of aqua-vitæ, stirring it till the honey is thoroughly heated and incorporated with the liquor; then add verdigris, Venetian borax, and gall, of each two ounces, scarsed through a fine searse, with two ounces of white vitriol pounded.

Boil these all together over a small-coal fire, stirring them till they be well incorporated, and keep the ointment for use. The applications, in these cases, must be kept on with splents.

When the disease returns after the sore has been cleansed, the following ointment is advised:

Take of burnt alum and borax in fine powder, of each two ounces; white vitriol and verdigris, of each four ounces, very finely powdered;

Put these into a very clean pot, with two pounds of honey, and boil them over a clear fire, stirring all well together till they be well incorporated; when the ointment is cool, stir in two ounces of strong aqua-fortis; keep it well covered for use, and stir it once a day, for several days.

For preservation, the frush ought to be pared often and the place rubbed once or twice with the above water, then bathe the feet daily with the following water: boil alum and white vitriol, of each a pound and a half, in a gallon of water, till it be wasted to two quarts.

Or take of rectified spirits of wine, and the sharpest vinegar, each two ounces; tincture of myrrh and aloes, one ounce; of Ægyptic ointment, half an ounce; mix them well together.

After washing the part with this mixture, dip a pledgit of tow into it, and secure it in the best manner possible.

During the use of this, it will be necessary to give a purge once in six or eight days, and in the intermediate days the diuretic medicines proposed for the grease. See *Grease*.

SCALD, in *Farriery*, the effect of boiling water on a part. See *Burn*.

Scald-*Cream*, provincially cream raised by heat, or clouted cream.

SCALDING, in *Farriery*, a name given to some caustic remedies applied hot. A compendious way of curing the poll-evil, where there is an exceedingly bad disposition and a very great foulness, is mentioned by Gibson, as being that by scalding, as the farriers term it. Several, he asserts, have succeeded very well in it. The manner is this:

Take of Corrosive sublimate,
Verdigris in fine powder,
Blue vitriol, of each two drachms;
Green copperas, half an ounce;
Honey, or Ægyptiacum, two ounces;
Oil of turpentine,
Train oil, of each eight ounces;
Rectified spirit of wine, four ounces.

Mix these together in a pint bottle for use.

He adds that some "make their scalding mixture milder, by using red precipitate instead of sublimate, and white vitriol instead of the blue; others leave out the train oil, and use only oil of turpentine and linseed oil, which makes but little alteration; and some use the following with good success:

Take of Verdigris, half an ounce;
Train oil, half a pint;
Oil of turpentine, four ounces;
Oil of vitriol, two ounces.

Mix.

"The manner of scalding is, he says, first of all to clean the abscess very well, with a piece of sponge soaked in vinegar and squeezed. Then put a sufficient quantity of the mixture into a ladle with a spout, and when it is made scalding hot, pour it into the abscess, closing the lips together with one or more stitches in proportion to its size. This is to remain so for several days, and if good matter appears and not in an over-great quantity, it will soon do well without any other dressing besides bathing with spirit of wine. But if the matter begins to flow in great abundance, and of a thin viscid consistence, it will require to be scalded a second time or oftener, if the same disposition continue. The corrosive ingredients, whereof these liquid mixtures are compounded, would be harsh to human flesh, but agree very well with horses, whose fibres are more rigid, and therefore such sharp applications help greatly to contract the vessels. This method of proceeding is chiefly useful when the poll-evil happens to be the crisis of an acute fever, or when it happens to horses that have been surfeited, or under some other chronical disorder; for in all cases proceeding from common accidents, cleansing tinctures and fresh dressings will do the business."

Modern practitioners however reprobate this remedy on the ground of its cruelty, confining its use to extreme cases, where there exists in the parts a great degree of morbid insensibility.

SCALDERINGS, the under burnt core of stone-lime, the external parts of which peal or blister off, in scales or shells.

SCALDS, a provincial term used to signify such patches of land as are more apt to be burnt up in hot seasons, than other parts of the same land.

SCALE, to spread or scatter about manure, gravel, &c.

SCARCEMENT, a term signifying the small pedestal or off set, left in constructing earth fences, at the basis of them.

SCARIFIER, an implement somewhat of the hoe kind, made use of both on lands in the state of tillage and those under grass, when intended for the latter being somewhat differently constructed, and having frequently the names of sward cutters or dressers. See *Sward dresser*.

In the cultivation of tillage land, they have lately been found of considerable advantage for the purpose of working over, cutting up, breaking the earth and clearing it to a good depth. They are made in different forms and constructions to suit different uses, and have from seven to thirteen or more teeth fixed into wooden bulls, and which are sometimes furnished with a sort of triangular feet formed of thin iron, so as to be steeled, and kept quite sharp on the edges, which are five or six inches in length, and on each side; they are likewise in some cases provided with low wheels, but in others are wholly without them, and are of course less expensive in the construction

They have in general a pair of handles fixed on behind, by which they are directed in their working, being raised or depressed by the pressure of the hand. It is proper to have them so formed as to work to a good depth without being easily thrown out of the ground by such obstructing substances as they may meet with. It was formerly supposed that a great number of teeth were necessary, but it has been found by later experience that they work better where the teeth or hoes are fewer. The number should, however, perhaps be proportioned in some measure to the state of the land in respect to cleanness, cultivation and tenacity. The author of the Experienced Farmer has advised that where the land is foul from couch, sods, or any other cause, the number of teeth or hoes should be reduced to five or seven, two or three being placed in the fore bull, and four in the hindermost, increasing them to nine as the land becomes in a fine condition.

An implement of this sort advised by Mr. Parkinson in his work on Irish Farming, is seen at *fig.* 1. in *Plate* XXVII. A, the chain and hook to draw by. B, The wheel or roller to steady the scarifier and give any depth that may be required. C, The claw or teeth with screws and nuts to fasten them, that they may be taken out with ease if it be necessary to repair them or to increase or diminish their number. D, The handles by which to work the scarifier. *a*, The bolt passing through the two cross bars to let the roller up and down. *b*, The hammer and wrench to screw the nuts on the claw or teeth. *c. d. e.* The three bulls, the fore one having iron plates at each corner to strengthen them, and the two hinder ones iron plates at the top and bottom for strength also, and to keep the claw from wearing the holes wider than they ought to be. *f. g.* The two caps to keep the bulls together. *h. i.* The cross bars to strengthen the bulls and fix the roller in.

It is observed that the chain by which the scarifier is drawn, enables the person that holds it to work it better, than if it were drawn by a beam like a plough, and occasions also less draught by the power being nearer to the claws; the machine goes more freely than it would if some of the claws were in the fore bull, the sole use of that bull being to draw by. When the scarifier was made in a triangular form and with the same number of claws, it was apt to go on its head, or by raising the hindmost claws out of the ground to work frequently at one corner only. The claws are formed at the bottom with a point, so as to push a stone out of the way before the broad part can meet with any obstruction, which makes the machine cut with much greater ease. As to their width at the foot, they may be made to cut all the land more clearly than a plough if required, where thistles, fern, &c. grow, and the claw is so formed by its crooked direction as to raise every obstruction to the top, rock excepted.

And at *fig.* 2. is another implement of the same kind, formed purposely to scarify and hoe wheat on four furrow work. It is made from a double mould board foot hoe plough, and is the invention of the Rev. Mr. Priest of Scarning, Norfolk.

Upon the beam of this *hoe-plough* is fixed two scarifiers or hoes, as they are wanted. A. B. represents a part of the back of the beam of the plough. A. the head, and B. the tail. *c. e.* is a small iron bolt with a nut and screw at one end fixed into a cap upon the beam to be taken out at pleasure. At each end of this bolt is fixed a chain *c. d. e. f.* each two feet long and hooked to plates of iron, *d. g. f. h.* These plates *d. g. f. h.* are flat and 8½ inches long, 2½ inches broad, and moveable upon staples fastened into the beam. Upon the ends of these flat plates of iron are fixed two pieces of wood, *d. o. f. p.* parallelopipeds 2 feet 3 inches long, 2½ inches broad, and 2½ thick, moveable at *d.* and *f.* by hooks (upon the wood of the same breadth as the iron plates) and eyes upon the iron plates. The points *q.* and *r.* mark the distances to which the expanding mould boards are opened, viz. about 10 inches from one to the other.

At *m.* and *n.* distances beyond the points *q.* and *r.* are cut grooves through the wooden parallelopipeds for the scarifier and hoes to be fixed in.

k. l. is a flat piece of iron 3 feet long, 2 inches broad, and ½ an inch thick, passing through grooves in each parallelopiped, and in the grooves through which it passes are screws to fasten it. This iron does not communicate with the beam of the plough. At *s.* and *t.* points on each side the beam, are hung weights such as may be necessary to make the scarifier or hoes to do their work properly.

The scarifiers and hoes are nearly the same as those used upon all implements of this kind.

There are many other implements of this nature. Mr. Cook has invented a tillage scarifier which consists of a diagonal beam in which are fixed a number of narrow shares or hoes. This tool is capable of being wrought with broad triangular shares, when it has the title of a *scuffler*, and when the whole is complete with the different shares it is denominated a *cultivator*.

An useful tool of this kind has also been described with a figure in the Agricultural Report for the County of Suffolk, by the Rev. Mr. Lewis of Thorndon, who observes that "a Mr. Hayward, of Stoke Ash, in this neighbourhood, has invented a machine for destroying weeds, and clearing ploughed lands for seed, which, by the experience of four years, is found more effectual than any other instrument hitherto used for that purpose. Having lately the opportunity of speaking to Mr. Hayward concerning it, he enquired whether he would apply for a patent, or take any method to make it public? Upon his replying in the negative, he requested his permission to take a plan and description of it: which he has inclosed, and begs leave to submit it to the inspection of the Agricultural Society, as the speediest mode of introducing to universal practice an instrument so essentially serviceable to farmers. The extirpator, or the scalp plough, as it is generally termed, is drawn by two or three horses,

according to the quality of the soil, and the depth you put it to. The land should be once ploughed over, before this instrument be used. If it has laid a summer fallow, the usual way is to work it twice over with the extirpator, about two inches deep at the first, and about four inches deep, and crossways, at the second time, which, with running a harrow once over, will not only effectually destroy all weeds; but also render it very fine, and ready for the drill or sowing. Lands being ploughed in autumn, and intended for spring crops, are by this instrument prepared for seed better than any other method ever tried in this country. It will work in all lands, and may be handled by any person that knows how to manage a plough. It will easily plough one acre per hour, and not in the least distress the horses. A farmer assured me, that he could with three horses work up sixty acres per week with it; and that a person having the extirpator, may, with only three horses, farm as much land as would, without it, require six horses. It is not customary in this part of the country, he says, to work oxen, but he is confident it will answer the same purpose where oxen are used. It is advisable to work all lands that are over-run with weeds, twice over. Some lands may possibly require three times dressing. Some time should elapse, for the weeds that are cut to die, before it is ploughed a second time. It is now adopted by most farmers in this neighbourhood; and its great utility will be attested by every person that has used it. Many whose prejudice against every novelty induced them as first to ridicule the idea, are now as warm in praising it, and acknowledge it to be the greatest improvement in agriculture they have ever witnessed."

SCARIFICATION, in *Farriery*, an incision of the skin with a lancet, or such like instrument.

SCARIFICATOR, a name sometimes applied to a tool of the scarifying kind. See *Scarifier*.

Scarificator, in *Farriery*, an instrument used to scarify a part. It is very conveniently effected by a number of points set in a plane, which are all struck into the part at once.

SCARIFYING, the operation of working lands by means of scarifiers. In this way the ground when under tillage is broken down and reduced into fine order, as well as freed from root and other weeds, and the use of the plough rendered less necessary. It is an useful process in cases of the heavier sort of turnip soils, in rendering the surface, which has been acted upon by frosts in winter, fine and mellow in the spring for the sowing of barley or other grain crops, without having recourse to the plough, which in such cases, is apt to turn down the fine pulverized surface mould, and bring up the sterile clung bottom, and thereby afford a less favourable bed for the reception of the seed than was previously provided. The improved system in such instances is therefore to apply this practice in the place of ploughing. In this business the implements must be suited to the nature of the work and ridges. That of Mr. Cook with a cast iron beam, or any other that is heavy enough, may be employed, the horses walking only in the furrows without any trampling of the land. In this operation the earth should always be stirred to the full depth, that the plough has gone, whether it be four, five, or more inches. The mould is of course well loosened and broken. And in order to effect the work in a perfect manner, in some cases the operation may be required two or three times, especially where the land is of the more tenacious kind. Where the teeth or hoes are so fixed in the bulls of the tool that is made use of in the process, as to cut at certain distances in every direction, almost the whole of the soil may be stirred in the execution of the work.

In various cases, where lands have undergone one ploughing, they may be rendered afterwards perfectly fine and clean, by having recourse to proper scarifying. This is a sort of tillage, which has lately gained much ground in different arable districts, and which in various instances may save much, in rendering the more expensive practice of ploughing unnecessary.

The process of scarifying, or cutting over the surface of grass lands, has likewise been asserted to be a practice of considerable utility in the improvement of the sward of such sorts of land, particularly where they have manure applied immediately afterwards. See *Sward dresser*.

Scarifying-*Machine*, an implement made use of for the purpose of scarifying land. See *Scarifier*.

SCATCH-MOUTH, in *Horsemanship*, a bit mouth differing from a cannon-mouth in this, that the cannon-mouth is round, whereas the scatch-mouth is more oval. Commonly snaffles are scatch-mouths.

SCIATICA, in *Farriery*, a disease of the rheumatic kind in horses: to cure which, take half an ounce of oil of turpentine, and two ounces of camphorated spirits of wine, with which rub the part well, and let the horse have rest for a fortnight, and the complaint will mostly be removed. See *Rheumatism*.

SCIRRHUS, in *Farriery*, an induration of the glands, such as happens to the liver in many animals. It is one of the usual terminations of inflammation. According to Gibson it is a very hard swelling, sometimes entire, smooth, and without pain; sometimes divided into little knots and bundles, seated for the most part among the glands and kernels. See *Tumor*.

SCORE, a term signifying twenty pounds in speaking of the weight of cattle or swine.

SCORING, a provincial term signifying the glossing or making the furrow slice shine in ploughing or turning land up, by the plough acting as a trowel. Mr. Marshall says it is prevented by the use of a strong rope yarn round the mould board. It is sometimes written scowring.

SCOTCHES, a term signifying scores or notches.

SCOTCH FIR, a term sometimes applied to the common fir tree. *See* Pine.

SCOTS, a term sometimes applied to Scotch cattle.

SCOUR, in *Farriery*, a disease of the lax kind which frequently affects cows, calves, and other animals. See *Looseness*.

White-Scour, in *Farriery*, a disease in sheep of the more violent flux kind, supposed to originate in consequence of their feeding upon putrescent vegetable food, especially that of the shells of such turnips as have been left upon the feeding grounds. In these cases it has been advised to give two or three large spoonfulls of the following mixture every two or three days, the diseased sheep being separated from the rest of the flock.

Take of finely powdered and sifted bay salt, half a pound;
Old verjuice one pint;
Common gin half a pint;
Mix them well together.

And in order to facilitate the removal of the disease the sheep should be put upon good dry food.

Scouring *in Calves*, in *Farriery*, a disease to which they are very subject at an early period, being often caused by improper management in putting them too soon to the teat, or letting them remain too long at it. It is also sometimes caused by too frequently changing the milk.

In order to effect a cure it has been advised to restrict the calf in the quantity of its food, giving a hard boiled egg made fine by chopping in a drench, the first thing in the morning. Chalk powdered and mixed up with flower into balls with gin has also been recommended as useful and safe in these cases by a writer in Mr. Young's Annals of Agriculture.

SCOW, a term signifying the sheath of a horse.

SCOWER, in *Farriery*, a disease in sheep common in the winter season, being believed to originate from the severity of the frosts, especially when they set in suddenly or alternate frequently with thaws. The chief dependance for a cure in these is upon an expeditious change to dry keep, as in the practice of some good sheep farmers, the use of hay on the mornings when hoar frosts are prevalent, has been found a good preventive. It is sometimes called the *gall* by sheep farmers.

SCOWERING *in Cows*, in *Farriery*, a disease in these animals of the flux kind, in which there are frequent liquid dejections from the intestines proceeding from irritation, the excrements according to Downing being "slimy bilious or black, sometimes they are limpid and fluid like water cast out; at other times they are frothy, greasy, and mixed with a fat clayish substance. This disorder is generally attended with a bad appetite, a weak depressed pulse, harsh dry skin, dull countenance, and something of slow fever. This disease is so obvious that it needs no further description; for the copious evacuation of the excrements, and many other signs make it evident to the knowledge of every person."

He supposes that "the first stage of it is a companion of the *joint yellows*, and may be traced out to the satisfaction of any one who will take the trouble to open any animal that dies of this disorder."

According to others it affects oxen as well as cows, and arises either from want of sufficient food, both in quality and proportion, from being overheated or overworked, by feeding on wet unwholesome fog or after grass, by not being lodged in dry situations, sometimes from giving them too large a quantity of cut hay or straw hotter than their natural temperature; though it is sometimes a hereditary taint, and in cows is caused by their taking cold while calving. But whatever be the cause, as soon as it begins to appear it will be necessary to house the beast and put it to dry food, which, in early stages of the disease, often effects a cure.

In this case, Mr. Downing advises the following:

Take of Mutton suet, one pound;
Oil of turpentine, four ounces;

Boil these together in three quarts of milk till the suet is dissolved, and give it at night, milk warm, and the next morning give the following medicine:

Take pomegranate powder eight ounces; logwood in powder two ounces; new pipes pounded, two ounces; peruvian bark in powder two ounces; roch alum in powder six ounces.

Mix them together to be given in two quarts of old ale or urine and repeated every other day. The beast should fast two hours before and two after taking the medicine.

He afterwards has recourse to crab verjuice in the quantity of a pint for several mornings. And also the following:

Take calcined oyster shells in powder, four ounces; ditto pipe clay, one ounce; oak bark powder, two ounces; grains of paradise, one ounce; Roch alum, one ounce.

Mix these together for one dose to be given in a quart of old beer and a pint of red wine, or in three pints of oak dip from the tan pits.

Others advise half a pound of grossly pulverized tormentil root to be boiled in two quarts of water till reduced to one quart, then straining it off, and adding a quart of red wine, a quarter of a pound of finely powdered chalk or whiting, and two ounces of diascordium without honey. The mixture should be preserved in a bottle and occasionally well shaken together, making it lukewarm before it is given. The dose is half a pint, given three times in the day at equidistant periods.

Or half a pound of pulverized common chalk may be boiled in two quarts of water, till diminished to three pints, then adding four ounces of hartshorn shavings, and one ounce of cassia, stirring the whole carefully. When cold, two drachms of tincture of opium, and one pint of lime water may be added; the whole being kept closely stopped in a bottle, and well shaken before it is used: the dose is one or two horns ful in the day.

SCOWRING REMEDIES, in *Farriery*, the gentle evacuating medicines generally given to horses or other animals.

These are of several kinds, but the most gentle and natural is grass. See *Purging*.

SCRATCHES, in *Farriery*, a disease in horses,

of a varying kind, and distinguished by various names, as crepances, rat-tails, mules, kibes, pains, &c. being no other than the scratches, which are certain dry scabs, chops, or rifts, that occur between the heel and pastern-joints, and many times go above the pastern, to the hoof of the hinder-legs, and sometimes are upon all four legs, though this is not very common. Scratches in the heels have much affinity with the grease, and are often concomitants of it. See *Grease* and *Rat Tails*.

SCRAWLY, provincially signifying thin and ravelled as grain.

SCROPHULA, in *Farriery*, a swelling and obstruction of the limphatic glands sometimes affecting hogs.

SCREEN, a term sometimes applied to such belts, clumps, or hedges, as are planted with the view of affording shelter in exposed situations. And Mr. Marshall in his Landed Property considers the effect of such plantations, not "merely that of giving shelter to the animals lodging immediately beneath them; but likewise in breaking the uniform current of the wind,—shattering the cutting blasts, and throwing them into eddies: thus meliorating the air to some distance from them. And, moreover, he is of opinion, that living trees communicate a degree of actual warmth to the air which envelopes them. It is at least, he thinks, a probable truth that where there is life there is warmth;—not only in animal, but in vegetable nature. The severest frost rarely affects the sap of trees," it consequently appears to him, that trees and shrubs properly disposed, in a bleak situation, tend to improve the lands so situated, in a threefold way, for the purposes of agriculture: namely, by giving shelter to stock, by breaking the currents of winds, and by communicating a degree of warmth or softness to the air, in calmer weather or when the seasons are more mild.

It is suggested that "the proper disposal of screens in this intention is in lines across the most offensive winds, and in situations best calculated to break their force. Placed across valleys, dips, or more open plains in bleak exposures, they may, he supposes, be of singular use; and also on the ridges, as well as on the points, and hangs, of hills or other elevated places."

In regard to "the *width* of such screens, they ought generally, he thinks, to be regulated by the value of the land for agricultural uses, and the advantages of the situation for the sale and delivery of timber. In ordinary cases, it is conceived that from two to four statute poles, may mostly be considered as an eligible width," for such purposes.

With respect to the nature or "*species* of plants, which are the most suitable, they must constantly be adapted to the given soil and situation." Mr. Marshall thinks, that "in bleak and barren situations, the larch will generally be found the most profitable, as timber. But, being deciduous, it does not, in winter, when its services are most wanted, afford so much *shelter*, as the common fir. A skreen to shelter live stock, should be close at the bottom. It is, otherwise, he says, injurious rather than beneficial. Not only the blast acquires additional current, but snow is liable to be blown through, and to be lodged in drifts on the leeward side; to the annoyance and danger of sheep that have repaired to it, for shelter. A larch plantation margined with firs, and these headed at twelve or fifteen feet high, would, he supposes, afford the required shelter, for a length of years. The firs, thus treated, would be induced to throw out lateral boughs and feather to the ground: while the larches, in their more advanced state of growth, would by permitting the winter's winds to pass through the upper part of the screen, break the current and mellow the blast." And in this way a complete shelter be provided.

But in other "more genial situations, he says, the beech by retaining its leaves in winter, especially while it is young, forms a valuable skreen. And that if the outer margins were kept in a state of coppice wood, and cut alternately, and the middle ranks suffered to rise as timber trees, the triple purpose of skreen plantations might, he imagines, be had in an eminent degree, and almost in perpetuity," with but little trouble. And "in deep soiled, vale districts, which not unfrequently want shelter, skreens of oak might, he conceives, be managed in a similar way. And hollies, or other hardy evergreens, planted as underwood in groves of either of the above descriptions, would, if suitable situations were assigned them, he supposes, assist much in this intention;" especially where proper care was taken in planting and protecting them.

Screen *Fences*, such fences as are raised for the purpose of affording shelter from winds, storms, &c. Mr. Marshall suggests that "for the purpose of shelter to pasturing stock, a tall impervious fence is nearly equal to a depth of coppice wood, and infinitely preferable to an open grove of timber trees; besides its additional use as a fence," or means of inclosure.

He says, that "there appears to him to be only one *species* of fence which is properly adapted to this purpose; and which is that of the coppice mound hedge of Devonshire and South Wales:"—and which consists in a high wide bank or mound of earth, planted with coppice woods. This, he says, becomes, immediately on its erection, a shelter, and a guard, to pasture grounds," round which it is formed.

In respect to "the method of forming fences with this intention, it is, he says, that of carrying up long piles of earth, between two sod facings, "battering," or leaning somewhat inward, to the required height; and planting on the top, the roots and lower stems of coppice plants, gathered in woods or on waste grounds; or with nursery plants, adapted to the given situation. If the mound be carried to a full height, as five or six feet, and about that width at the top, and this be planted with strong plants, with stems cut off about two feet above the roots (in the usual practice of Devonshire) a sufficient fence is thus immediately formed against ordinary stock. But if the bank be lower, or if nursery plants be put in, a slight guard, run along the outer brink, on either side, and leaning outward, over the face of the mound, is, he observes,

required (especially against sheep) until the plants get up." But where a hedge of this kind is raised as a plantation fence, (especially on the lower side of a slope) the outer side only, he says, requires to be faced with sods; the hedge plants being set in a rough shelving bank, on the inner side" of the fence.

With respect to "the species of hedge-woods proper for mound fences, they depend entirely, he thinks, on the soil and situation. On mounds of bad soil, in a bleak situation, he has seen the furze, alone, affording much shelter, and a good fence. The sides being kept pruned, so as to show a close firm face rising above the top of the bank, it was a secure barrier, even against the wilder breeds of Welsh sheep. The beech is commonly planted in high-exposed situations. And in places more genial to the growth of wood, the hazel, the ash and the oak are the ordinary plants of hedge mounds. The willow tribe have a quality which recommends them, in situations where they will flourish: they grow freely from cuttings, or truncheons set in the ground; whereas to secure the growth of ordinary coppice woods, rooted plants are required. The sallow (*salix caprea*) will grow in high and dry situations" in a manner so as to be useful in this sort of business.

It may be further noticed in regard to this description of fences, he says, that "on thin soiled stoney surfaces tall mounds are difficult to raise; and, there, stone walls are not only built at a small expense, but are convenient receptacles for the stones with which the soil is encumbered. But a stone wall unless it be carried up to an inordinate height, at a great expense, is, he conceives, useless as a screen;—may be said to be dangerous as such in a bleak exposed situation, for, says he, as soon as the drifting snow has reached the top of the wall, on the windward side, it pours over it, and inevitably buries the sheep which may be seeking for shelter, on the leeward side." It is therefore conceived, that "it is necessary that a stone fence should be backed with a screen plantation," in order to render it more safe and effectual for the purpose.

These sorts of screens should be more attended to by the proprietors of land in all exposed situations, as they have much effect in promoting the improvement of different sorts of live stock in such exposures.

SCROTOCELE, in *Farriery*, a rupture of the scrotum.

SCRUPIN, in *Farriery*, the same as splent. See *Splent*.

SCUD, provincially to clear with a spade or spittle.

SCUFFLER, an implement of somewhat the same kind as the sacrifier, but which is mostly lighter and employed in working after it.

There are a great variety of these sorts of implements described in works on agriculture. The following have been found to perform the work well in actual practice.

At *fig.* 3. *plate* XXVII, is a tool of this sort invented by the Rev. Mr. Priest of Norfolk, and found highly useful in that district. It is described in the Agricultural Survey of the above county as being formed from a double-breasted foot plough, by taking off the breasts, and having a share larger and flatter than the original one made. To the end of the beam of the plough, a cross beam of wood, 3 feet long, 4 inches broad, and 4 inches thick, is fastened; and at the distance of $12\frac{1}{2}$ inches each way from the center of this cross beam, are inserted two coulters, each 12 inches long, 3 inches broad, and $\frac{3}{4}$ of an inch thick on the back, but reduced to 3-8ths in front; and into these coulters, at the bottom, are rivetted two shares, of nearly the same size as the first share, which was 9 inches broad, but these two only 8 inches. The cross-beam is strengthened by two iron reins, or bars, fixed to the cross-beam, and also to the beam of the plough, in the manner seen at *fig.* 4.

c d, a part of the beam of the plough.

a b, the cross-beam.

e g, *f h*, *m k*, *n l* } iron reins, or bars to strengthen the cross-beam.

The coulters which are fixed into the cross beam, do not stand perpendicularly; but inclining, as the coulter at the head of the plough: thus they are fixed into the cross-beam by a screw, *a b*, and a nut, *c d*. as seen at *fig.* 5.

The advantage of this scuffler above any that the inventor has seen is, that it is used with *two* horses only. It does the work of more than two ploughs, as the three shares cut nearly the width of 30 inches, whereas two ploughs would cut only 24 inches. It is used on farms which consist of heavy land, as well as land of a mixed soil.

At *fig.* 6, is a profile of the scuffle recommended by Mr. Amos, with its appendages. A A represents the wheels on which it is carried from one field to another, and by which the depth of working is regulated. These wheels turn round upon their axles, and also upon the under end of the upright shank in imitation of bedcastors. B. represents the middle beams to which the horses are fixed; C. the side beams; D. D. D. the shank of the shares fixed in the beams by nuts and screws. They are fifteen inches long below the beams made of iron, one inch and a half, by half an inch square. E. E. E. the shares rivetted on their shanks. F, the handles for managing the machine, about four feet three inches long.

And at *fig.* 7 is a horizontal view of the scuffle A. A. A. represent the mortise holes that receive the shanks of the wheels; B. the middle beam, about six feet nine inches long and five by four inches square; C. C. the two side beams, which are about five feet long, and four inches square; E. E. E. E. E. are five shares in the form of an isosceles triangle, the hind side of which is nine inches long and the other two sides are each twelve inches, so disposed as to cut forty-five inches clear; F. F. the handles which govern the machine; G. a bar four in-

ches square, for bracing the machine together and for receiving the shanks of the hind wheels; H. another bar, three by four inches square; I. I. the hind wheels ten inches diameter.

This implement is said to be of great utility in cleaning bean and pea stubbles, in order to their being sown with wheat. And it is very advantageous in destroying weeds upon fallows, where ploughing might be injurious either on account of the land being too moist or very light in its quality.

It is likewise admirably adapted to the cleaning of land that has been sown with the garden pea, in order to its being ploughed, harrowed, rolled and drilled with turnips or rape seed, in the latter end of summer at the beginning of August.

With this tool it is asserted that one man and two horses are capable of scuffling six or eight acres per day. It is advised that after the land is scuffled over it should be harrowed twice or three times in a place, and the weeds collected and destroyed.

It has been made an objection to these sorts of tools with some, that they cannot be made to operate in a beneficial manner, except where the land has been previously brought into a fine condition and rendered clear of weeds. These as well as scarifying implements are likewise liable to objection from their being subject to clog much when the lands are wet.

A tool of this sort has however been employed in the midland districts, which is said to be in a great measure free from the last objection. It has been recommended by Mr. Bower. In this tool, by the teeth being only twelve inches from each other, and their intersecting, that distance is reduced to six inches, where the breadth of the shares from being full three inches afford another reduction, which brings them so near together, that the land is almost wholly broken and reduced, and the intention of a ploughing as well as a harrowing accomplished at once without cutting the roots of the couch grass in two, which is a great superiority that it possesses over the plough. And from the teeth bending forward and having that kind of position, the roots are brought to the top more perfectly, which is another superiority over the plough. It has also much superiority in the dispatch of work, four horses and a man being able to finish six acres or more of land of a sandy quality in the course of a day.

The following are the dimensions of this tool, which is seen at *fig.* 8, in *plate* L. of the first volume: The length of the first bull from A to B, is four feet and an half. And the length of the second bull, from C to D, three feet nine inches; from A to C, is sixteen inches. The teeth are two feet in length, and bent near the bottom in order that it may lie flat on the earth. The length of the beam from E to F is six feet. And the length of the iron axle tree, for the small wheels, is one foot and an half. The length of the iron, that shifts through the beam, from I to K, and fastens with a screw at L, is two feet.

SCUM *of Sugar*, a substance sometimes used as a manure. See *Sugar Scum.*

SCUR, a precipice faced with rock.

SCROGS, a term provincially applied to such stunted shrubs, as have been browzed upon by cattle, as hazel, &c.

SCUTTLE, the name of a shallow basket or sort of wicker bowl much used in the barn and for other purposes. The large ones have handles, but the small ones are without them.

SEAL-HAIR, a substance made use of as a manure in the way of top dressing in combination with rabbits' dung and lime, but can seldom be provided in any sufficiently large quantity, nor is it found very beneficial for the purpose.

SEAM, a horse load or three hundred weights.

SCYTHE, sithe, or sythe, the implement used in mowing, being a crooked blade joined at right-angles to a long pole or handle. See *Mowing.*

SEA-OUSE, a rich sort of mud or deposition raised from the sea shores in different parts of the kingdom, and which has been found in many cases of much use as a manure. It might probably be found good in many situations on the sea coasts where it has not yet been thought of by the farmer. As there can however be no doubt of its possessing a highly enriching property, it should be diligently provided in all places where it can be had.

It is stated in the Norfolk Agricultural Survey, that Mr. Palgrave at Coltershal, uses much sea mud scraped up by the *bear* from the bottom of Yarmouth Haven. He lays on 40 loads per acre, and has thus manured 70 acres; the improvement very great. It was found on trial that it is a calcareous mud; on scalds or burning places, and sand or gravel, it forms a cold bottom, and is an effectual cure.

Fifty loads per acre of sea ouse have been used on the upland loams of Warham with very great success; superior crops the consequence.

And another substance may be considered under this head, though in the above Survey it has been described under that of sea weed, which it does not seem so properly to belong to. It is found "on the coast at Thornham, being marked in Mr. Faden's map of the county for what is termed *crabs, scalps and oak roots.* It is stated by the writer on examining it, to be obviously the ruins of a forest of large trees, the stubs and roots remaining, but in such a state of decay, that with a spade he dug into the centre of many, and might have done of all, with as much facility as into a mass of butter. Where the stumps are not found on digging, a black mass of vegetable fibres, apparently consisting of decayed branches, leaves, rushes, flags, &c. is turned up: to what depth this vegetable stratum extends has not been ascertained, but at some creeks on the very edge of the sea at low water, there is a very fine soapy sea ouze at two or three feet depth: the extent of this once sylvan region, which every common tide now covers, can scarcely be less, in one place only, than from 5 to 600 acres. There is not an appearance of any tree lying at present from the stump, as if blown down or left after falling, but rather that of a forest cut down in haste, the stems cleared and hurried away, leaving the branches to rot; but this

is mere conjecture. It is remarkable that there is not, as he is informed, any mention of this ruined forest in the old historians of the county; nor does tradition offer the least conjecture or report on the subject. Trees, roots, and stumps, are very common in bogs, wherever found; but here is not the trace of any thing like a bog, the earth is solid, and all a fine ouze or sea-clay." It is added that "Mr. Rishton viewed these relics with the eye of a farmer; for experiment, he sent his carts down for some, and spread 10 loads per acre of it, for turnips; it answered perfectly, and on comparison, equalled his yard-dung, and also rape-cake. In another experiment, he manured two acres for wheat, with a compost, consisting of nine loads of this weed, (or ouze) and three chaldrons of lime, mixed, one acre with yard-muck; one acre with tallow-chandler's graves, 16 bushels, and the rest of the piece with rape-cake; the graves were, in effect, far beyond all the rest; between which the difference was not very perceptible. The expense only 1s. per load: but if a barge was floated to the spot, and anchored when the tide was in, for loading at low water, it might be procured at a much cheaper rate."

It is suggested that this ingenious cultivator "has opened a real mine to such farmers as shall have the sagacity to dig in it: it appears astonishing, he thinks, that none of them should long ago have made the same experiment, and consequently have profited by so beneficial a vicinity."

By proper examination other situations might be found to afford substances that might prove useful as manures.

SEA-SALT, a saline substance sometimes made use of as a manure; and also as a condiment for animals. See *Salt*.

Sea-SAND, that sort of sand which is thrown up in the creeks and other places on the coasts of the sea, and which is often very useful as a manure.

It is remarked in the Agricultural Survey of the North Riding of Yorkshire, that in many cases in the vicinity of the sea, use has been made of sea sand as a manure with constant success, and that for the districts of Cleaveland, and the coast where the wet adhesive clays want draining and breaking, and in most parts of which it might be easily procured it would be equally useful. It is supposed to be there disregarded in consequence of its great plenty and being capable of being provided without expense. See *Sand*.

Sea-SHELLS, such as are dug from the creeks and bays on the sea coast. See *Shells*.

The great use of marine sheils is still more shown in the following passage in the Statistical Account of the parish of Kirkmabreck, in Galloway. "The principal manure used for improving land is sea-shells, of which there is an almost inexhaustible quantity, not only within the high-water mark on this side of Wigton Bay, but also in the dry land, several hundred yards from the shore. These shells are sold at fivepence per ton, 25 of which is sufficient for an acre; and prove a cheap and excellent manure, preferable to either lime or marl. Many thousand ton of these shells are annually carried (by vessels constantly employed in the business) all round the coast, and sometimes even to the Isle of Man. These shells have been used with great advantage for the improvement of barren heathy land, insomuch, that many hundreds of acres in this parish, originally not worth more than 2*s*. per acre, have been made worth 10*s*. to 15*s*. per acre. Yet this, like every other advantage that is easily attained, is not duly prized: for upwards of 1000 acres in this parish, though capable of cultivation, lie in a state of nature, covered with heath, and almost good for nothing. A little calculation might serve to show landlords that on nothing could they lay out their money to so much advantage. As for a tenant, where he has only a lease for 19 years, and perhaps his encouragement not great otherwise, it cannot be expected he should do much in the cultivation of barren land. The tenant, however, might well lay these shells on land already cultivated."

This hint should be duly attended to by the cultivators of such lands in situations where such manures can be readily provided.

It is observed that "in Loch Tarbert there is an immense number of oyster-shells, almost unmixed with any sand, when the thin stratum above them is removed: the extent of this astonishing mass of shells is unknown, but it is probable it can never be exhausted. A vast tract of improveable moorish land in the neighbourhood may some time or other show that Providence did not place this fund of manure in vain so near it. For such moorish heathy ground, these sea-shells are the fittest manure, but their use ought not to be confined to it. In order to make the carriage lighter and the effect the quicker, perhaps it would be worth while to burn them first, as is sometimes done to marl. The kiln might be made with one or two eyes, running into it about half way at the bottom with some flags or stones, rudely arched over them, the kiln then filled with shells and fed with fire for a day or two as might be found necessary.

"Lime is burned in this way in the space of from two or three days, and shells already in a mouldering state, would take much less both of time and fuel. The operation would not be hindered by the tides, as these shells are found also under the surface beyond the sea mark.

"Stratums of these oyster-shells are also to be found at the head of Loch Caoles port; but there (so slow is the progress of the improvement!) they have not yet begun, the writer says, to use them as manure: probably the time, says he, is not distant when these shells will become an article of commerce, and be carried at least along all the shores of Kintyre."

And it is stated by the author of the Agricultural Report of Norfolk, that "in East Winch and West Bilney, and scattered for ten miles to Wallington, there is a remarkable bed of oyster-shells in sea-mud: the farmers use them at the rate of 10 loads an acre for turnips, which are a very good dressing;

they are of particular efficacy on land worn out by corn. Mr. Foster several years ago, he says, laid 20 loads an acre on some worn-out land, and they had an amazing effect in producing grass, when laid down in seeds, giving a deep luxuriant hue like good dung: the benefit very great at the present time. They are found within two feet of the surface, and as deep as they have dug, water having stopped them at 16 or 18 feet deep. They are used again and again on the same land, and with the same effect. At East Winch, Mr. Crowe, he adds, has acres together of this most valuable manure. They fall to powder on being stirred.

SEA-WARE, a term frequently applied to the weed thrown up by the sea in many situations, and which is collected and made use of as a manure and for other purposes. It is the *quircus marina*, and has often the names of sea wreck, sea tangle, &c.

SEA-WATER, that which is brought by the sea, and much impregnated by saline matters. It is suggested in the Argyleshire Agricultural Survey, that as it is known that salt is beneficial as a manure, sea water, which is found to contain it, in the proportion of about a bushel to a ton, may also be recommended in the same view. And that from its promoting putrefaction, it may be applied to peat earth, dung heaps, and composts, with much advantage.

SEA-WEED, the wreck or weed thrown up by the water on the sea coasts, and sometimes cut from their sides. It is the plant known by the name of *quircus marina*.

It is a material much used as manure in some districts, as those of Kent, and the northern counties, as well as in the islands of Jersey and Guernsey. It is found to become tender and easily reduced by remaining some time in heaps, and taking on the process of fermentation. It is strongly impregnated with saline matters, and of course proves a beneficial application for land.

It was found in the practice of Mr. Rudd in Yorkshire to answer well in composition with kelp, ashes, slam from the alum works, and lime, the whole being mixed up with earth. But in many places it is made use of in its simple state after having undergone a degree of fermentation, or after being incorporated with yard dung.

In the Agricultural Survey of Argyleshire it is stated that "along all the coasts it is much used as a manure, though not always valued as much as it ought. Its effect is not so lasting as that of dung, nor is it so great when laid on in winter as in April or May, when it is riper and more impregnated with salts. What comes ashore during summer after the ground is sown, the more careful farmers gather into heaps or spread on lay grounds. In either way it turns to little account. Much of the heaps melts away, and much of what is spread dries and shrivels to nothing. If mixed with earth, moss, fern, weeds, &c. in a compost, it would produce a quick and strong fermentation, and all its juices would be preserved. This is the way to make the most of this great gift of Providence, and the farmer and cottager both should thus increase their store of manure."

In the above islands, where this weed has been long employed, it is cut twice in the year, the first cutting in February or March, being applied as a manure on the pasture grounds, nursery lands, and those sown with barley. It is used in the proportion of two cart loads weighing two thousand pounds each, with six carts of stable dung, to a 1000 feet square. The second cutting, which is performed in July, is laid to dry on the sea shore, and afterwards made use of as fuel; the ashes of which is found an admirable manure especially on stiff land. It is spread over the surface of the land in the winter season or early in the spring, in the proportion of about half a bushel to the perch. It is said to have a great effect in giving a full ear to the grain, and to prevent its being laid.

It has not been ascertained upon what sorts of land the weed in its simple state has the most effect. It is found to afford great vigour of growth to plants in all kinds. It has generally been supposed to have little effect beyond the immediate crop; but when duly blended and incorporated with other proper earthy or other materials, it has been found to be more lasting in its effects. See *Manure*.

SEAGRIM. See *Ragwort*.

SEAM, a term applied to tallow, grease, hogs-lard, &c.

Seam *of Corn*, a quarter, or eight bushels.

Seam *of Wood*, a horse load of wood.

SEAR, a term applied to dry wood in opposition to green.

SEARCHER, an implement used for boring. See *Borer*.

SEARCHING, the operation of boring or sinking into the bowels of the earth for the discovery of the different materials which it may contain. For the detection of marles or other similar substances, the use of the borer may be sufficient. But where difficulties arise in performing it in this way from the obstruction of stones, &c. a narrow shaft such as a well may, Mr. Marshall says, be carried down, without much expense, to the depths at which it can be wrought with advantage. See *Borer* and *Marle*.

SEAVES, a term used to signify rushes, especially the soft rush.

SEAVY GROUND, such ground as is over-run with rushes.

SEED, the product of a plant, whereby the species is propagated, upon its being sown or put into the earth.

The choice of the seed intended to be sown is an object of greater importance than many farmers seem to imagine. It is not sufficient that the finest grain be chosen for this purpose, unless it be likewise clean from weeds.

In procuring seed it should be a rule with the farmer to purchase or reserve such as is the most full, plump, sound, and healthy, whatever the sort may be, as it is perhaps only in this way that crops of good corn can be ensured. And this practice is still more obvious from the circumstance of its being in some measure the same with plants as with animals, that the produce is in a degree similar to that from which it originated. It is not, however, merely on this principle that such grain as is small, shrivelled up and

imperfectly fed, should be rejected as improper for seed, but as containing a smaller proportion of farinaceous matter, and being thereby less proper for affording that degree of nourishment which is necessary to the young plants during the period of the first stage of their growth. Where shrivelled up and imperfectly ripened seed is sown, in general but a little of it vegetates, and that which does mostly sends forth plants of a weak and feeble kind that afford only a lean and steely sort of crop.

Besides, there are other circumstances which ought to be taken into the account in providing of seed corn; such as that it be new and recently threshed from the straw, and that the skin be clean and thin; for, it is found that grain which is fresh and only just threshed out, is in a much more proper state for quick vegetation than such as has been long kept, consequently less liable to perish in bad seasons; and that where the rind or skin is of a bright colour and thin, a much larger proportion of fine farinaceous or mealy matter is yielded from the same quantity of grain, which renders it of course more valuable to the cultivator. This is particularly the case in wheat, and the same thing probably takes place in other sorts of corn.

The author of the Synopsis of Husbandry has shown by some experiments, that wheat after being kept six or seven years, though there may not be any perceptible difference in its appearance from such as is new, is wholly unfit for being made use of as seed, on account of only a small portion of it being capable of vegetating, a circumstance that may probably in many cases be owing to the grain being more disposed under such conditions to take on the putrefactive fermentation or become rotten, than to the absorption of oxygen, which is believed to be essential to the process of vegetation in the early stage, as stated by Mr. Gough in the Manchester Transactions; and besides this effect, where the moisture and juice of the grain is much taken away, as is the case in keeping it for a great length of time, the plants that are produced from it, may even be less vigorous and luxuriant, as happens in gardening to some kinds of seeds, as that of the melon, which is frequently kept for several years in order to effect this purpose in a more perfect manner.

It must be evident that on these principles, grain, in order to secure its most perfect vegetation, should not be placed too much out of the influence of the atmospheric air, and that the bed of mould or earth in which it is deposited be in as fine a powdery state as possible, as under such circumstances the air is more uniformly admitted, and the seed from being in a more equal temperature and more equably supplied with moisture is exposed in the most favourable circumstances to the combined effects of the causes that have been found to promote the sprouting, growth, and prosperity of the young corn plant, as has been fully shown by Mr. Gough in his excellent paper on the vegetation of seeds.

There should likewise be a constant attention that no such grain as is in any way diseased should ever be made use of as seed corn. As the sowing of this sort of seed, though it may have been advised by some cultivators who have not been sufficiently cautious, or who have placed too much confidence on the efficacy of *steeps*, as they can only disappoint the views and hopes of the farmer by propagating more widely such maladies, or producing scanty crops of good grain.

Many different methods have been pursued in the view of securing such grain as is healthy and proper for the purpose of sowing; but that which is the most readily executed is probably that of selecting from among the corn plants while they are growing in the fields, as in this way an opportunity is afforded of choosing such heads or ears of the plants of different kinds as are the most perfect, the most forward and most vigorous in their growth, and which contain such seeds as are the most plump and full and the best ripened. These benefits or advantages may likewise in some measure be attained in the most valuable sorts of grain by having them picked over by hand after being threshed out; but this is a tedious practice, and not so certain of having the seed from the most healthy and best ripened plants, as the above and some others.

Therefore, to have the most perfect sorts of seed, and at the same time the most healthy and proper for vegetation, the most vigorous plants should be selected, as well as such as are the most forward and early in respect to the season, and that these while they are growing be so preserved that they may not be injured by having weaker plants of the same kinds near them; as the art of having good seeds does not, it is contended by an experienced farmer, depend so much upon obtaining new seeds from places at a considerable distance, as upon collecting and reserving the best seeds or roots of our own production. Dr. Priestley, in a paper in the first volume of Communications to the Board of Agriculture, has remarked that this method of practice has been had recourse to in consequence of its having been found that, though vegetables of all kinds are extremely liable to changes in respect to the times of their maturation or ripening and other properties, the best seeds never fail to produce the best plants. It is likewise remarked in addition that in the preserving of seed grain, by collecting it in the ears from the stacks or sheaves, there may however be disadvantages in the way of lessening the produce by choosing the largest ears, which have rarely more than one upon a stalk, and by taking such as become ripe at different periods.

Many different modes have been proposed for ascertaining the goodness of grain or seed corn; but the farmer generally depends upon the appearances that it exhibits, preferring such as is full, plump and well fed, and that has a certain brightness and clearness, without any shrivelling or shrinking in the husk or external covering. But it may perhaps be ascertained with greater accuracy by other means, as the weighing of a certain measure or quantity: and from its being well known that grain or seeds on being immersed in fluids leave the more light and imperfect floating on the surface, while the better and more perfect sink to the bottom; solutions well saturated with saline substances, from their gravity being much

increased become useful in ascertaining the goodness of the corns, as none but such as are perfectly sound sink in them. And the author of the Philosophy of Gardening conceives that the weight of a given measure of grain may also be a tolerably certain method of discovering the quantity of husk or bean contained in it compared with a quantity of flour: as that grain which is cut too early, or which is otherwise not quite ripe, as happens in wet seasons, shrinks in the barn or granary and becomes wrinkled, and has thus a greater proportion of skin or bran than that which has been more perfectly ripened, and weighs lighter in proportion to its bulk.

And another method which he supposes may be had recourse to in order to distinguish light from heavy grain is, that in winnowing, as the surfaces of light grains from their being greater in proportion to their solid contents may be carried further by the current of air afforded in the operation, of course in passing them through a screen the heavy grains may be liable to run further out on the floor from their being more propelled by their greater gravity, without the resistance of the air on their surfaces being increased, and be consequently more proper for seed corn. See *Change of Seed.*

But a very different notion to the above, is entertained by Sir Joseph Banks, though we do not find it supported by the test of experiment in the field. The result of a single trial made under the circumstance of a hot house can never be satisfactory to the farmer. He thinks that although the seeds of wheat may be rendered by the exhausting power of a fungus "so lean and shrivelled, that scarce any flour fit for the manufacture of bread can be obtained by grinding them, these very seeds will, except in the very worst cases, answer the purpose of seed corn as well as the fairest and plumpest sample that can be obtained, and in some respects better; for as a bushel of much blighted corn will contain one third at least more grains in number than a bushel of plump corn, three bushels of such corn will go as far in sowing land as four bushels of large grain."

"The use of the flour of corn in furthering the process of vegetation, is to nourish the minute plant from the time of its developement till its roots are able to attract food from the manured earth; for this purpose one tenth of the contents of a grain of good wheat is more than sufficient. The quantity of flour in wheat has been increased by culture and management calculated to improve its qualities for the benefit of mankind, in the same proportion as the pulp of apples and pears has been increased by the same means above what is found on the wildings and crabs in the hedges."

And that though "it is customary to set aside or to purchase for seed corn, the boldest and plumpest samples that can be obtained, that is those that contain the most flour, this is unnecessary waste of human subsistence: the smallest grains, such as are sifted out before the wheat is carried to market, and either consumed in the farmer's family or given to his poultry, will be found by experience to answer the purpose of propagating the sort from whence they sprung as effectually as the largest.

"Every ear of wheat is composed of a number of cups placed alternately on each side of the straw; the lower ones contain according to circumstances three or four grains nearly equal in size; but towards the top of the ear, where the quantity of nutriment is diminished by the more ample supply of those cups that are nearer the root, the third or fourth grain in a cup is frequently defrauded of its proportion, and become shrivelled and small. These small grains, which are rejected by the miller because they do not contain flour enough for his purpose, have nevertheless an ample abundance for all purposes of vegetation, and as fully partake of the sap (or blood as we should call it in animals) of the kind which produced them, as the fairest and fullest grain that can be obtained from the bottoms of the lower cups by the wasteful process of beating the sheaves."

However the further more numerous experiments have established this doctrine, the best practice of the farmer, is probably to take care to have good well ripened grain, clear from all adulteration of seeds of the weed kind; without any blackness about the extremities of the grains, being free from that dark brown colour that indicates its having heated too much in the stack; and that it have no signs of mouldiness from being badly secured, or of shrinking from being cut in too green a state.

It has also been lately suggested by M. Leori, who has been engaged in many interesting experiments on the subject, not by any means to procure seed grain from a soil north of that on which it is to be sown, but from a district south of it; as he considers it a general rule, that the product of seed improves in going from the south to the north, but decreases in virtue in passing from north to the south.

With respect to the proportion of seed that may be proper to be sown on different soils and situations, attention will not only be necessary to their peculiar nature, and to the periods of sowing or putting the sed into the ground, but also to the nature of the season and the mode in which the sowing is executed in it. For crops in general the strong, wet and stiffer sorts of land will demand a larger quantity of seed than such as are more mellow, thin and light; of course strong wet loams and stiff retentive clays must require more seed than light mellow loams and sandy gravelly or even thin chalky lands. But where lands of the rich loamy kinds have been well reduced and broken down by the operations of tillage, it is observed that "if the seed be not sown in too great a proportion, an opportunity is afforded for the plants tillering or spreading themselves from the roots, many stems often issuing from the same root in consequence of which the crops frequently become, even when thinly sown, extremely thick upon the ground; and from the great nutritive power of rich soils, or what is mostly termed strength by the farmers, would be greatly too much so, if a large proportion of seed were at first put in." And that "in the case of root crops, whether such as are formed

upon or within the soil, where such lands are in a sufficiently mellow and friable state for producing them, the seeds or sets should not on the same account be sown or put in, in too great a quantity or too thickly." While in the strong, stiff, wet, retentive soils, from the plants seldom striking, or branching off much from the roots, except in particularly favourable circumstances of season, a much greater proportion of seed will be necessary in order to secure such full crops as lands of this kind are capable of supporting" and bringing to maturity.

Where the soils are light and thin, a less quantity of seed will be sufficient, according to Mr. Donaldson; as if a large proportion be put into such kinds of ground, from their possessing much less strength the crops will rarely, except in particular seasons, be well formed in the ear, or have the grain plump and well fed. It is likewise a practice in the best grain districts, on all sorts of land to sow smaller proportions of seed on lands of the same quality, in the early periods of the seed time, than in those of the later. The reason of this, according to the above writer, is "that grain sown early in the season takes deeper root and has more time to branch out additional shoots than that which is later sown, which, when the soil is not very free as well as fertile, generally runs up into one single stalk, so that if a liberal quantity of seed be not allowed, the crop, however luxuriant in respect to the plants, must be scanty in the article of grain or produce." And for this there may also be other reasons, as "where the seed is put in at a late period, especially in the spring, it will not have time fully to establish itself in the soil before it becomes retarded by the hot and dry summer weather, unless a large quantity of seed be employed so as to afford protection by the closeness of the growth of the plants. And in the late autumnal sowings, the grain may not become well fixed and rooted in the soil before the frosts begin to affect them; and on that account a larger proportion of seed be required than under other circumstances would be necessary." Something may likewise depend on the state of the weather in sowing or putting seed into the ground; "as where the season is very dry and there is but a small proportion of moisture in the soil, more of the seed may fail in vegetating, than where the contrary is the case; which also shows the propriety of steeping and putting in the seed in such dry seasons immediately after the plough" has performed its work.

It must likewise vary according to the manner in which it is deposited in the earth; as where the grain is scattered over the whole of the land, in some measure at random, as in the common broadcast method of sowing, a much larger proportion of seed must be sown, than where the grains are deposited with equality and exactness, but only on certain portions of the land, as in drilling and dibbling. And as some disadvantage may attend the first method in respect to the vegetation of the seed, a larger proportion may also be requisite on that account. It is consequently evident, that the quantity of seed must vary according to different circumstances, and that it is a matter of much difficulty to fix upon any proportion that may be suitable to all the circumstances and sorts of soil.

It is however commonly supposed that from two and a half, to three and a half bushels to the acre may be the proportion that may be the most proper both in the spring and autumn sowings. Mr. Middleton has suggested, that for sowing wheat broadcast about the latter end of September, two bushels and a half is the most advantageous quantity on soils of a medium quality; but that for every fortnight later, four quarts of seed should be added to that proportion. But the tabular view of the proportions that have been found to answer well in practice in an extensive midland district, on soils of different qualities, may afford a more satisfactory notion of the nature of seeding soils of different kinds.

We shall before this, however, show the quantities in use in a great southern grain district with wheat.

In Norfolk, in the practice of the best farmers, the proportions of seed wheat usually made use of, according to the late survey of that district, are about Watton when dibbled six or seven pecks, in the practice of some; but with others, when sown before Michaelmas two bushels, afterwards two and an half.

Near Durham, the quantity is four bushels broadcast, and when dibbled from ten pecks to three bushels. At Wissen ten pecks dibbled and three bushels broadcast; and at East Bilney, and the adjoining parishes, only from two and an half to three.

In the practice of Mr. Henry Blythe of Burnham, seven or eight pecks are drilled per acre; but the common quantity broadcast from ten to twelve.

In the clays of Marshland, from five to six pecks are sown broadcast. And about Wymondham they dibble in from six to eight pecks, but in the broadcast method sow three bushels.

In some situations they complain of loss from too thin a plant in this sort of crop.

TABLE OF PROPORTIONS OF SEED ON DIFFERENT SOILS.

Kinds of soil.	Wheat.		Barley.		Oats.		Beans.	
	Seed bush	Crop qrs.	Seed bush	Crop qrs.	Seed bush	Crop qrs.	Seed bush	Crop qrs.
Rich newly broken up common land.	—	5	—	—	—	10½		
	—	—	—	—	—	9		
	2½	4	—	—	6	7		
	—	4½	—	—	—	8	—	4½
	3	3½	3	5	5	6	4	5½
	3	2½	4	4½	7	5		
	—	—	—	3	—	4		
Middling land.	3	—	4½	4				
	3	3	4	3½	5	4		
	3	2¾	3	4				
	2½	3	4	5				
Newly inclosed land.	2¼	3	4	4	4	5	3½	4
	—	5	—	—	—	—	—	4
	2½	3	4	4	—	—	4	3
	—	4						
Newly inclosed land.	3½	4	4	4½	—	—	3	4½
	4	—	—	—	7	—	4	5
	—	—	—	—	—	10		
	3	3						
	3	5	4	6	—	7	—	5
Wold land.	3¾	2½	4	4	7	5	3	3
	—	—	4	5	—	—	4½	3
	2½	3	4	3	7½	4	4½	3½
	—	—	—	—	—	10		
Marsh land.	3	—	5	—	7	—	5	
	3½	3	5	4	8	5½		
	3½	4	4	5½	5½	7½		
	—	3½	—	—	—	—	—	3
Clay and marsh land.	—	2½						
	2½	3½	—	—	5	7½	4	3½
	3½	2½	4	3¾	5	5		
	2	3	2	4½	4	8		
	3	3	4	3½	6			
	—	—	—	2½	—	4		
	4	5	4	6				
	3½	3	4	4½	6	5		
	2½	3	4	4	6	5		
Strong land.	3	3¾	3¾	4¾	—	—	2	4¾
	2½	3½	3	4½	6	6		
	2¼	3¼	3	4½	6	5	2¾	4
Average.	3	3½	3¾	4⅓	6	6½	3¾	3¾

However, the exact proportion of seed that may be required under different states and circumstances of lands, in order to afford the most full and productive crops, cannot by any means be ascertained, much constantly depending on the judgment of the seedsman, who must always decide in respect to the necessary proportion for the particular circumstance, having a due regard to the nature and quality of his seed, as well as the time and manner in which it is put into the ground. See *Sowing*.

The quantities or proportions of seed that are most commonly made use of in all the different sorts of field crops, are mentioned under the particular heads to which they belong.

SEEDS, a term applied to young grasses, or lands newly laid to grass.

SEED-*Furrow*, the furrow or ploughing on which the seed is sown or put in. It is usual in the last ploughing before sowing to have the furrow less turned than in other cases. See *Ploughing*.

SEED-*Grass*, a term used to signify cultivated herbage or grass raised in opposition to natural grass.

SEEDNESS, provincially used for seed time.

SEED-*Seam*, the interstice between two plats as left by the plough. Also the channels made by floating, drilling, &c.

SEED-*Lip*, a sort of basket, in which the sower carries his seed, in order to sow it. It is sometimes written *seed-leap*, or *seed-lop*.

SEED-*Weeds*, such weeds as arise from the sowing of their seeds, and do not propagate themselves by the roots. See *Weeds*.

SEEL, a term provincially applied to time or season in respect to crops, as, hay seel, or hay time, and barley seel, or barley seed time, bark seel, barking season, &c. It is sometimes written *seal*.

SEELING, in *Horsemanship*, a term used by dealers to imply the time when a horse begins to have white eye-brows; that is, when there grows on that part to about the breadth of a farthing, a parcel of white hair mixed with those of his natural colour. This is a mark of old age, a horse never seeling before he is fourteen, and always before he is sixteen years old. Jockeys by trimming prevent this appearance.

SEG, the name of a castrated bull.

SEGRIM, the name provincially applied to the weed ragwort.

SEGS, provincially the name applied to sedges.

SELENDERS. See *Salenders*.

SELLING *of Land*, the business of disposing of or transferring it to another for a certain stipulated sum.

There are different modes of effecting this, according to Mr. Marshall, as by public biddings, and private contract or agreement, in each of which a proper degree of precaution is requisite. And in the former, as the conditions are fixed, an accurate valuation affords the greatest safety; and in the latter with upright intentions little more is necessary. In particular cases however, where a landed estate has fallen into bad hands, more caution may be required, and it may be occasionally necessary to call in the professional aid of those who from the nature of their employment are upon their guard against all sorts of trick and cunning. It is suggested as highly improper to make use of the person who is "to examine the title and adjust the deed of conveyance, to carry on the business of purchasing an estate;—of whose value and uses he is professionally ignorant; as the irresolution, want of decision, the consequent mistakes, and the necessary delays, that will always attend the negociations of men who are conscious of a want of knowledge in the subject they are employed to treat on, must ever tend to the disadvantage of their employers. Mr. Marshall has known so many instances of disadvantages arising from suffering mere men of the law to intermeddle in the purchases of lands, before the preliminaries of agreement have been adjusted, that no apology is due to the profession" for the observations which he has thrown out.

In purchasing by private contract, the particulars

which may be required to be furnished by a seller, are, he says, "the quantities of the several pieces of lands on sale, together with the maps, or rough drafts of the same. The tenure under which they are holden. Some assurance as to the title of the seller, and his right of alienation. The tenancy under which the several farms are let; and, if on lives, the ages of the nominees. If for a term of years,—the number unexpired. If at will,—the notices (if any) which the tenants have had." And "an abstract of the covenants under which they are let; particularly those which relate to taxes and repairs, to the expenditure of produce, to the plowing of grass lands, &c. The existing rents and profits receivable; whether for tenanted lands, appurtenances or abstract rights; with the estimated value of the demesne, and the wood lands, in hand; together with the estimated value of the timber growing upon the estate on sale; as well as of the minerals and fossils which it may contain. The outgoings to which the estate is liable. The proposed time of the delivery of possession. The price and the mode of payment expected" for the same.

And in the next place he considers it as "proper to set down the particulars of *instructions* to be given to a surveyor, or other valuer, of an estate to be purchased. But it will be right, however, he thinks, to premise, that much, in this respect, depends on the probability of purchasing; and on the time allowed for making the estimate. In cases of sale by public auction, where there can be no certainty as to purchase, and where the time for valuation is limited, a rough estimate of each farm, and a general idea of the value of the timber and other appurtenances, may be all that can be prudently ascertained." While "in a sale by private contract, where the refusal of an estate is granted, and time allowed for deliberate survey, a more minute investigation may be proper, especially when there is every reason to believe that a bargain will take place. For the same report will not only serve as a guide to the purchase, but will become a valuable foundation on which to ground the future management of the estate." And he suggests that "for these and other reasons, a purchase by private contract is most to be desired by a gentleman, who is not in the habit of personally attending public sales, and is unacquainted with the business of auction rooms. But, he says, it does not follow that a sale by auction is equally ineligible for a seller; who may gain the vantage ground, by this mode of disposal;—provided he can frustrate the combinations of public sales. The auction duty, however, and the heavy expenses of public sales are objections to this method of making a bargain; as the money thus expended must necessarily come out of the pocket of the buyer or the seller."

In regard to the particulars to be required from a surveyor or surveyors, they are principally these: "The rental value of each field or parcel of land, with the state in which it lies, as to arable, meadow, pasture, or woodland. The value of the timber and other appurtenances. The characteristic, and the state of management, of each farm or tenement, with the eligibility of its occupier; together with the state of repair of buildings, gates, fences, watercourses, and roads. The amount of the encumbrances and outgoings. And, lastly, the probable value of the improvements of which the estate may appear to be capable," in different ways.

It is added, "these several particulars of information being procured, the subjects of treaty are few. The two statements having been duly compared, so that no misunderstanding can take place between the parties, the price, with the times and mode of payment are the principal matters of agreement. A clear understanding, respecting the custody of title deeds, and the expenses of conveyance, require, however, to be enumerated among the preliminaries of purchase" before any thing is finally settled.

In what relates to "the business of the negociation, it is best carried on by letters; which become vouchers of facts. Whatever is done by interview, requires to be reduced to writing, and to be read by or to, the parties before they separate; that no possibility of misconception may arise." And in addition to these precautions, "it is proper in large purchases, and when abstracts of intricate title deeds are to be made out, and examined, that a legal contract, or memorandum of agreement, should be entered into, for the mutual satisfaction and surety of the parties. This contract, and the deed of conveyance, (namely the instrument which is legally to transfer the property from the seller to the purchaser,) may be said to conclude and ratify the business of purchase, and in this part of it, legal assistance is essentially necessary;—to examine existing deeds, and see that the seller has a legal right and clear title to the land, and a legal power to dispose of it; as well as to draw up, or examine, the fresh deed of conveyance, and see that it is sufficient to transfer the property, legally and adequately, to the purchaser" of such landed estate. See *Valuation of Land.*

SEMBRADOR, an implement of the drill kind, used in Spain for sowing corn. See *Drill Plough.*

SEMINAL *Varieties of Plants*, such as are produced from seeds, which in many instances is invariably the case as in the potatoe, &c.

SEMINAL *Weakness*, in *Farriery*, a disease supposed sometimes to take place in young colts before they are castrated, from the appearance of a discharge from the urethra. It is usually termed *shedding* of the seed, which fully explains what was meant by it; this however rarely takes place in brute animals, the discharge being mostly caused by a redundant secretion from the prostate gland, or of mucous from the urethra.

In the cure, Gibson advises an ounce of Venice turpentine to be dissolved in the yolk of an egg and formed into a ball, to be given as there may be occasion.

SEMINATION, the act of sowing grain or other sorts of seed. See *Sowing.*

SEPARATERS, in *Farriery*, the teeth usually called incisors, by which an animal separates or bites off a portion of his food for chewing. See *Teeth.*

SEPTEMBER, the ninth month of the year.

In most of the more southern parts of the island,

the grain crops are in general cut and preserved in the preceding month; but in the more northern districts, some of the oat, barley, and pulse crops, are often to be secured in this. But from the increasing shortness of the days, and the setting in of the wet season, the business should be concluded with as much dispatch as possible. Where beans, from their bulky and succulent nature, have not been brought into a proper state for being put in the stack before this period, they should as early as possible in this month be carried and preserved in the barn or stack.

In the southern counties where hops are in cultivation as field crops, this is the usual season for picking them, a sort of labour which is commonly done by persons who come from different parts of the kingdom at this period for the purpose. The price of executing the work is mostly from three-halfpence to two-pence or three-pence the bushel. Great care is necessary in this business to see that the picking is properly performed, and that there are plenty of hands to have it done in an expeditious manner. See *Hops*.

Where there are fruit orchards on farms, this is the time for gathering much of the fruit, which in fruit districts is constantly done in a careful manner, but in other situations is often neglected for other farm work; which is highly improper, since fruit is become of equal value with any other sort of crop, and in some places much more so. Apples and pears are shown to be in a suitable state of ripeness for keeping when the leaves of the tree wither and decay, and the pips of the apples become of a brownish black colour.

Care should likewise be taken to keep the trees clean from moss, and where they are declining from age or other causes, to have them replaced by young ones.

The fruit should be gathered from the trees when quite dry without being bruised, and be preserved in a dry place by being thinly spread out upon the floor, and some have recourse to a little clean dry straw. It is also advisable to have the fruit so sorted that the different keeping kinds may be together as much as possible: those which are not proper in this intention being disposed of as soon as convenient and markets suit.

But one of the principal employments of the month is that of putting in the wheat crops, or of preparing the lands for the reception of the seed in the following one. On all the more moist, cold and backward soils, this is the most proper time for performing the business, provided the weather be not too dry, as wheat should be sown when there is considerable moisture in the soil. On the more dry and forward sorts of land the work may be delayed till the following month. By sowing in this there may, however, be a saving of seed, as two bushels put in, in this month are nearly equal to three in the following. The clover and other layers may now be broken up in order to be sown in the succeeding month, especially when the season is wet, as there is an advantage in having such layers remaining some weeks after ploughing before they are sown.

These crops may be put in after various other sorts of crops, as beans, clover, tares, turnips, and on fallows; but this last is probably the most improper in general for sowing such crops upon. See *Wheat*.

This is also a principal month for sowing winter tares. It is remarked by Mr. Young that "the earlier they are got into the ground the better; for the difference of forwardness in the spring, from only a week difference in the time of sowing, is sometimes great." And that "the young farmer should proportion the breadth of ground he applies to this crop, to the circumstance of the quantity of lucerne or chicory he has for the purpose of soiling: if he has little or none of those plants, he must appropriate a good breadth to tares, for in such case he will find them very advantageous," in many different applications.

It is a good practice in many cases to turn hogs, geese, &c. upon the stubbles in this month, in order that they may pick up what grain has been scattered on the land. Where hogs have been previously grazed upon the clovers, they may often be finished in this way, with much advantage to the farmer. For young pigs it is always an advantageous practice.

Great attention is now necessary by the farmer to see that the fattening cattle proceed in a proper manner, and that they do not be kept back for want of food. Those in the pastures which are forward should now have a full supply, as they begin to be particular, and when in the least restricted fall off and cause much loss. They should of course have a due change of pasture.

Where fat stock of this sort are in a state to be now disposed off, it is mostly an advisable plan to get quit of them in the early part of the month, as the prices generally begin to get lower towards the latter end of it, from the increased quantity of summer fattened cattle which is brought into the markets. Such stock can only be kept longer with benefit as is capable of going on till Christmas or the early part of the ensuing year.

For such sorts of fattening cattle it is of vast utility and advantage to have cabbages, Swedish turnips, or other similar sorts of food for carrying them on with, as little can be expected from the pastures after this period as by such means the preserved after-grass may be applied to its proper use, the support of ewes and lambs, in March and April, which mostly pays much better than by being consumed by cattle. In some cases, however, this may not be the best management, as where the lands are apt to be flooded, or are of a soft poachy nature, it may be more beneficial to eat them down as bare as possible before the setting in of the autumnal rains. It is only in sound dry grass lands that the preserving of the after grass can be had recourse to with success.

It has mostly been the practice in drawing of fattened cattle stock for the market, to take the fattest, and leave such as have not gone on well for further exertion. On this Mr. Young has remarked that if

"the food provided be not costly, this to a certain degree is *admissable*; but if the beasts are for cake or corn, or the quantity of other food rather limited, it is a very questionable conduct. He would not give expensive food to beasts which have proved themselves unthrifty, but on the contrary draw off for this purpose the most thriving ones in the lot: the contrary conduct has often been the reason why all winter fattening has been so heavily condemned. The moment the grazier is well convinced that he has a beast that is an *ill doer*, the first loss is the best, and he should get rid of him as soon as he can."

This is likewise the common season for buying in store stock, as oxen for working, and cows in calf, also horses for labour, &c.

With sheep, where regular flocks are not kept upon the farms, they are in general bought in annually about this time at the different fairs. The kinds are mostly wether lambs, old crones, &c. to be managed under different systems of fattening, and which often afford good profits. Where sheep are bought in for being wintered on turnips, whatever the sort may be, more than from eight to ten per acre, according to the crops, should not be calculated upon, and for fattening not more than from five to six or seven; proper food for carrying on the stock when the turnips are finished being provided in addition.

In regard to the sorts or breeds which may answer best for the farmer, it must depend greatly on the nature of his land and keep. It often happens that he can procure them in the neighbourhood, which mostly answers better than having them from a distance. The new Leicesters and South Downs mostly pay the owner well; but other breeds in particular circumstances pay equally well. These should always be suited to the nature and state of the pasture as well as that of the situation.

The attentive dairyman must at this season also bestow great care upon his dairy cows, to see that they have plenty of suitable food, as without it they will fall off much in their milk. In addition to the natural grass that may still remain, lucerne cut green and given them in the yard is highly valuable.

And Mr. Young has remarked on this that "the product is so regular that it is an easy matter to proportion the dairy to the plantation, and never be under a want of food, for lucerne mown every day regularly will carry them into October: and although some persons have asserted that cows will not give so much milk thus managed as when they range at large and feed how and where they will, it is not a matter of inquiry; because if they give less, the quantity will pay more clear profit, than more in the other case: there may be some inferiority; but the cows are kept on so small a quantity of land, that there remains no comparison between the methods for profit."

The teams, from their great expense, should at this period as well as others be kept to close work, especially where the sowing of the wheat crops is going on. And whether they be of the horse or ox kind, they may now be fed with lucerne or other similar food cut green, as they have been found to work well upon it; but as at this season it is less nourishing than in the summer months, a little oats or cut chaff should be given along with it when they are engaged in plough work.

Such pastures or mowed lands as are intended to be reserved for spring feed should now be shut up from all sorts of stock, in order that they may afford the fullest advantage for ewes and lambs at that season.

The burnet lands should likewise be constantly avoided feeding in the autumnal season. It has indeed been recommended by the author of the Farmer's Calendar not to permit any cattle to pasture the burnet fields after mowing; for, says he, the "greatest peculiarity of this plant is to afford a full bite in March; and if you leave it six or eight inches high in October, you will find more the beginning of March, and in possession of the leaves it had in autumn, for the winter frosts have not much effect on it. Upon this caution, therefore, depends much of the advantages of burnet. Some who have found fault with it and asserted that it is unprofitable have fed off the aftergrass in autumn bare, and let their sheep and cattle get into it in winter. It is then no wonder that burnet does not answer the character given of it by others, who have managed in a different manner."

In regard to saintfoin, it does not afford two distinct cuts, as is the case with clover and lucerne, in one year, but the rouens are abundantly productive of salubrious nutritient food for most sorts of live stock; which as it is supposed to be much sweetened and rendered more palatable by the action of the frosts in the autumn, should not be turned upon till towards the latter part of this month: when they will be found of admirable use in increasing the milk of cows, as well as in improving fattening cattle in flesh; and after these have been removed still a good store sheep feed be left. Mr. Bannister says that in feeding sheep on saintfoin rouens, one caution is necessary to be attended to; which is not to lay them too thick on the pasture, nor to suffer them to remain too long upon it, as in either case much mischief would be done by gnawing off the crowns of the plants. In his opinion stock of every sort should be removed from the pastures of this sort before Christmas; as this grass, from its beginning to shoot very early in the spring, the following year's shoot would be greatly retarded, by suffering the stock to continue on such rouens too long in the winter.

Such grass lands as have been fed down in a bare manner, may at this season demand some attention in the dressing of them. The usual method is the application of manure in its simple or compound state about the end of the month. In the former case, it was usual formerly to have the dung in such a state of reduction as to wash wholly into the sward; but later experience has shown that it is much more beneficial, when applied before it has reached that state, or while it is capable of undergoing the process of fermentation. But it is perhaps in many cases equally advantageous to have recourse to composts, and certainly goes much further. In this way a

great variety of substances may be employed with a little dung, such as clay, especially when burnt, chalk, turf, ditch earth, mud of ponds, ashes, lime, soot, &c. These on being well blended together with very little dung, are in a state to spread over grass lands with good effect, and may be laid on in the proportion of from fifteen to twenty loads to the acre: as too much at a time may often be laid on lands in the state of sward, the better practice is to repeat it more frequently, as by this means it will be washed in more completely.

The scarifying of the surface of grass lands is a practice which has lately been advised as highly beneficial. It is performed by a sort of harrow which is termed a sward cutter or dresser, and manure or compost is laid on afterward, or sheep may be folded upon them if more convenient. Where this method is had recourse to, it is best performed in the beginning of the present month before the land gets too much saturated with moisture.

After the last cutting of the lucerne crops, it is advised by some to dress the land with twelve, or fifteen loads of the richest compost to be procured, after the operation of the scarificator or harrows. And that where the lucerne has been drilled, to spread the compost over the field, and then draw a furrow with the plough in the midst of each interval, by which the manures and a portion of mould are thrown upon the rows of plants, and they lie covered, warm and dry all the winter. As early as possible in the spring, the ridges should be cross harrowed sufficiently to level the whole field. It is supposed there is no winter-management of lucerne, or indeed any grass, equal to this, but careful water-furrowing should be practised.

This crop, Mr. Young says, requires much manure, though, on very good rich lands, it may afford good crops without any; however, to bring it to the utmost perfection "not only of *product* but of *clear profit*," it must have a plentiful supply.

Where lands have been omitted laying to grass in the preceding month, that business may be effected in the beginning of this month with much success, by sowing the seed with the wheat crops on such lands as are perfectly clean.

And where new lays have failed, fresh seeds may be sown in the beginning of the present month, after the land has been suitably prepared to receive them. In slight cases they may be rolled or trodden in by sheep; but the sheep should not be suffered to remain longer than is necessary for the purpose, as such lays should always be reserved for the spring use of ewes and lambs.

On the poor pasture and meadow lands in Norfolk a curious practice has been had recourse to by Mr. Salter of Winborough; which is, wherever he improves poor meadows or pastures by spreading earth, clay, chalk, marle, gravel, &c. to harrow in winter tares on such manuring, and, if wanted, grass-seeds or white clover. And it is a curious fact, that on his farm the grass-seeds succeed better where winter tares are sown than in any spots where by accident there happens to be none. The improvement of the old grass by the tares is very great, and the value of the tare crop is considerable in soiling, or in hay.

And Mr. Rix of the same county has found the practice equally successful. This sort of business may be well performed at this season in many cases.

Where a suitable preparation has been made of crops for the purpose of soiling, with a proper reserve of common grass in a proper state, it is a business that may go on through this month with advantage, though frequently neglected by farmers in the practice of doing it in the summer months. By this means a more full supply of grass is left for sheep in this and the following month, by which they are more cheaply kept at such periods, which is an object of great moment to the farmer.

As the raising of the greatest possible quantity of manure should always be an object of the first consideration to the farmer; all such substances as are capable of being converted into it should be provided and stacked up in the farm yards to be used as litter during the winter season. Fern, sometimes known by the titles of brake and bracken, and the long stubbles remaining after harvest, are materials that may be very beneficially made use of in this way. In respect to the first, it should be cut, according to the author of the Farmer's Calendar, and carried into the farm yards, being built into large stacks, for cutting down in the course of the winter, as the cattle tread and convert it into manure. It must also be employed as litter for the stables, cow-houses, pigsties, ox-houses, fattening-stalls, and sheds, &c. "By having, says he, great plenty of it, you will be able to raise immense quantities of dung, which is the foundation of all good husbandry; and it is well known that no vegetable yields such a quantity of salts as fern: from which we are to conclude, that it is well adapted to the making manure. The good farmer, in this work of bringing fern, should not confine himself, he thinks, to his own wastes, of which he may have none, but purchase it of his neighbours, if they are within a tolerable distance. It will answer exceedingly well: he need not therefore fear paying for it, as for refuse straw."

And the wheat, rye, and other long stubbles should on the same principle be cut and raked up into heaps, to be conveyed to the same place for the same purpose. It has been observed in the above work that "this is a business strangely neglected in most parts of the kingdom; but is nevertheless of great importance; the stubble left on the land is of little advantage as a manure, but it prevents the plough from turning in the land with neatness, but carted into the farm-yard it becomes an excellent manure. Any sort of litter there is valuable, and serves for the cattle treading into dung. In those parts of the kingdom where this use of stubble is common, the price for cutting and raking into heaps is from 2s. 6d. to 3s. 6d. per acre; a very small expence, compared with the great advantages that undoubtedly result from it."

In situations where rushes abound in the wet bot-

toms or on waste lands, they may likewise be cut, raked, and stacked up for the same use. And this is a good time for this sort of work being performed.

Where the farmer is situated near such rivers as have sedgy banks, much useful materials for this purpose may likewise be collected.

And when the farmer has the opportunity, it is a most beneficial husbandry for him to let all sorts of stubbles be now turned by the plough. It is a much better practice than the common one of permitting them to remain till after barley seed time before it is executed.

It is remarked by the author of the New Farmer's Calendar, that, "according to the old system, lands were left rough in their stubble, and perhaps deluged with wet for want of surface draining, all winter, even until April, for the purpose of starving and perhaps rotting a few miserable draggled sheep. The loss from this practice was enormous every way. Exclusive of the want of that profit which would have accrued from a proper management of the sheep, and of the actual damage sustained by them, the land missed the greater part of the immense benefit of being pulverized and mellowed by frosts, and was injured in an equal degree by the seeds of weeds being locked up securely in its bosom, to vegetate in abundance after the first spring-stirring; instead of being exposed by the tilth, to destruction, either from the winter frosts, or having vegetated to be smothered by the spring-culture. Lands, winter-fallowed early, and harrowed fine, will produce a crop of weeds to be smothered by the plough before the frost sets in."

Water furrowing is also a business which should be now well performed, on such lands as have been sown with wheat, without any time being lost. It is also very beneficial on the autumn ploughed lands when well executed, as it keeps them in a dry and healthy condition.

Where the system of folding is pursued, it may be carried on through the month with propriety in sufficiently dry soils.

SERVANT, a person employed in the performing of the business of a farm, of whatever kind it may be.

The following judicious hints have been thrown out by the author of the "Landed Property" of England, for the direction of those servants, who have the conducting management of farming business: "Nothing, says he, contributes more to facility and satisfaction in this sort of business, than a forecast toward works to be done. A miscarriage is ever to be dreaded, as a mischief; and when it is brought on by a want of forethought, it brings with it a degree of discredit, and a train of unpleasant reflections, which sour every enjoyment." This kind of servant "should, he thinks, have a forecast toward crops, for three or four years,—toward team labour, for as many months,—and should look forward with a view to hand labour, some weeks; according to the season of the year." And to bring it "to a degree of certainty, it is necessary to make out a *list* of the *fields*, or parcels of land, of which the farm consists; with the crops which each has borne, for some years back; together with the manurings which they have severally received; in order that the future treatment of each may be decided upon, with sufficient accuracy." And to prepare "every autumn, by the assistance of such list, an *arrangement* of the *crops* that are intended for the ensuing year: classing the fields, or pieces, according to the purposes for which they shall be intended: thus ascertaining the quantity of each crop, whether arable or grass, as well as the quantity of ground intended for pasture: in order that the quantity of team labour may be distinctly foreseen,—the required strength be estimated, from time to time,—and the several crops be sown in due season; and in order that the stock of the ensuing summer may, in due time, be properly apportioned to the intended quantity of pasture ground; as well as that the works of summer and harvest may be constantly before the eye; and proper hands be engaged, in time, to perform them, in season," and with the necessary dispatch.

And he further advises a sort of "memorandum list of business to be done,—immediately,—or in immediate succession; whether it relate to crops, or to any other concerns of the farm; that nothing may escape the memory; and that the most requisite may be brought forward, first; or another which is more suitable to the state of the weather," and other circumstances. In this as well as other "business, the great object to be aimed at is that of ensuring success; which is not only profitable to an employer, but satisfactory to the person employed. Whereas, a miscarriage injures, at once, the property of the one, and the character, as well as the peace of mind, of the other. Hence, a farm manager ought to engage in a work, whether of improvement or ordinary practice, with caution; and to proceed in it with attention, and firmness. A standing rule, respecting this main object of management, is not to attempt too much; and never to begin a work, without a moral certainty of being able to finish it, in due season.

"But besides the common work of a farm,—as the culture and harvesting of crops, the rearing and fatting of livestock, and the business of markets—there are, he says, various other objects of attention, which ought to be constantly kept in the mind, or the mind's way, of a manager; as on them the difference between good and bad, between correct and slovenly, management, very much depends: such as, keeping the homestall in repair, and free from impediments; attending to private roads and driftways; keeping up fences, every where, in thorough repair; attending particularly to young hedges, and to the rearing of hedgerow timber; the seeing that gates swing clear, and catch with certainty; equally to preserve them from injury, and to prevent loose stock from going astray; the attending to drains, and watercourses; to see that superfluous waters have free passages to their proper outlets, and be readily discharged.

And he advises that "in summer, strict attention be paid to drinking pools, and other watering places of stock, as well as to the state of pasturage, and the shifting of pasturing stock. Likewise to weeds,

as well in grass grounds as in arable lands;—to see that not a thistle blows, nor any other weed matures its seed, either in the areas, or on the borders of fields," as great injury is done by their shedding their seeds.

And in winter, much care is necessary, he says;—"not only to see that they are regularly supplied with proper fodder; but that sufficient shelter, and comfortable resting places, are assigned them," so that they may be kept in a proper thriving state.

At this season also the watering of grass lands should be attended to as much as the nature of the situation will admit. And to the accumulation of manure an unremitted care should be bestowed the year round, as upon it much depends.

On the whole, "to perform these and other objects with propriety, repeated examinations of every part and particular under his care; and committing to his memory whatever requires his more immediate attention; so that whether he is on the spot, or arranging his plan of operation, in the hour of leisure, it may be present to his mind, and take its proper course" in the routine of work which is to be carried forward.

In the time of work, the business of a managing servant lies in the field,—in executing the plans he has formed,—"in passing from one set of workpeople to another: not more to see that the different operations are rightly executed, with proper dispatch, than to order any required assistance (to the teams most especially); in order that every part of the machine may be kept in profitable motion." And he advises that "in the ordinary operations of husbandry, and on common occasions, a steady even pace be recommended: equally for the good of working animals, and the work which they are performing. Nevertheless, there are times when quick dispatch is necessary: and then it is his duty to encourage good speed;—by his example; and by promises of reward, if the occasion require it." That "at all times, and on every occasion, idleness is a crime which ought not to be suffered to pass, with impunity. It is a direct fraud;—and a manager should guard against it, with the same care and assiduity, as against pilfering. A day labourer who idles away an hour, robs his employer of an hour's wages;—and thereby injures him as much as if he were to steal a fagot of equal value. This truth requires to be deeply imprinted on the minds of labourers. He has known the impression to have a good effect."

He properly remarks that "the right ordering of servants and workpeople is a difficult branch of moral duty; and forms an important part of that of the managing servant. They require to be treated according to their respective merits: encouraging good ones, by extra wages, or other rewards. Some men are worth double the wages of others,—as day labourers. Yet custom makes no distinction between them, in this respect! Hence the propriety of engaging the best workmen the country affords; and retaining them, by civil treatment, and suitable encouragements." The managing servant should keep "his workpeople at a proper distance; without destroying that free communication of opinion, respecting the work in hand, which, on ordinary occasions, every intelligent workman should be allowed." And a "standing rule of conduct, in the ordering of workmen, is never to find fault, without occasion: nor to commend, without reason. Good fellows will not brook the former, nor will bad ones be mended by the latter. But it is right to habituate workmen in general to be told of their real faults; first, in the mildest terms the occasion will admit of; reserving the warmth of temper for extraordinary occasions; and then it is prudent to sting them with keen, rather than to load them with heavy words: to endeavour to stir up their pride, rather than their malice or resentment." And "much of the smoothness, and uniform success, of business depends on the manner of communicating orders to workmen. If orders are inaccurately or loosely given, it is unreasonable to expect that the execution of them should be faultless. It is difficult to explain business in words with sufficient accuracy, to rustic workmen; and if a third person is suffered to intervene, errors are inevitable." The servant who has the management "ought therefore to make a point of giving orders, in person, and if possible on the spot, to the men whom he means shall execute them. There, he can explain himself to them, intelligibly, and fully; or assist them in marking out their work. There is always danger, in merely verbal orders; and, in a message, certain mischief." It should be an invariable rule for him to "set his men to a fresh work, in person; and, if it is out of the common way of husbandry, to stay by them, or direct them with his own hands; and return to them, again and again, until he finds them completely in their work." In this view, this sort of servant, as well as for various other reasons, "ought to be master of every implement, tool, and operation, belonging to his profession; and if he find himself deficient in any particular, he should practise it, day by day, until he make it familiar to him: or, says he, how is he to correct a bad workman; or to know when to be satisfied with a good one; who, knowing when he is right, will not bear the reproaches of ignorance? He has no other way of securing the esteem and attachment of good workmen, and of finishing in a workmanlike manner every thing that he undertakes, than by making himself master of his business:—without which little satisfaction will arise from it to himself, or profit to his employer." And in "the general principles of conduct, in his dealings and intercourse with other men, punctuality is one of the most essential. Method is the best assistant of punctuality; and clear accounts are one of the best results of method." These should always be kept with exactness, and be sent when required to the proprietor in weekly, monthly, and annual periods, so as to show the daily state of the work; the monthly state of receipts and payments, and lastly the whole state of accounts and balances.

It is extremely necessary for the farmer to be careful in providing his servants, not only to see that they are proper for the work, but that there be not more than are necessary for executing it as the expense of them is now become extremely great. It has long since been recorded by Mr.

Marshall, in his Minutes of Agriculture, that on the maturest calculation, he found the yearly expense of a man servant in the house to be 35l. and that of a boy 23l. supposing the man's yearly wages to be 10l. and the boy's 3l. Now the expense of a day-labouring man for a whole year, (if he works every day) is but 27l. 10s. which is 7l. 10s. difference against keeping a man in the house by the year and hiring one by the day. But that of a boy is still more in proportion, viz. the expence of a day labouring boy for a whole year if he works every day is but 14l. which makes a difference of 10l. or more than ⅔ of a boy's day-wages. In the above account, no deduction in the daily pay is made for rainy days. The impropriety, therefore, of keeping plough-boys in the house is very visible: and though it may be convenient to have the carters about the house, the conveniency is not worth 7l. 10s. a year. He therefore recommends putting a woman into a cottage, within about two hundred paces of the farm yard, to take in lodgers; and to keep in the house no more farming servants than a bustler and a yard-man. Indeed he says it is absolutely necessary to have somebody about a farm-yard in cases of emergency: but the above two are sufficient, as the carters in the adjoining cottage will be nearly as handy as if they were in the house. (This measure like many others is merely local; but the hint is universal.)

Perhaps the farmer who keeps no accounts, imagines he saves money by boarding his servants in the house; but if he keeps them in the luxurious manner which farming-servants in general expect to be kept, he will be mistaken. A farmer, indeed, who sits at the head of his kitchen-table, may no doubt feed his men considerably cheaper, than a person who eats in a separate apartment. It is a just observation, that one fed by his master costs the community as much as two who provide for themselves; for discharge a grumbler, one who pretends to be dissatisfied, though in fact only satiated, and he will return to his bread and cheese with, perhaps, equal health and equal happiness. He sits down to his master's table with a resolution to eat voraciously of the best, to do himself justice; but at his own table, eats sparingly of the meanest, to save his money. His motive in both cases is the same: self-interest.

It is added that "in some counties, particularly in Surrey, it is an established custom for every man, in harvest, to work by the acre, or by the month, not by the day. If a labourer be constantly employed through the year, he expects during harvest to be constantly employed in mowing, reaping, &c. by the acre, or to have his harvest-month; that is, to have an advance of wages certain, wet or dry, during one month; which month commences when it best suits his employer. This, he says, is very convenient; they are always at command, in cases of emergency; and nothing but a continuance of rains while the barns are empty can make them burdensome. He strongly recommends the employing of active young men; for one invalid or sluggish fellow will spoil the whole set; and this holds generally. Mix two or three old women or two or three boys, with a company of men, and the effect will be very soon visible; for the men will soon conform to the ways of either the old women or the playfulness of the boys. It is not prudent to employ many women with the men; and nothing but necessity can excuse it. Two women after the first or second day, will do as much work as half a dozen alone. If it be necessary or convenient to employ a number of both men and women, it is but common good management to keep them separate; with this exception, which may be laid down as a maxim, viz. one man among women, and one woman among men. A crusty conceited old fellow will check the gossipping of the women, and it has been remarked that raking after a young wench has animated more than a gallon of ale. Two are dangerous; they breed contention, and rather retard than accelerate. The most valuable servant in harvest is a good carter. It is necesary to common management that he should be able, willing, and careful. Every pitch of hay and corn, generally speaking, passes twice through his lands; he loads and unloads, which are the two most laborous tasks of harvest; he drives the team backwards and forwards; if he loiters by the way, the field-men or stackmen must stand idle; if he spill or overturn his load, or if he break his waggon, or set his horses, the arangement of the day is broken; and, perhaps, the damage done by the loss of time rendered irreparable by the next day's rain. A good carter will not suffer his waggon to be overloaded. The fieldmen too, that is the pitchers and assistant loader, should be young and active, and well matched with the carter."

Since the above was written, the prices of servants have considerably increased in every district of the kingdom, and the expences of keeping them been very greatly augmented. This has led to fewer being kept, and especially in the houes.

In Hertfordshire the annual wages of a carter or ploughman was formerly from six to nine guineas. Boys from two to four guineas, and maid-servants about five guineas; but they have since risen to nearly double.

In Norfolk farmwork was particularly distinguished by the cheapness as well as expedition with which it was performed; which, it is said, arose not merely from the cheapness of labour, but the greater exertions of servants and labourers than in most other districts; but this is considerably diminished at present. In some parts of that district the custom of allowing board wages to farm servants, instead of the old plan of feeding in the house is coming into use. And 8s. a week are given. This is a bad immoral regulation, which should be discontinued.

In Yorkshire the wages of servants have also been greatly increased. In the West Riding "the wages of a house servant (of which kind most of the ploughmen are) may be estimated from 25l. to 30l. yearly, including maintenance. There is a practice which prevails over a considerable part of this district, of giving them drink both forenoon and afternoon, be the work what it will; which is a ridiculous custom, and ought to be abolished without loss of time. What can be more absurd, than to see a ploughman stopping his horses half an hour, in a

cold winter day, to drink ale? But the practice is so deep rooted, that it will not be easily removed without a compensation."

It is suggested that the proper "remedy is to let the value of the ale be paid to the servant in money, which probably would be as much for his interest, and certainly more advantageous to the farmer. In those places where long yokings are taken, say seven or eight hours, it may be necessary to feed both men and horses on the ground; but this practice cannot be recommended unless in urgent cases, it being very injurious to their health. In the best regulated agricultural counties, five hours labour in the morning and four hours in the afternoon, when the season allows, and five hours, or five hours and a half, in short days, is considered to be as much as horses are capable of sustaining, and yokings of this duration require no refreshment on the ground."

It is added that "the hours of labour are generally in summer from six to six, with the usual time for rest and refreshment, which gives betwixt nine and ten hours labour each day, and in winter from light to light. Much of labour, such as ditching, hedging, threshing, &c. is done by the piece, but the prices vary greatly in different places. We only add, that when the farmer is a proper judge of his business, piece work is not only most to his advantage, but the only way by which an active diligent servant can be properly rewarded for his labour."

In Herefordshire, where the hours of labour are from light to dark in the winter, and from six in the morning to the same hour in the afternoon, in summer, the following are the average prices of wages now given to servants kept in the house by the farmers.

Waggoner,	10 to 12	Guineas per annum.
Bailiff or cattleman,	8 to 10	Ditto.
Dairy-maid,	6 to 7	Ditto.
Under-maid	2 to 3	Ditto.

In East Lothian, the wages are mostly from ten to fourteen pounds per annum; but this class of servants is but small. The female servants have from four pounds, to four pounds ten shillings, or five pounds.

In Clydesdale, "the greatest part of agricultural labour is performed by servants hired by the half year, and living in the farm-houses. In many parts of the county the women servants work along with the men, at almost all kind of out work. But as more hands than ordinary are needed for cutting down the corn in harvest, many husbandmen, to secure a fixed number for that purpose, when they can be got, contract with villagers to assist during the time of reaping. All these labourers have no fixed hours, but continue their labour while light and weather admit, and circumstances require. The poor girls, when light is gone and the men sat down by the fire, resume their household labours." The "labourers, both men and women, are sometimes hired in by the day, particularly in the time of planting, sowing, and hoeing turnips and potatoes, hay making, and harvest, when a fixed number are not provided. These work only ten hours in the day, beginning at six in the morning and stopping at six at night, and taking an hour to rest at breakfast, and another at dinner. Hired labourers in winter, take breakfast before they go out in the morning, make a short pause to eat a little at mid-day, and quit when light fails in the evening."

The following are the prices of wages.

"Wages of men servants, besides bed, board, and washing, per annum, { Former. from 13*l.* to 16*l.* | Present. from 20*l.* to 25*l.* }

Wages of a maid servant, besides bed, board and washing, per annum, } 5*l.* to 7*l.* | 8*l.* to 9*l.* 10*s.*"

In Perthshire "a man servant, who is master of all the operations in farming, receives in the corn-country, between eight and twelve pounds, for twelve months. In the grazing districts, more remote from the seat of manufactures, their wages, and the price of all kinds of labour are about one fourth lower." But in "many cases the servants are maintained in the farmer's family; but the practice of giving them six and a half bolls of meal, together with a house, a garden and a cow's grass, free of rent, and some fuel, is daily becoming more general. These farmers, who keep any married servants, have them all on this establishment of livery meal.

"Maid servants live all in their master's family, and are engaged for betwixt three and four pounds, and in some cases five pounds of yearly wages, according to their expertness, and the nature of their work.

"But common labourers earn between one shilling and one shilling and three pence a day; and if able bodied and handy, they demand one shilling and sixpence, without victuals. The various denominations of artificers charge according to the nicety of their art. The hours of labour from the vernal to the autumnal equinox are from six to six, allowing an hour for breakfast and another for dinner; and during the other half year, from the dawn of day till the light fails at night, with an allowance of one hour for breakfast. Household servants are not so exact, with respect to hours: in the long days, they continue to work after six at night; and in short days, they get out of bed, before day light, where there is much grain to thrash. But in many of the large farms, thrashing machines have been erected; and they are such a great saving, by the abridgment of labour, that more of them are set up every year, in different parts of the county."

In Argyleshire within these 30 years, the price of labour is somewhat more than doubled. It still varies in different parts of the county, but may be estimated in general at the following rates.

"Man servant's wages per annum, with victuals, from 6*l.* to 8*l.*

treated in the same manner, in order to obtain a depending orifice for a free discharge of the matter, and which, being once procured, this method will completely cure the disease."

In neat cattle setons are often of great benefit, as in the dew-lap and other parts near the seats of local diseases. These may be put in, in the same manner as above, or by dividing the skin with a sharp instrument. They should be frequently removed, as in the other cases, when there begins to be a discharge. Downing advises that some plaited hair should be drawn through between the skin and the flesh, anointing it with turpentine, being moved occasionally as above, a knot being made at each end to prevent its slipping out.

SETONING in *Farriery*, the operation of putting in setons. See *Seton.*

SETS, a term applied to the cuts or plants of potatoes, &c.

SETTER, in *Farriery*, a kind of seton or issue, made by cutting a hole in the dewlap of an ox or cow. *See Seton.*

SETTING *of Farms*, the business of letting them to tenants. See *Farm.*

SETTING-*pin*, the name of a dibble.

SEVERAL, the same as dole. See *Dole.*

SEVERALTY *Land*, such as is in an open field state, or divided amongst many. It is a bad situation or tenure of land.

SEVIL, in *Horsemanship*, a part of the branches of a bridle. It is a nail turned round like a ring, with a large head made fast in the lower part of the branch.

SEW, a term applied to a cow signifying to go dry.

SEWER, the name of a large ditch or water fence, or artificial shore. It is sometimes written shewer.

SEWL, provincially a plough. It is sometimes written sule.

SHAB. See *Scab.*

SHACK, provincially to shed as grain at harvest.

SHACK, a provincial term applied to the waste corn, left in the fields at harvest: also to the stock turned upon the stubble after harvest; and likewise to such grounds as lie open to common fields. Pigs are the stock usually employed in gathering this, and in some parts flocks of geese and turkies. Where pigs are clovered through the summer, they are finished with the shacks and the acorns; but some farmers are so improvident, as neither to feed their clovers in that advantageous way, nor even keep pigs enough to pick up the waste corn, which is sometimes absolutely suffered to rot in the fields. Young pigs answer well in this use, as they thrive greatly, especially when bred upon the farm.

SHACK-*fork*, provincially a wooden fork for shaking straw off the barn floor, made of forked willow, &c.

SHADE, provincially a shed for fuel, &c. it also signifies to shed as grain.

SHAFT, a name provincially applied to a handle of a tool, as a spade, fork, &c.

SHAFT-*Drain*, that sort which is effected by carrying a sort of shaft or pit down to the porous stratum below, and which is in use where a superficial descent cannot be had, for the collected waters and an open stratum lies beneath the subsoil, ready to receive it: a communication between them becomes here of high advantage; as the cost and attention of raising the water, by machinery, may thereby be avoided. In cases of this kind Mr. Marshall advises the drainer to "ascertain the lowest point of the site to be improved; and there, says he, sink a shaft down, and into, the receiving stratum, and fill it up, to within a few feet of the surface, with rough stones, the roots of trees, or other open materials; and, on the top of these, form a filter, with heath and gravel, or other substances, that will prevent earthy matter, or water in a foul state, from entering the shaft. And to this filter lead the collected waters." And that where "the water is collected by the means of covered drains; and where the filter also has a covering placed over it; the entire process will be free from external injury; and a work of this kind may remain unimpaired for ages." But "even if the waters were collected by open drains, and the filter were suffered to remain in a state of neglect, until the shaft, in process of time, should become defective,—the remedy would be easy. Embrace, says he, a dry season to re-open the shaft, and to cleanse it, and the materials with which it may be filled, from their impurities; and thus restore it, at a small expense, to its original state of perfection."

It is further stated that "if the site of improvement be liable to any other surface water, than what falls on its own area, such water ought to be conducted away from it, superficially; by cutting it off at such a height as will gain a sufficient fall." And that where the quantity of water which descends into it, subterraneously (or would descend if a free passage were opened for it) should be found to be too copious to be readily discharged, by a *shaft drain*, in the manner here proposed, proper efforts should be used to cut off the supply, or as much of it as may be, by a perforated trench or otherwise, at a sufficient height to be able to convey it away, superficially; and with a sufficient fall, to prevent its entering the area to be improved; which will thus have only its own superfluous waters to discharge by the shaft." He "is desirous, to clear the way which leads to this valuable improvement; as he is convinced that there are many instances in which it might be applied with great profit. Many of the low flat-lying moory vallies of Norfolk, from whose bases superficial drains would be difficult to make, have for their substructures, it is probable, he says, insatiable depths of sand." And that "in every district of the island such objects as are proper for this practice may be found."

SHAFT *of a Mine or Pit*, the opening which is sunk for the purpose of obtaining the contents. They are of several different kinds according to the nature of the work and situation, &c.

SHAKING, in *Farriery* a disease in sheep consisting of a weakness in their hind quarters, so that they cannot rise up when they are down. There has not hitherto been found any remedy for this disease.

SHANK *of a horse*, that part of the fore-leg which is between the knee and the fetlock or pastern-joint. The larger and broader the shank is the

tern joint. The larger and broader the shank is the better. It is known to be so, by the back sinew being at a distance from the bone, or well separated from it, and having no kind of swelling betwixt it and the bone, which may cause the leg to appear round.

SHAPE *of Animals*. the particular compact rounding form, which constitutes the beauty and excellence of them, for the purposes of the breeder and grazier, and which is fully described in speaking of the different sorts of live stock, as neat cattle, sheep, horses, swine, &c. See *these several heads*.

SHAPE *of a Horse*. See *Horse*.

SHAPE, *Inflammation of*, in *Farriery*, an affection in cows arising in hot weather after taking the bull; and which is shown by a swelling of the parts with boils or eruptions. It is shown by the animal rubbing her hind parts in the hedges, &c.

In the cure Mr. Downing advises, after free bleeding, the following:

Take of Nitre in powder, two ounces;
Cream of Tartar, three ounces;
Castile Soap, one ounce;
Aniseed powder, one ounce:

Let them be mixed for a dose, to be given in a quart of warm whey, repeating it as there may be occasion.

SHARD, a term applied to a fragment of an earthen vessel, or the gap in a hedge.

SHARE *of a Plough*, that part which cuts or breaks the ground, the extremity forward being formed with a sharp-pointed iron, called the point of the share; and the end of the wood behind, the tail of the share. See *Plough*.

The length of the whole share from point to tail, according to Tull, should be three feet nine inches; at the top of the iron it has an upright piece called the fin; and near the iron at the other end, there is an oblong-squared hollow called the socket, the use of which is to receive the bottom of the sheat. Near the tail there is a thin plate of iron, well riveted to the wood; by means of this plate, the tail of the share is held firmly to the hinder sheat of the plough by a small iron pin, with a screw at the end, and a nut screwed on it, on the inner or right side of the sheat.

The point of the share is that part in which it does not run up to the fin; this point is generally made three inches and a half in length, and should be flat underneath, and round at the top, and the lower part of it must be of hard steel. The edge of the fin should also be well steeled, and should make an acute angle with the share.

The socket is a sort of mortise: it should be a foot long and about two inches deep: the fore-end of it must not be perpendicular, but oblique, conformable to the end of the sheat which enters into it. The upper edge of the forepart must be always made to bear against the sheat; but if this end of the socket should not be quite so oblique as the sheat, it may be helped by paring off a small part of the wood at the point.

But in modern ploughs the shares are very different, according to their constructions and the uses for which they are intended.

And lately, improved cast iron plough shares, have been made by R. Ransome of Ipswich, Suffolk, for which he has obtained a patent. These shares are made hard on one side and soft on the other, which affords the great advantage of wearing thin, as it is found by farmers that those made in the common way wear thick with a basil on the under side, which obstructs their entering into hard or strong soils, and at the same time increase the labour of the team, as well as pass over weeds without cutting or eradicating them. The same person also makes *plough grounds*, which are so contrived as that by turning a screw the plough is made to work more or less to the land with the greatest ease and facility. And both these contrivances are said to be capable of being applied to all sorts of ploughs.

A representation of the share is seen at *fig.* 7. in *Plate* XXIX.

SHARE-*Grass*, provincially a sort of sedge.

SHAR-*Hog*, a provincial term signifying a yearling sheep, which has been once shorn. The same as lamb-hog.

SHAW, a term applied to a wood that encompasses a close.

SHAWLE, a name applied to a shovel used in winnowing corn.

SHEAF, a bundle of corn as bound up in the field. See *Harvest*.

SHEAR, a provincial word signifying the reaping of grain. It is also applied to sheep, as one shear or two shear, which signifies one or two years old.

SHEARDAY, provincially the *sheep* shearing.

SHEARING *of Sheep*, the operation of cutting off the fleece or coat of wool with a pair of shears.

This is performed in different ways by different persons, but the best mode is that of the circular or round the sheep, instead of the longitudinal, which is now mostly in use. It is usually performed about June or July according to situation and season, but should not be done either too early or be too long protracted, as injury and inconvenience may attend either extreme.

A good clipper is capable of clipping from fourteen or fifteen to twenty or twenty-five in the day, and more are frequently done by very expert persons. Great care should be taken not to cut or prick the animals; but where this accident happens in the northern parts of the kingdom, they touch the part with a little tar or sheep salve; and in Sweden it is often done with train oil and resin melted together. See *Clipping* and *Sheep Shearing*.

After shearing, the sheep should be turned into a warm dry pasture. See *Sheep*.

SHEARING, a term applied to a sheep that has been once shorn.

SHEARLING, a word also applied to a sheep that has been once shorn.

SHEAT *of a Plough*, that part of the plough which passes through the beam, and is fastened to the share.

The sheat, or as it is sometimes called, the fore-sheat, there being another piece of timber behind it called the hinder-sheat, should be seven inches wide, and fastened to the beam by a retch (a piece of iron with two legs), and by a wedge driven by it into the hole of the beam. The angle contained between the sheat and the beam of the plough should be about forty-two degrees.

SHEAVES, provincially the broken parts of the stems of flax which come away in dressing.

SHED, a term applied to any slight temporary building.

Shed, a term signifying to part with the fingers wool, hair, &c.

Shed, a sort of slight open building, for containing cattle and various other uses in the farm yard. See *Cattle Shed.*

SHEDDING *of the Seed*, in *Farriery*, a disease in horses.

In its cure advantage, it is said, has sometimes been found from plunging the horse every morning into cold water, and giving him the following ball every night and morning:

Take Venice turpentine, one ounce; make it into a ball with a sufficient quantity of bole armoniac.

See *Seminal Weakness.*

SHEDDING *of the Hair*, in horses. See *Moulting.*

SHEEDWOOD, provincially rough poles of top wood.

SHEEP, a well known species of live stock kept by the farmer.

The sheep belongs to the class of ruminant animals or such as chew the cud, and of which there are numerous species, and varieties or breeds.

In its generic character it is distinguished by being with or without horns, which are hollow, wrinkled, turning backward, or intorted in a spiral manner. Eight front teeth in the lower jaw, in the upper none.

Sheep are animals of the utmost importance to mankind, whether considered in the light of affording food and clothing, or in that of the vast improvement and profit which they produce, in the various systems of management to which they are subjected by the farmer; in some instances constituting a very large proportion, and in others nearly the whole of his dependance and support. There is also another point of view, in which they appear equally advantageous and interesting, which is that of their becoming thus beneficial in situations and upon lands that must otherwise be nearly if not wholly useless.

In the view of affording the raw material for one of the most extensive staple manufactures of the kingdom, the advantages which they afford are incalculable. In usefulness they may of course be placed at least next to the cow. In disposition almost all the improved breeds are extremely mild, tame, and gentle, which is a proof of their value as grazing stock: but those which have been less attended to, or which continue more in their native or original state, are much less tractable, as those which inhabit the downs, heaths, and mountains in different parts of the island.

The growth of the sheep continues to advance till at least three years old, when it is in general considered as in the most proper state for the purposes of the grazier, though it is employed in this way till a much later period, sometimes even till five or six, and also with the view of breeding; but an early maturity is a property of much consequence, especially for the grazier. Of sheep, the breeds or varieties that are dispersed over the globe are almost endless; even in this country they are so extremely numerous as scarcely to be described with any correctness. The characteristic circumstances by which they have been chiefly distinguished, are those of their possessing horns, or being wholly without them, and from the length or shortness and fineness of the wool or coat, as well as the situation in which they are chiefly found.

It has been stated by Lord Somerville in his "System of the Board of Agriculture," that "all the breeds of sheep in this kingdom may be arranged into two classes; those which shear the short or clothing and those which shear the long or combing wool." And that "the quality of the flesh in each class follows the character of the wool; the short woolled sheep being close in the grain as to flesh, consequently heavy in the scale, and high-flavoured as to the taste; the polled long woolled sheep more open and loose in the grain, and larger in size."

And by the author of "the Present State of Husbandry in Great Britain," they have been distributed under three general divisions as below:

The Mountain breed;
The Short-woolled breed; and
The Long-woolled breed.

In the first are comprised several varieties, as the black faced, which range on the mountains of Wales, Westmoreland, Cumberland, Yorkshire, and those in the south, west, and north of Scotland, and in the Shetland Islands; the Cheviot hills, in the south of Scotland and North of England; and the forest and common sheep of the last mentioned country.

In the second division, are included those of Hereford, Dorset, Sussex, Norfolk, and some parts of Cumberland.

And the third division comprehends all those varieties that are dispersed over the more rich and fertile parts of England, and which are distinguished under the titles of the Durham or Teeswaters, the Lincolnshires, the old and new Leicestershires, &c.

Others divide them into *long*, *short*, and *middle woolled* kinds.

A still more clear and concise view of the various breeds of British sheep, is likewise afforded in the tabular form given by Mr. Culley, as enlarged and corrected by the author of the "General Treatise on Cattle."

TABLE.

				Weight of Fleece.	Price per lb. of Wool.		Wethers pr. Quar	Age killed.
No. 1 Teeswater	No horns	White face and legs	Long wool	9 lb.	1s.	0	30 lb.	3 years
2 Lincoln	Do.	Do.	Do	11	1	0	25	2
3 New Leicester	Do.	Do.	Do (fine)	8	1	0	22	2
4 Cotswold	Do.	Do.	Do. do	9	1	0	24	2
5 Romney Marsh	Do.	Do.	Do. do	8	1	0	22	2
6 Dartmoor or Bampton	Do.	Do.	Do	9	1	0	25	2
7 Exmoor	Horned	Do.	Do. (coarse)	6	0	10d.	16	3½
8 Heath	Do.	Black face and legs	Do.	3	0	8	15	3½
9 Hereford, Ryeland	No horns	White face and legs	Short wool (fine)	2½	2	9	14	3½
10 Morf, Shropshire	Horned	Black and speckled	Do	1¾	3	0	12	3½
11 Dorset	Do.	White do	Do	3½	1	6	18	3½
12 Wilts	Horned	Do. do	Short (mid.)	3	1	6	20	3
13 Berks	No horns	Black and white	Long wool	7	0	10	18	2½
14 South Down	Do.	Speckled do	Short wool	2½	2	3	18	2
15 Norfolk	Horned	Black do	Do	2	1	8	18	3½
16 Herdwick	Do horns	Speckled do	Do	2	0	8	10	4½
17 Cheviot	No.	White face and legs	Do	3	1	1	16	4½
18 Dun Faced	Do.	Dun do	Do	1½	3	2	7	4½
19 Shetland	Do.	Various coloured do.	Fine cottony	1¼	3	2	8	4½
20 Spanish	Rams horned.	White	Do. superfine	3½	6	6	14	3½
21 Do. Cross			Do. (fine)	2¾	3	2	16	2

As it is found by the grazier that the more an animal approaches towards perfection in its form, the better in general it is adapted to the purpose of fattening; it is obviously a matter of much importance to be well acquainted with the peculiar disposition and connection of parts which constitute such excellence or perfection of form; these have been already fully explained in speaking of the nature and principles of breeding animals, as well as in considering the nature and management of cattle. And the same thing is to be aimed at in sheep stock, as the more any breed may approximate to such an excellence of shape, the more perfect it must be. A sort of model to be aimed at, in so much as shape is concerned, in the improvement of these animals, due attention being always had to other properties, has been given by Mr. Culley in his description of a ram, and which may be seen under that head. The nature and combination of the various points and parts, should of course be well understood and impressed on the mind of the breeding and grazing farmer.

Teeswater breed. This is a breed of sheep said to be the largest in the island; it is at present the most prevalent in the rich, fine fertile inclosed lands on the banks of the Tees in Yorkshire. In this breed, which is supposed to be from the same stock as those of the Lincolns, greater attention seems to have been paid to size than wool. It is however a breed only calculated for warm rich pastures, where they are kept in small lots, in small inclosures, and well supported with food in severe winter seasons. The produce in weight of mutton is large, but then from their requiring so much longer time and richer keep, and being admitted in so much smaller proportions on the acre, they are probably not upon the whole so profitable, even in situations where they can be kept with the greatest chance of success, as the smaller more quick feeding breeds. In the ewes there is, however, a property which is of much consequence; which is, that in general they are very prolific, bringing two and frequently three lambs, and in some cases a greater number each, according to Mr. Culley. He gives the following description of the breed:

The legs are longer, finer boned, and support a thicker and more firm and heavy carcase than the Lincolnshires; the sheep are much wider on the backs and sides; and afford a fatter and finer grained mutton. The weight per quarter in two-years old wethers is from 25lbs. to 35lbs. and in particular instances to 55lbs. or more. The wool is shorter and less heavy than in that breed.

The writer of the Treatise on Cattle thinks that the breed is nearly worn out; but suggests that there is a similar breed in Ireland.

It is a sort of sheep that has been little attended to, but which when improved by proper crossing it is supposed would answer and pay well in districts where it could be well supported. In the corrected Report of the State of Agriculture in the West Riding of Yorkshire, Mr. Parkinson supposes that an useful kind is capable of being bred by crossing the ewes of this sort with Dishley rams, in a careful manner. And it is added that "by the use of these, and those of the Northumberland kind, the quality of the wool and the mutton has not only been greatly improved, but the quantity of bone and offal much lessened; and, at the same time, the fattening property considerably increased; they becoming fatter at two years old than the others are at three. The wethers of this improved sort generally sell unshorn at two years old, from 45 to 55s. a piece, and weigh from twenty-four to thirty pounds the quarter."

Lincolnshire breed. This breed of sheep is characterised by their having no horns; white faces; long thin weak carcases; thick rough white legs; bones large; pelts thick; slow feeding: mutton coarse-grained;

the weight per quarter in ewes from 14lbs. to 20lbs. in three year old wethers from 20lbs. to 30lbs.; the wool from 10 to 18 inches in length."

It is chiefly prevalent in the district which gives the name, and other rich grazing ones. But Mr. Lawrence supposes that this breed is "now so generally improved by new Leicester tups, that they are, probably, in a great measure, free from those defects of the old breed, of which Mr. Culley, he says, with much reason, complained, namely, slow feeding, from a looseness of form, and too much bone, and coarse-grained flesh. It must not, however, be denied, he observes, that a good old Lincoln has ever been, and the name, at least, still continues, a great favourite at Smithfield, and the flavour of the Lincoln mutton has been generally held superior, as more savoury than the Dishley. The improved Lincolns have now finer bone, with broad loins and truss carcases, and are among the best, if not actually the best long woolled stock we have. Many, says he, will recollect the ridiculous and indecorous squabble, some years ago, between two eminent breeders, concerning these two breeds of sheep. About that time, they attempted to feed Lincoln sheep on the Essex marshes, and pretended the stock degenerated, which might happen from insufficiency of winter keep, or if they were breeding flocks, from crossing with other breeds, an everlasting and unregarded practice in those not professedly breeding counties."

It has been suggested as a breed only capable of being made fat on the richest grazing lands: but that in such cases it may probably be kept till three years old, with greater profit than the new Leicester kind. The proportion of bone to mutton is considerable, and the latter not very fine in quality.

The principal excellence of the breed is in the large quantity which it affords, which pays for their being kept longer before they are fatted. Such breeds as feed quicker should however be preferred by the farmer.

New Leicester or *Dishley breed.* This is an improved breed of sheep, which is readily distinguished from the other long-woolled sorts, according to Culley, by having fine lively eyes, clean heads without horns, straight broad flat backs, round or barrel shaped bodies; fine small bones; thin pelts, and a disposition to make fat at an early age; to which may be added a superiority in the fineness of the grain and the flavour of the mutton to that of other sheep of the large long-woolled kinds. The weight per quarter in ewes three or four years old from 18lbs. to 26lbs.; in two years old wethers, from 20lbs. to 30lbs; the length of wool from six to fourteen inches. A ram of this breed is seen at *fig.* 5, *Pl.* XXVIII.

But Mr. Lawrence characterises them as having "a fulness of form and substantial width of carcase, with a peculiar plainness and meekness of countenance; the head long, thin, and leaning backward, the nose projecting forward; the ears somewhat long, and standing backward; great fulness of the fore quarters; legs of moderate length, and the finest bone; tail small; fleece well covering the body, of the shortest and finest of the combing wools, the length of staple six or seven inches. The fore-flank (a term of the old school- current in the time of Lisle,) or that flap of skin and fat appended to the ribs, and the inferior part of the shoulder, is remarkably capacious in this breed. New Leicester mutton, he believes, is the most finely grained of all the large and long-woolled species, but of a flavour bordering on the insipid."

He adds that "it is reported, and with the strongest probability, from the appearance of the stock, the fineness of the wool, and of the grain of the mutton, that a Ryeland cross was a prime instrument in the Dishley improvement of sheep. Probably the root or foundation was Lincoln. In the ordinary and gradual course of improvement or alteration of form, it must have taken, he thinks, a long time and vast pains, to mould the animals into that artificial and peculiar shape which distinguishes this remarkable variety, unless indeed something nearly similar was suddenly and fortuitously chopped upon, as will occasionally happen, when the fickle deity is good humouredly disposed to spare our labours."

The great advantages of this sort of sheep have been stated "to consist in producing a better profit to the farmer, in proportion to the quantity of food consumed, than most others; in being more perfectly formed, and consequently more disposed to fatten quickly; in containing a much larger proportion of meat on an equal weight of bone; in thriving well on such pastures as would not support other sorts of the same size; in being capable of being kept or fattened in larger proportions to the acre than other breeds of the same size of carcase; in the wool being more valuable, though less in quantity; in their being ready for the butcher in the early part of the spring instead of the autumn, by which there is a considerable saving in the summer's grass; and in the mutton, from the closeness of its texture, keeping longer than that of other equal sized breeds." And that the principal defects are the fattening too much, and the mutton in consequence becoming less delicate in its flavour than in that of other breeds that require a greater length of time in the process; the deficiency in the quantity of wool which they produce; and the not being calculated for the fold. It has also been supposed that their peculiar rounded form, from throwing much of the fat on the external parts, prevents their tallowing well internally; and that from their great propensity to fatten, they are liable to early decay, becoming old sooner than other breeds.

There can however be no doubt but that it is a valuable breed on pastures that are adapted to it, as is evinced from its rapidly making its way into different districts of the kingdom; but some suppose that the sheep are too small, and that, from the thinness of their skins or pelts, they may not be so capable of bearing cold, which however experience does not appear to support.

The author of the Treatise on Cattle, who seems to chiefly object to this breed from its too great pro-

pensity to fatten, which, he thinks, also abates the procreative and lactiferous powers, says, "Pure Dishley sheep, are by no means the most prolific, nor the best nurses." And he adds that, "the heads of improvers having had time to cool, it is no longer boasted that New Leicester sheep are able to subsist, and even thrive, on the shortest commons. In fine, he thinks, the merits of this stock as an improving cross, (their grand point of utility) being so undeniably great, their disadvantages have been overlooked, and comparisons have been usually made with such only as had a strong need of improvement, in which the New Leicesters in course were sure to triumph."

He further states that though "the Dishley cross has made its way into every part of this island; to the Land's End, to the bottoms of the Welsh mountains, and of the Scottish Highlands, to Ireland, and even to Russia; its general success has been attended with various particular instances of failure, a remarkable one of which is given by Lord Somerville, in his Facts, in respect to the Bampton or Western long woolled sheep. The cross is sometimes very injudiciously used with short or carding wool stock, excepting where the intention is only forward lamb. On stock naturally good and improveable, this peculiar effect of the New Leicester cross has resulted, the improved have considerably surpassed in the most valuable properties their improvers. Of this many examples may be seen, he thinks, in the improved Lincoln, Northumberland, and Midland county sheep."

The following is a table of the value of New Leicester sheep, at various ages, as given on the authority of different eminent breeders in the Lincolnshire Survey.

	s.
Wether lambs, at 6 months, worth	17
———, at 12 months	30
———, at 18 months	35
———, at 24 months	45
———, at 30 months	45
———, at 36 months	55

Others in different parts of the district state it thus:

Leicesters at six months old, worth	14*s.*
——— at twelve ditto	22*s.*
——— at twenty-eight ditto	28*s.*
——— at twenty-four ditto	35*s.*
——— at thirty ditto	45*s.*
——— and, if kept to thirty-six, would be	50*s.*

If a three-shear, sells for £.3 it will be worth,

At 6 months, 28*s.*	
At 12 months, 35*s.*	Wool 9½lb.
At 18 months, 40*s.*	
At 24 months, 48*s.*	Wool 9lb.
At 30 months, 56*s.*	
At 36 months, 60*s.*	Wool 9lb.

According to the first of these tables the scale of receipt is,

	£.	*s.*	*d.*
For the first summer	0	17	0
For the first winter	0	13	0
For the second summer, including 8lb. wool at 9*d.*	0	11	0
For the second winter	0	10	0
For the third summer, including wool	0	6	0
For the third winter, including wool	0	16	0
	3	13	0
Three fleeces	0	18	0
As above	2	15	0

At 73*s.* they pay, per annum, 24*s.* 4*d.*

It is remarked that "at these prices the last half year pays better than any; if this is just, there is a great loss by selling at 2½ years old, for it is just at the conclusion of the worst half year there is."

And Mr. Dawson of Berthorp, who has an excellent stock bred from Mr. Dalby's tups, last year sold 200 two shear wethers at £.3 round. The following is his table of sales for seven years, of wethers of that age.

1790 average	35
1791	35
1792	43
1793	38
1794	44
1795	50
1796	60

He tods threes.

Average 2*l.* 3*s.* 6*d.*

And at this average he would thus divide it, by supposing the proportion to be,

	£.	*s.*	*d.*
At 6 months	0	17	0
At 12 ditto	1	7	0
At 18 ditto	1	12	0
At 24 ditto	2	0	0
At 30 ditto	2	3	6

The advantages and disadvantages of the Lincoln and new Leicester breeds of sheep have been very fully considered in the survey of the former county under the direction of the Board of Agriculture, and the results stated as below in the different districts of it.

Circumstances of comparison between the Lincoln and Leicester Breeds of Sheep.

Boston	Lincoln better than Leicester on general experience, and particular experiment.
Brothertoft	In experiment very little difference.
Ewerby	Leicester tenderer than Lincoln. Lincoln pay best for keeping to three shear.

Hackington Last year of Lincolns pay best.

Ewerby. Old sheep stand the winter better, and pay better than young.

Owersby Shearling Leicesters have, at Wakefield, sold as high as two shear Lincolns. Difference of wool has been as 8 to 16. Leicesters run thicker, 1 in 5. Leicesters tenderer in winter.

Normanby Lincoln fleece 2lb. heavier than Leicester. Leicester off shearlings; Lincolns two or three shear, but the latter pay well, if kept to three shear. Leicesters finer grained mutton.

Leicesters rather thicker on the land, but Lincolns considerably larger.

As much wool per acre from Leicesters as Lincolns.

Waleot Leicester fleeces, though not so heavy as Lincoln, sold in one instance for as much money.

Barton Leicester not tenderer in winter than Lincoln.

Old breed of Lincoln used to go lean at two years old.

Now, Leicesters fat at the same age.

No difference in number on the same land.

Wool the same.

Bonby Leicesters come to sale sooner, but will not bear cold wet land in winter so well, nor heat or cold after shearing as the Lincoln.

Barrow Five Leicesters where four Lincolns; and Leicesters have resisted hardships on the worst land better.

Brocklesby Lincoln more profitable than Leicester.

Lumber Where a man can keep by means of marsh, to three-shear, Lincoln most profitable, but not otherwise. Not more Leicesters kept on the same land. Leicester wool 1*s.* a tod more than Lincoln. Leicester more liable to the fly.

Cadney Leicester will feed a little faster, and run a little thicker

Belesby Leicester one in six more on the same land, but both go at the same age. Leicesters hardier, and have less offal. Tallow equal; wool higher priced. Gives corn to Leicesters, but did not to Lincolns.

Alesby Leicesters feed quicker, and have less offal; wethers and hogs less wool, but ewes equal, and on the whole more per acre; hardier, and bear driving better. Go off at the same age, but Leicesters fatter. Five kept instead of four. Lamb, easier; necessary to give corn.

Humberston More pride than profit in the new sort.

Leicesters 2lb. less wool than Lincolns, and not better; but run one in ten thicker.

Louth Leicesters feed quicker, and have lighter offals. No difference in hardiness. Lincoln best.

Tathwell Lincolns and Leicesters being put together into the marsh, and sent thence at same time to Smithfield; the former yielded 4*s.* a head more, and 5*s.* a head more wool.

Cookswold Marsh graziers all prefer Lincoln. No difference in number kept.

Tathwell Lincoln wool 4lb. heavier than Leicester. At two-shear, Lincoln heavier by 2lb. a quarter; at three shear, 5lb. In tallow, 6lb. at three shear, in favour of Lincoln. In number per acre no difference. In hardiness, Lincoln best. Leicesters less wool and less mutton per acre.

Driby No difference in number kept.

Spilsby Leicesters as fat at Lady-day, coming two-shear, as Lincolns at Lammas. Same number per acre. No difference in hardiness; Leicesters have corn.

Horncastle Three-shear better than two, as sure to find more tallow.

Asgarby Leicesters bred too fine; fine headed ones do not yield wool enough.

Frampton As many of one as the other per acre. Lincolns travel best and pay best.

Ranby Leicesters thicker on land, as five to four.

Alderkirk In an experiment of the two breeds on the same land, of the same weight and age, the Lincolns considerably superior.

Thoresway True Lincolns most saleable, and most profitable to breed.

Sudbrook One third more Leicesters on the same land.

Riseholm Boston graziers not judges, for they can get good Lincolns, but not Leicesters, as the breeders of these can fat them themselves. Leicesters run one-fourth thicker on the land. From 6 to 12 months old, rather tenderer than Lincolns; Leicesters travel best.

Claypool Leicesters as fat at one year as Lincolns at two, and with less trouble, and one-tenth thicker. Do as well as Lincolns in winter on wet land.

Marston Leicesters best, and run one-sixth thicker.

Woolsthorpe Leicesters by far the best; but more apt to be barren than Lincoln. Drape ewes far more valuable.

Grimsthorpe Leicesters travel best, and are the best; and much less loss in lambing; run one-third thicker.

The writer remarks that he is "very unwilling to add any thing here in his own person; the table is not long, and a little attention to it will enable any reader to draw his conclusions without material error. A clear distinction is to be drawn between the rich south-eastern district and inferior soils; for upon the former the information is strong in favour of Lincoln.

"In general he should observe, that the new Leicesters are spreading very rapidly over the county, probably faster than they have done in any other, one or two only excepted, which may be attributed to the general goodness of the soil; for this breed makes a much more respectable figure here than it has done in various trials made in countries inferior to it in soil; and the breed driving out the Lincoln so much as it has done in the poorer parts of this county, is a fact that unites with this circumstance. The true Lincoln is a larger sheep, and with a longer wool, and therefore demands better pasturage; where it finds such, there the old breed remains; subject, perhaps, to little more change than fashion may cause. Upon inferior land the Leicester establishes itself; and upon land still inferior in other counties, experiments prove unsuccessful for the same reason; that of the necessity of having a smaller size and shorter wool."

Some of the original pure long-woolled polled breed of sheep, are still said to be met with in the midland districts, which are a larger boned, longer formed, deeper coated, and more coarse stock than the improved sort. And that, from the coarseness and larger size of the head and neck, in the old sort, the ewes lamb with more difficulty than in the true Dishley breed.

The *Cotswold* or *Gloucester breed.* This breed of sheep, according to Mr. Lawrence, "is of the fine combing wool species, deriving the fineness of their fleece from the same source as the new Leicesters." This part of that county, he says, "formerly, and within memory, bred small fine woolled sheep of the Ryeland species, which in past times had been cotted, but the practice was discontinued. These sheep, being judged too small for the improving state of the country, have been, by gradual crossings with Midland long woolled rams, chiefly Warwicks, completely changed from short, to large, long-woolled stock. He saw a picked lot of Cotswolds last year, he says, which answered the following description: long coarse head, with a particular blunt, wide nose. A top-knot of wool on the forehead, running under the ears. Rather long neck. Great length and breadth of back and loin, full thigh, with more substance in the hinder than fore quarters. Bone somewhat fine, legs not long, fleece soft, like that of the Dishley, but in closeness and darker colour, bearing more resemblance to short or carding wool. Although very fat, they had all the appearance of sheep that were full of solid flesh, which would come heavy to the scale. He adds that it is said, some of those sheep have reached 40, and even 50lb. a quarter, at two years and half old, giving 11 to 14lb. of wool each sheep, which being fat, they are, indubitably among the largest breeds in England. A single dip, continues he, of New Leicester gives the Cotswolds a fullness in the fore-quarters; but any farther cross of that species, it appears, diminishes their size. The strange cross of Wilts horned sheep has been recurred to in some parts, for no possible good purpose, he should apprehend, either to the carcase or wool; and it is probable, supposing such large stock profitable, that the chief alteration required by the Cotswolds, is to encourage length of staple in their fleece or wool."

In this breed the ewes are usually put to the tup so as to have lambs at two years old, mostly producing two lambs each in the proportion of nearly one third of the whole, where kept well, which must always be done. They may be kept for breeding till three or four years old, where of the proper improved sort.

It is said that the wethers afford most profit when killed so early as at two years old, as they are apt to become too fat when kept longer.

Romney-Marsh breed. This is described by Mr. Young as being a breed of sheep without horns; white faces and legs; rather long in the legs; good size; body rather long, but well barrel-shaped; bones rather large; and it is said that the weight per quarter in fat wethers at two years old, is usually from 22lbs. to 28lbs. In respect to the wool, it is fine, long, and of a delicate white colour, when in its perfect state. On this marsh 20lb. of wool is supposed to be produced per acre. In this breed there is a property of arriving at the state of fatness at an early age, as well as that of producing a large fleece of fine long combing wool, of course it is a valuable sort; however, from the size, and great weight of the coat, it is only capable of being supported and fattened on the rich kinds of marsh pasture: and on those which extend from Hastings to Rye, in Kent, according to the Sussex Report, the graziers find it much more beneficial than the South Down; the marsh wethers fattening more quickly. The wool afforded by such fat wethers averaging six pounds, and in breeding ewes five pounds, but not equal in quality to the wool clipped from shearlings. And the author of the Synopsis of Husbandry observes that a convincing "proof of the great value of this breed of sheep, as well as of the land on which they are fed, is seen in the manner of stocking, which in tags is from four to seven per acre, in fattening wethers from six to eight, in barrens from two to three, and in couples three;" which is certainly a great stock.

This is a breed that might probably undergo much improvement without crossing, by proper care and attention, and being less exposed in the winter season.

Dartmore, Devonshire, Bampton or *Natt breed.* This is a breed of sheep which is chiefly distinguished by having no horns; white faces and legs, thick necks, backs narrow, and back-bones high; sides good; legs short, and bones large: and probably without any material objection, being a variety of

common hornless sort. According to Mr. Culley, the " weight of ewes on the average about 20lbs. per quarter: in wethers at two years and a half old 30lbs. Length of wool much the same as in the Romney-Marsh breed. It is a breed found to be prevalent in the districts from which it has derived its name. It is supposed to have received considerable improvement by being crossed with the new Leicester or Dishley improved sort."

Exmoor breed. This is a sort of sheep which is characterized by having horns, white faces and legs; by being very delicate in the bone, neck and head, or what is sometimes denominated deer-necked; by the form of the carcase being indifferent, narrow and flat-sided. According to Mr. Culley, the weight per quarter in wethers at two years and a half old from 15lbs. to 18lbs.; and the weight of wool much less than in the Devonshire breed. It is a small breed of long-woolled sheep, principally produced on or in the neighbourhood of the moor from which it takes its name, which is in the northern extremity of the above county. Mr. Lawrence supposes that in their present state they are by no means to be considered as a profitable sort of sheep stock either in what relates to flesh or wool; on which account he thinks it would be for the interest of the county to change them for the best fine woolled breed. It is remarked by Mr. Billingsley that this breed " of sheep are frequently kept two or three years merely for the annual profit of their fleeces, which often do not exceed more than four pounds in weight; and that from their being kept upon very bare and indifferent pastures while young, they are supposed by many sheep farmers to be a very profitable sort of stock."

Heath-breed. This is a breed of sheep which, according to Mr. Culley, have large spiral horns, black faces and legs, a fierce wild looking eye, short, firm carcases, 12 to 16lb. per quarter, covered with long, open, coarse shagged wool, fleeces 3 or 4lb. each, wool worth at present about 8d. per lb. They are an active, hardy sort, running with amazing agility, and best adapted, of all other breeds, to exposed, heathy, and mountainous districts. Seldom fed until three, four or five years old, when they feed well, and makes the finest mutton, having a high flavoured gravy.

This wild looking breed are natives of the north west of Yorkshire, and of that mountainous tract of country adjoining the Irish sea, from Lancashire to Fort William: they have been of late years introduced into the western Highlands of Scotland.

Mr. Lawrence supposes " the black faced Linton, or short sheep of Scotland, to be a variety of the Heath sheep. They have been crossed with the Cheviot breed, and Mr. Culley, he says, recommends a Dishley cross, meaning, doubtless, for the use of the low lands. If he may be allowed to give an opinion, he would, for upland situations, recommend a Spanish cross, with good winter management, in preference to all others. It is disgraceful, he thinks, to the rural economy of Britain, that so excellent a breed of sheep should be needlessly compelled to brave the rigour of the seasons, in such loose, ragged, and beggarly clothing, when they might, with a few years pains, and without any deterioration of the carcases, produce a fleece of high value and consequence to the manufactures of the country." He adds that " Mr. Henry King, salesman of Newgate market, and an eminent grazier, informs him that he once fed a lot of these northern Heath sheep, and made excellent mutton of them, about 16lb. a quarter; but that their wool hanging down their quarters like goat's hair, was so execrably bad, that it could be sold only for mop yarn."

What are termed *black faced or short sheep* are said to have been originally short woolled, the present length of it having proceeded from crossing; and it is not well ascertained whether they are a native Scotch breed or have been introduced from the moor lands of Yorkshire.

Besides the objection to these *black faced* sheep on the ground of the coarse loose nature of their wool, they are said to be subject to the *braxy*, a disease that was unknown in the Highlands before their introduction.

It is remarked in the able Survey of East Lothian, " that the kind of sheep bred and most generally kept in Lammermuir is the black faced, or more properly what is called the *brocked* faced, a sort of dirty looking mixture of black and white; they are for the most part horned: when they are fed, the wethers weigh from ten to twelve pounds per quarter, and the ewes from eight to ten on an average. It will take eight or nine fleeces of the ewes and hogs, and six or seven of the wethers to make a stone of seventeen pounds (twenty-one ounces to the pound); the quality and consequently the price varies much. The difference of quality may result from various circumstances; it is owing partly to the quantity of tar put upon the sheep in salving; partly, it is supposed, to the situation in which they pasture, as those fed on high grounds and coarse mossy herbage are thought to have inferior wool, and partly to the general attention and care which farmers bestow upon their flocks, in which some are greatly superior to others."

" The black faced sheep seem, the writer says, to be capable of very considerable improvement; it does not indeed appear that much has been done for improving that breed, which certainly places them in an unfavourable situation when their merits come to be discussed in opposition to others which have received great attention. There can hardly be a doubt, that the weight of the carcase and the quantity and quality of the wool might all be increased by sufficient care to select the strongest, healthiest and best feeding among them for the purpose of breeding. It has been observed that those which feed best have the greatest quantity of wool, and generally of the best quality; and it is natural to suppose that it should be the case, as they must be healthiest and strongest."

Herefordshire, Ross, or *Ryeland breed.* This is a sort of sheep which is distinguished by the author of the Treatise on Live Stock, by the want of horns,

and having white legs and faces; by being small in size; and the wool growing close to the eyes; by the carcase being pretty well formed; and by the excellence of the mutton. Weight per quarter from 10lbs. to 18lbs. Wool fine and short, the lean poor-fed sheep producing the finest. It is the true breed of this sort of sheep which is properly denominated Ryelands. In the Report of that district, they are said, in symmetry of shape and the flavour of their meat, to be superior to most flocks in the country. They lamb in February and March.

An ewe of this breed is seen at *fig.* 6. in *Plate* XXVIII.

It is a breed which, Mr. Knight says, is found to be remarkably easy in respect to food, but which, in its management, requires cotting in the winter season, and being fed with hay or peas-haulm. In some cases they are housed all the year round in the night-time. The cots are low covered buildings, proportioned to the extent of the flocks. In the Herefordshire Report, it is observed that the cotting materially contributes to the health of the animal and the fineness of its fleece. The quantity shorn from each of the small original breed does not average more than two pounds; but the quality is such as almost to rival that imported from Spain. The price has often been as high as thirty-three shillings the stone of twelve pounds and a half untrinded, when the coarse wool has brought but ten or twelve shillings. They are said, by Culley, to fatten the best at four years old. The Archenfield or true Herefordshire breed are said to afford the finest wool except the Spanish. It is suggested by Mr. Knight, that the disposition of sheep to fatten in the north-west part of that district is in proportion to the fineness of the wool; but he is not certain of its being so in this breed; however, it seems to him, that "where the wool is close and fine, there are many advantages; less nourishment is drawn from the body in its support than in the contrary case. The long coarse-woolled fleece admits the rain more freely, and by dividing on the back lets it down to the skin. It also takes in a larger weight of water, which must more inconvenience the animal already heavily loaded. The fine close fleece of this breed admits the water with difficulty, even when immersed in it, in washing, and is never wet through by rain. On account of the closeness of the texture, it only lodges on the outside, and is easily removed by the animal shaking itself. Besides, a fleece of this kind is much more warm and light." For these reasons it is supposed, that no breed of sheep in the island is capable of subsisting on so small a proportion of food as this.

"This animal, says Mr. Knight, appears to me to be much more patient of hunger and to keep itself in better condition on a less quantity of food than any other which I have had an opportunity of observing. To the great scantiness of the pasture on which it is usually condemned to feed, is to be attributed the fineness of its fleece; for the quality of this becomes immediately impaired by a copious supply of food; and this circumstance should be attended to, in every county where these sheep are introduced.

"Some attention has lately been paid to its improvement; and although the wool is somewhat less fine in its quality than it formerly was, it is still the finest in the island, with the exception of the Spanish sort recently imported; and the animal must be allowed, on the whole, to have been considerably benefited. The quantity of wool afforded by the improved sort of Ryelands, although increased, is still far from large; a three year old wether rarely yielding more than three pounds and a half.

"But as a large number of sheep will subsist on a small portion of ground, and the wool is still worth two shillings and sixpence the pound, its value compared with the quantity of food consumed by the animals, is probably much greater, than that afforded by any other breed.

"The Ryeland sheep readily acquires on a very moderate pasture, that degree of fatness which renders its flesh more acceptable, but it is wholly incapable of being loaded with fat in the manner of Mr. Bakewell's. It appears to me, says he, to fatten, somewhat more quickly than those I have seen of the South Down breed."

In the Survey of Herefordshire it is suggested, that "a cross between the Ryeland and real Spanish, seems the most probable mode of adding to the fineness and value of the wool; and amongst many spirited breeders who are now making the experiment, Colonel Scudamore of Kentchurch, sold the fleeces of a flock so crossed at forty-shillings per stone, in the fair at Ross, in the course of last year. The first stage of the cross materially detracts from the beauty of the Ryeland's form; but by continued attention, this objection will probably be removed, and the flavour of the mutton is uninjured. Lord Somerville has found that they feed quickly and weigh heavily, although their form be not attractive; but perhaps form in this animal is of little comparative consequence. An ox rarely fattens well, or has flesh of good quality, unless it be in one particular shape; but sheep fatten well, and the meat is of prime quality in those of very different forms. Two Leicesters which were fed by Mr. Hewer, of Abergavenny, and slaughtered before the Agricultural Society of this county in March last, weighed no less than fifty-one pounds in each fore-quarter, and forty-five in each hind-quarter. But notwithstanding this great weight, the Leicesters are often found less heavy than they appear to be, whilst the half Spanish weighs more than is generally expected from its size."

In crossing this breed with the Dishley an useful kind of sheep has however been produced, both the wool and carcase being increased in weight, but much injured in respect to fineness; and it is contended by some, that the breed is rendered much less hardy by it.

Shropshire or Morf breed. This sort, according to Mr. Lawrence, have "small horns, with speckled dark or black faces and legs; they have the full character of real fine woolled sheep, and have been, for centuries, bred in Shropshire, Staffordshire, Worcestershire, and the vicinity. Their fleece is nearly all fine, and it is said, superior to Ryeland wool, since the crossing which has taken place in that stock."

Mr. Pitt, of Pendeford, in a letter to Lord Somerville, dated 1799, "estimates, he says, the extent of Morf common, or waste, at 3,600 acres, and the number of sheep summered thereon, at 15,800, to the annual profit of fifteen shillings per acre in wool only, on a moderate calculation, eight fleeces and a half to the stone of 14lbs. Nothing is reckoned on account of carcase, as the sheep have some extra keep during winter." It is added, that "the Shropshire commons produce good fine wool, but none equal to Morf by sixpence a pound."

Dorsetshire breed. This breed is known by having the face, nose and legs white, head rather long, but broad, and the forehead woolly as in the Spanish and Ryeland sorts, the horn round and bold, middle sized, and standing from the head, the shoulders broad at top, but lower than the hinder quarters, the back tolerably straight; carcase deep, and loins broad; legs not long, nor very fine in the bone. Weight per quarter in wethers at three years and a half old from 16lbs. to 20lbs. Mr. Billingsley says, that the wool is fine and short. It is a breed which has the peculiar property of producing lambs at any period in the season, even so early as September and October, so as to suit the purposes of the lamb-suckler. It has been found to answer well in some of the midland districts, and, from its close make, to be equally advantageous with almost any other. It is, however, supposed capable of improvement by being crossed with rams of a larger size. There are varieties of it met with in several districts.

It is said, by Mr. Lawrence, that the "Dorset breeders pay great attention to preserve the colour of their flocks from mixture, since white lambs are most esteemed in the London markets, from a presumed superior delicacy in the meat." He believes "this is one of the best breeds in England, if not superior to all others, considering its various qualifications. Their property of bringing twins, making our highest prized house lamb, must be considered first; they are both good hill sheep and good pasture sheep, and their flesh is an excellent medium between the delicate mutton of the hills, and the rich and juicy meat of the best lowland sheep. The later Dorset lambs when fattened, make the earliest grass lamb. By the practice of this county, the lambs which the breeders retain, are shorn at Midsummer, having been taken from the ewes in May; produce of wool, one pound to a pound and a half each, the price a penny per lb. nearly, under the price of sheep's wool. A three shear sheep may produce four or five lbs. of middling fine wool, which it would be highly advantageous to improve to the utmost, on this excellent breed."

There is a breed or variety nearly connected with these in the Mendip hilly district. They are samaller than that breed, having smaller horns, more deer-headed, the wool less but in weight; the mutton excellent in its flavour. It has been observed by the author of the General Treatise on Cattle, that in the West Riding of Yorkshire, and in the adjoining parts of Westmoreland, they have a breed of horned and white faced sheep, bearing a strong affinity to the Dorsets; they are called *Craven* and *Wensleydale* sheep, but more generally *Peniston* from the market town where they are sold. They are a good down or hill sheep, in their pure state, and give a fleece of coarse short wool, weighing between two and three pounds, the carcase good mutton, about fifteen pounds per quarter. They are variously crossed in that riding, with Cheviot, Dishley and Northumberland tups; with the two last, for the purpose of making pasture sheep, in which case the weight of carcase is increased to twenty or thirty pounds per quarter. In the north, this breed is commonly crossed with the Heath sheep, which gives them black or grey faces and legs, with sometimes a black spot on the top of the neck, the wool coarse and open, instead of being close and thick set upon the skin, as a defence against the severity of the climate of that hilly and exposed country in which they are fed: defects for which the remedy is obvious. Ryeland tups have been tried with the Penistonewes, a cross which made a considerable improvement."

Wiltshire breed. This sort has sometimes the title of *horned-crocks*. Mr. Lawrence distinguishes the breed, as having a "large head and eyes, Roman nose, wide nostrils, horns bending down the cheeks, colour all white, wide bosom, deep greyhound breast, back rather straight, carcase substantial, legs long, bone coarse, fine middle wool, very thin on the belly, which is sometimes bare." He supposes, with Culley, that "the basis of this breed is doubtless the Dorset, enlarged by some long-woolled cross; but how the horns come to take a direction so contrary, is not easy, he thinks, to conjecture; he has sometimes imagined it must be the result of some foreign, probably Tartarian cross. The old Hertfords were, he says, supposed a kindred breed with the Wilts, but at present, the few of this kind bred in Herts, are of smaller size, longer and coarser wool. These large and leggy Wilts' sheep work well in the fold, and have always had the character of good thrivers at corn, oil-cake, and the best meat, making very large mutton, and very deep in flesh, which is high flavoured, yielding the dark coloured gravy. The breed is, he adds, every where on the decline, generally supplanted by the South Downs, of which the farmers find they can, on the same quantity of land, keep more than one and a half, for one of the Wilts, the former, moreover, producing both better mutton and better wool. The disease called the *goggles*, is said to be peculiar to the Wilts sheep." It is stated, that this "breed has been used, more or less, in the counties bordering on Wilts, and in Surrey, Kent, Herts, Essex, and Middlesex." But, that it is a breed not worth preserving; perhaps the only thing to be done with it to advantage, is to cross it with Merino." The Hampshire variety of this breed, is, he says, said, for what reason he knows not, to be more hardy.

Berkshire breed or Natts. This is a sort, of which the same writer says, "considerable length and bone, straight made like horses, full fore flank, Roman faced, with distinct black spots, high on the

leg, thick fleece, of considerable length." He supposes "them to class with the long-woolled breeds, and to probably bear some affinity to the breed of Oxfordshire, which is, he is told, a peculiar variety."

It is observed in the Norfolk Report that "the Wiltshire sheep have proved in various trials, an unprofitable breed as well as the Norfolks; but it is remarkable that for turnips, no sheep are said, by many practical and experienced husbandmen, to pay better, if so well. In Hertfordshire, many who turnip-feed adhere to that breed, who admit the South Downs to be a superior sort for grass-feeding."

South Down breed. This is a valuable sort of sheep, which Culley has distinguished by having no horns, gray faces and legs, fine bones, long small necks, and by being rather low before, high on the shoulder, and light in the fore quarter, sides good, loin tolerably broad, back bone rather high, thigh full, twist good, mutton fine in grain, and well flavoured. Wool short, very close, and fine, in length of staple from two to three inches. Weight per quarter in wethers at two years old 18lbs. It is a breed which prevails on the dry chalky downs in Sussex, as well as the hills of Surrey and Kent; and which has lately been much improved both in carcase and wool, being much enlarged forward, carrying a good fore flank; and for the short less fertile hilly pastures is an excellent sort as feeding close. The sheep are hardy, and disposed to fatten quickly; and where the ewes are full kept, they frequently produce twin lambs, nearly in the proportion of one-third of the whole, which are, when dropped, well woolled. The wethers are capable of being disposed of at an early age, being seldom kept longer than two years old, and often fed at eighteen months, which is a very valuable property. But according to the Sussex Survey, the ewes are commonly kept till between four and five, and found to answer well to the graziers in the neighbourhood, as well as the farmers in Norfolk and the adjoining counties, in the place of home bred sheep, as being more expeditious feeders, and equally adapted for the purpose of the fold. It has been observed that it is in fact, "a breed of sheep, which from the compactness of their form, and their legs being shorter, considerably outweigh both the Dorset and Norfolk breeds in proportion to the size of the carcase, being heavy in a small compass. Their hardiness is estimated according to the darkness of the colour in the face and legs; but as there is inconvenience in the produce on this account, from the wool, especially about the head and neck, becoming spotted with black, and thereby thrown aside by the stapler, as only of half the full value, a middle degree of colour may be the best. As an open country breed, they are sufficiently gentle and tractable. They are capable of travelling well, and of resisting the effects of exposure to cold. The wool is scarcely, if at all, inferior in fineness to that of the Herefordshire kind; as the practice of sorting, which is common in that district, is not in use on the Downs." The excellent properties of this breed have been brought fully to the notice of the farmer, by the great patrons of improvement in Bedfordshire and Norfolk, and its superior merits on trial have been such as to have induced the sheep-farmers in various districts to introduce them in preference to other breeds. It is stated in the Annals of Agriculture, that "they have been found to consume less food in proportion to weight than the Norfolks, yet keeping in better order. Young sheep produce the best lambs, the crones are of course constantly sold at four or five years old; and if it were done earlier, it is supposed it would be more profitable."

The author of the General Treatise on Cattle, suggests that "the most noted variety is that of Mr. Ellman, of Glynd, in Sussex, who, he believes, first enlarged the Down breed, by the aid of polled or *natt* Berkshire tups. From this enlarged cross, he understands, originated the stocks of the duke of Bedford and Mr. Coke; the South Downs of Mr. Coke being generally acknowledged the largest and finest in England, a very pregnant proof of which was given at lord Somerville's cattle show, in a two shear Holkham South Down wether, which weighed more than 40lb. per quarter. Although quick and early feeders, they tallow within remarkably."

And in answer to the complaints of those who knew the old Down sheep, "that their wool is become so much coarser than formerly, from the modern habit of feeding the sheep with rape, cabbage, and oil-cake; they seem, says he, totally to forget the middle and long-woolled cross, by which the carcase of the South Downs of the present day have been enlarged, and their weight of wool increased, and rendered more coarse. The mutton is still excellent, although probably not so high flavoured as the old Down mutton."

It is further suggested that it would be "difficult to point out any part of the island for which this breed would be unfit, but extremely easy to name a vast number of districts, where it would be a most advantageous substitute for the native stock. It is supposed that all the South Downs want is the noble covering of a Spanish fleece, and how little their carcase would suffer by the cross, has, it is said, been demonstrated by Lord Somerville, in the exhibition of a very fine ewe, large enough for any purpose, half Spanish, and half South Down."

A ram and ewe of this breed are seen at *figures* 3 *and* 4 in *Plate* XXVIII.

In order to form a comparison between the Norfolks and South Downs, Mr. Overman of Norfolk, on March 27th, 1799, took from turnips 24 two years old Norfolk wethers and 10 South Down of the same age, having always lived together from the time they were lambed, and two hours afterwards weighed as follows:

	st. lb.	*st. lb. oz.*
24 Norfolks from the field,	264 7½	
Average		11 1 15
Do. after fasting 28 hours,	237 13	
Average		10 10 7
Difference		0 5 8

10 South Downs from the field	109 4		
Average		10 13	0
Do. after fasting 28 hours,	106 2		
Average		10 8	9
Difference		0 4	7

One of each lot slaughtered :

Norfolk.

	st. lb.		£. s. d.
Mutton	6 10	at 6*d.*	2 7 0
Tallow	1 2½	at 5*d.*	0 6 10½
Head and pluck	0 10½		0 0 9
Skin	0 9¾		0 1 0
Wool	0 3¾	at 17*d.*	0 5 4
			£.3 0 11½
Blood	0 6¼		
Entrails	0 11		
Loss	0 0¾		
Live weight	10 12½		

South Down.

	st. lb.		£. s. d.
Mutton	6 8½	at 6*d.*	2 6 3
Tallow	0 13½	at 5*d.*	0 5 7½
Head and pluck	0 10		0 0 9
Skin	0 10		0 1 0
Wool	0 7½	at 18*d.*	0 11 3
			£.3 4 10½
Blood	0 7		
Entrails	0 11		
Loss	0 0½		
Live weight	10 12		

Norfolk	3 0 11½
Down superior by	£.0 3 11

These Norfolk sheep losing 1lb. 10oz. more of their respective weight (taken full and empty) is a strong circumstance against them. The Downs are run much thicker on the land than the Norfolks.

Mr. Hill of the same district estimates the difference of stocking between Norfolks and South Downs, at one third in favour of the latter, in number, in better condition, and of greater weight, both in wool and carcase; all fairly attributable to the superiority of the breed, and free from any charge of lessening cattle, &c. When his flock was of Norfolks, scarcely one in a score had a whole fleece; but now they are South Downs, scarcely one in a score is broken. And Mr. Blythe of Burnham had, four years ago, a flock of between 5 and 600 Norfolks: he has now 1000 South Downs on the same land, and has likewise double the wool from his land, stocked with South Downs, to what he clipped when under Norfolks.

Mr. Dursgate, who has had South Downs six years, and is clear that, free from all change in husbandry, or other circumstance that would unfairly affect the comparison, the number kept, compared with the Norfolks, has been as five to four. The carcase is as heavy as the Norfolks, more wool and at a better price. He does not fold; but the South Downs would bear it better than the Norfolks. At Palsgrave he folds the South Downs because there is a sheep walk; a Norfolk flock changing gradually to South Downs.

It is stated in the Staffordshire Survey, that the Cannock Heath are a sort of sheep that has much resemblance to this breed, and is believed to have originated from the same. It is stated to have been much improved in the form, thickness and weight of the carcase, as well as the fineness of the wool, by crossing with rams of the Herefordshire breed. They are polled with grey faces and legs, low before; wool fine and thickly set, weighing two or three pounds the fleece; the mutton good: they weigh from 15 to 20 pounds the quarter. In Sir Edward Littleton's improvement of this breed by crossing with Herefordshire tups, the carcase and wool were both bettered, the latter rendered worth nearly 2s. the pound.

Norfolk breed. In this sort of sheep, the face is black; the horns large and spiral; the carcase long, small, weak and thin; narrow chine; large bones; very long black or gray legs: mutton fine grained and high-flavoured, but does not keep well in hot seasons. The weight per quarter from 16 lbs. to 20 lbs. The wool in the best part short and fine, but part coarse. This breed is chiefly prevalent in Norfolk and Suffolk, where folding is much the practice, as they have the property of travelling well. They are found in disposition to be given to be restless, which renders them unfit stock, except in good inclosures.

It is stated in the nineteenth volume of the Annals of Agriculture, that this sort of sheep, from possessing few valuable properties in addition to that of standing the fold well, and as requiring much expense in winter keep, an acre of turnips being the usual allowance for half a dozen besides hay, has lately given way to the South Downs, which are supposed by some to be hardier, less nice in their food, sooner ready for the fold, and more quiet. This last sort has lately gained much ground. The wool might be improved by a Spanish cross, but little other advantage would be gained.

It has been remarked in respect to the quick *tainting* of this mutton, by Mr. Vyse butcher of Eaton College that "the Norfolk mutton certainly will taint sooner than any other in very hot weather;

neither is there any sort (that he knows) of a worse flavour at that time, though inferior to none in cool weather. Many very fine and fat Norfolks do not please on the table. The fat runs away in roasting, if they are laid to a hot fire; and they rarely are so sweet as the South Downs. The latter are in hot weather worth a halfpenny a pound more than the Norfolks."

"When both are *completely* fatted, it is hard to say, (supposing the season cool) which upon an average is fattest: the flavour too, in such a season, he thinks, is equal, and as to coarse meat, there is none in either sort. But if they are killed in cool weather, before they are very fat, the preference must be given to the Norfolks, because the meat will in that case eat better, and there is a probability of much more fat within.

"With respect to profit to the feeder, if they are fed entirely with grass and upon good land, his opinion is decidedly in favour of the South Downs; or if they eat turnips in the winter, and after that are kept two or three months upon grass in the spring, it is the same; but if they are half fat against winter, and are to be completed at turnips, he believes no sheep are more profitable than Norfolks, perhaps none so much so. But both sorts should be kept where there is both turnip and grass land."

There are varieties of this breed in Cambridge and Suffolk, with coarse wool, and weighing about 18 or 20lb. the quarter.

Herdwick breed. This is a breed which is characterized by Mr. Culley by having no horn; and the face and legs being speckled, the larger the portion of white with fewer black spots, the purer the breed; legs fine, small and clean. The lambs well covered when dropped. The weight per quarter in the ewes from 6lbs. to 8lbs.: in the wethers of four years and a half old from 9lbs. to 12lbs. The wool short, thick and matted in the fleece. It is a breed peculiar to the elevated mountainous tract of country at the head of the river Esk and Duddon in Cumberland, where they are let in herds, at an annual sum, whence the name. At present they are said to possess the property of being extremely hardy in constitution, and capable of supporting themselves on the rocky bare mountains with the trifling support of a little hay in the winter season; scratching down to the heath during the snows, for their subsistence, and by their constantly moving about not being liable to be drifted over by snow.

From the nature of the climate, the ewes produce their lambs late; and are generally kept as long as they produce lambs. But the wether stock is usually disposed of from the mountains, without being put in the pastures, at from four to five years old.

It is observed, that the fleece in this breed is finer than in that of the heath sort, but coarser than any of the short-woolled breeds. It is a breed that stands in need of a cross with some of the finer-woolled breeds, and the Spanish has been suggested as proper for the purpose.

The property of the flocks, as well as of the mountains, is in Lord Muncaster the lord of the soil. And the farmer of the principal flock is now Mr. Tyson, whose family, it is said, have inhabited this wild and sequestered spot through four centuries. Mr. Tyson is a tup breeder, and sells a number of Herdwick tups yearly, some at several guineas each, to the adjoining districts, where their known hardy qualities are desirable.

Cheviot breed. This breed of sheep is known by the want of horns; by the face and legs being mostly white, and the eyes lively and prominent; the body long; little depth in the breast; narrow there and on the chine; clean, fine, small-boned legs and thin, pelts. The weight per quarter, when fat, from 12lbs. to 18lbs.; the wool partly fine andpartly coarse. Mr. Culley considers this "as a valuable breed of mountain sheep where the herbage is chiefly of the natural grass kind," which is the case in the situations where these are found the most prevalent, and from which they have obtained their name. It is a breed which has undergone much improvement within these few years in respect to its form and other qualities; and has been lately introduced into the most northern districts; and from its hardiness, its affording a portion of fine wool, and being quick in fattening, it is likely to answer well in such situations. The Spanish and South Down have been advised as proper crosses for this sort of sheep.

It is observed by the writer of the Argyleshire Report that "the Cheviot sheep are in every respect superior to the black-faced kind, and found to be equally fit for a mountainous situation. They are hardy, fine woolled, and well-shaped. They are long-bodied, and long-limbed, which fits them for climbing steep mountains, and for travelling, either for seeking their food, or going to a distant market. Their fleece, too, is finer, closer, and warmer. They have every property that should be sought in a mountain sheep, and accordingly they have been found to thrive in every part of the Highlands in which they have been tried: and are said to be less subject to diseases than the black-faced kind. Some of them have been lately introduced into the county by the Duke of Argyle, and by Mr. Campbell of Auch, in the highest parts of Glenurchay, and found to answer exceeding well. And Lord Breadalbane, a few years ago, made a present of some Cheviot wedders to several of his tenants in Glenurchay, in order to try how they would fare on the same pasture with the black-faced kind, and the writer was informed by some of the store-masters, that they perceived no difference in their thriving. Indeed no part of this county is more inclement than that from which they came, where the hills are sometimes covered with snow for three or four months in a year, and where many of the lower walks consist of peat-bogs and deep morasses; so that with us their situation would be mended; a circumstance which will always ensure success."

It is stated in the twelfth volume of the Statistical Account of Scotland, that "the following experiment, made in the parish of Barr, in Ayrshire, shows the comparative hardiness and value of the Cheviot breed. "In June 1792

a ram, and two score of ewe hogs of the Cheviot breed, were put upon one of the highest and coldest farms in the parish. The harvest was wet, the winter and spring stormy, and the loss of the native sheep, through poverty and disease, was considerable. Yet all these, though strangers, and in such a situation, did well. The wool of the native sheep, taking 10 fleeces to the stone (24lb.), sold at 7s. 6d.; the wool of the Cheviot kind, taking only seven and a half to the stone, sold at 15s. The profit here was great; but how much more, if the wool had fetched its real value of 20s. the stone!"

And in "Observations on different Breeds of Sheep," it is stated that "in 1792, the Cheviot wool sold from 18s. to 20s. the smeared, and from 20s. to 22s. the white; from six to eight fleeces of the first, and from eight to nine of the last, going to the stone. Some went as high as 23s.; and it is thought it will soon be improved so as to fetch 30s. if not 40s. Draft ewes sold from 12s. to 16s. and three years old wedders from 18s. to 22s. In Etterick, Ewesdale, and Liddesdale, they are now converting their flocks as quickly as possible into the Cheviot breed."

The Roxburgh Report also says, that "Liddesdale is the worst district, yet the Cheviot breed thrive in it."

The writer of the first of these Reports remarks that "it is difficult for those who have already got another kind to change the breed; but new beginners ought undoubtedly to stock with the Cheviot kind. It is said that the Yorkshire graziers have a prejudice against this kind; probably because they would then have more rivals in the trade, which is now in few hands; as the carcass, and not the wool, is the principal object of attention. Whatever may be in this, the introduction of the Cheviot, which would treble the price of wool, would more than balance it." And he adds from the same volume of the Statistical Account of Scotland, that "even they who have another stock, and cannot conveniently change it, might at least cross it with the Cheviot breed, which might be done with little trouble, and to great advantage. In the year 1787, 1788, and 1789, an intelligent farmer in the parish of Moffat, put Cheviot rams to his black-faced ewes. In 1790, he sold the wool of the sheep produced by that cross at 10s. the six fleeces; and the wool of his other stock of the black-faced kind, which went exactly on the same pasture, only at 6s. 3d. the seven fleeces. The sheep thus produced were as healthy as his other sheep, the carcass not materially altered, and the weight of the wool increased a seventh part, and its price more than a third. The farm on which they were is as high ground as almost any in Scotland."

What are at present known by the title of *Long Hill Sheep*, by the northern farmers, are a hornless, white-faced, loose shaped breed, having a coat of ordinary short or of fine wool, perhaps raised by crossing through time the old country, breed with those of the Cheviot kind. They are said to be more tender than the short or black-faced breed, but to answer well with good care and keep.

From the practice of milking ewes of this breed for the purpose of making cheese, being found to be prejudicial, it has been much left off by the best sheep-farmers in these districts.

Dun-faced breed, This is a sort which Culley says has no horns; the face in common of a dun tawny colour; the size small; the tail short; the mutton fine in texture. The weight often only 6lbs. or 7lbs. the quarter. The wool variously streaked and blended with different colours, some of which is very fine. He supposes it to partake of the Spanish breed, but it is not so hardy as the Cheviot breed. The mutton of this breed is excellent in flavour: they are supposed by some to have had a Spanish origin.

They have been naturalized for a great length of time on the Grampian and other hilly districts in Scotland.

Shetland breed. This is a small breed, and mostly without horns; but what more particularly distinguishes it from other breeds is, the uncommon smallness and shortness of the tail. The weight per quarter from 7 lbs. to 10 lbs. The wool very fine, and of various colours. The breed is very hardy, but much too wild in its disposition to be confined in inclosed pastures, and of course less proper for the purposes of the grazier.

There is a sort of this breed of sheep which, according to Mr. Johnson, "carry coarse wool above, and fine soft wool underneath; and have three different successions of wool annually, two of which resemble long hairs rather than wool, and are by the common people termed *fors* and *scudda*. As soon as the wool begins to loosen at the roots, which is mostly about February, the hairs or *scudda* spring up; and when the wool is cautiously pulled off, the tough hairs continue fast until the new wool grows up, about a quarter of an inch in length, then they gradually wear off; and when the new fleece has acquired two months growth, or thereabouts, the rough hairs, termed *fors*, spring up and keep root until the proper season for pulling it arrives, when it is plucked off along with the wool, and is separated from it at the time of dressing the fleece, by an operation called *forsing*. The *scudda* remains upon the skin, as if it were a thick coat, a protection against the inclemency of the season."

But the native or kindly breed, that bear the soft cottony fleeces, according to Mr. Culley, are rather delicate, though the fact of their eating the sea weed greedily when the ground is covered with snow, and often during long and severe snows, when they have little else to live on, seems to prove the contrary. Nature, he says, "seems to have imparted to them a perfect knowledge of the times at which this food may be procured; for immediately upon the tide beginning to fall, they in one body, run directly down to the sea shores, although feeding on hills several miles distant from the sea, where they remain until the tide returns, and obliges them to seek their usual haunts."

They are very hardy, and the wildest of all the breeds of these animals.

In respect to the wool of these *beaver* sheep as they are termed, it is short and open, and destitute of a covering of long hairs. These fine soft fleeces are liable to be rubbed off during winter, or early spring, which, it is supposed, might be prevented, by clipping the sheep in the usual way, instead of the absurd mode of pulling them off, which tends to weaken the sheep, and decrease the length of the staple of the wool.

In regard to colour this wool is various, as *silver grey*, which is the finest and softest; the pure *white*, which is mostly of the greatest value for all the purposes of the finest combing wool; the *black* and the *mourat* or *brown*, which are very little inferior. The whole of the softest texture, fit for the finest manufactures, and in some instances rivalling even Spanish wool, than which it is somewhat longer in the staple, and not so elastic.

It is stated to have been manufactured into stockings of extraordinary fineness; and that the fleece attached to the skin, affords a fur of great value. This breed was "formerly a native of the higher parts of Aberdeenshire, and in the districts to the northward of it; but it has been since much crossed, and is now mostly confined to the Orkney and Shetland isles, the purest breed being to be found in the latter. The number of the *beaver* sheep in these isles amounted to ninety thousand some years since, and five or six of them are said to be capable of being fed with the food required for one English sheep. In the West Riding of Yorkshire, Mr. Beaumont is said to have made a trial of these sheep, the result of which was, that they did not fat, but grow, which shows that their size would improve with that of the soil; their wool also improved in length.

The original old breed of the Highlands are said to partake of the nature of the goat and deer. Their coat consisting of a sort of fur or down, covered by long, straight, rigid hairs, like those of the beaver, rather than wool; tail short, slender, tapering, not larger than that of the deer or goat, and thinly covered with strong, silvery hairs; the face covered with sleek hairs like the face of the deer, with his prominent eyes. Tame, delicate of frame, and requiring to be housed in winter: their flesh of high venison flavour. It is found in its original purity, in the central Highlands, on the southern banks of Strath Tay, and between those and Strath Brand, and on the banks of Loch Ness, in the northern Highlands, as well as in the Shetland islands.

Merino or *Spanish breed.* In this breed of sheep the males have horns, but the females are without them: they have, according to Lord Somerville, white faces and legs; the body not very perfect in shape; rather long in the legs; fine in the bone; a degree of throatiness or production of loose pendulous skin under the neck; and the pelt fine and clear. Weight when tolerably fat per quarter in the rams about 171bs.; in the ewes 111bs. The wool very fine: it is a breed that is asserted by some to be tolerably hardy, and to possess a disposition to fatten readily; but others maintain the contrary opinion. A ram amd ewe of this sort are shown at *figures* 1 *and* 2 *Plate* XXVIII.

According to Doctor Parry, who has had great experience of this breed, they are, as stated in a late work on live stock, "entirely enveloped in wool, which grows under the jaws, down the forehead to the eyes, under the belly, and down the legs to the very feet. It is astonishing to see how thickly it covers the skin; it will scarcely give way to the pressure of the hand, but yields as it were by starts, like the close short hair of an extremely fine clothes-brush. In washing them, the water penetrates to the skin with great difficulty. The fleece is heavier in proportion to the carcase, than that of any other known breed in Europe. In the raw state (unwashed on the sheep's back or afterwards) the fleeces of the two year old ewes average at 4½lb. avoirdupoise, and the weight of the living ewe being about 60lb. the proportion of wool to that of carcase is about one to twelve and a half. The fleece of a fat wedder of the same age will be from 5 to 7lb. In eight shearling rams, weighed alive, after having been clipped, the weight of the fleece to that of the living animal, was as one to about twelve and three quarters. The wool from the head and behind the ears, and the rest of the refuse, generally called *daglocks*, had been previously taken away." It is added that "had these sheep been washed before shearing, their fleeces would have lost about a ninth part." And that "the length of the staple or filaments varies. In a shearling ram, shorn when a lamb, a sample of the wool cut close to the skin above the shoulder, was three inches and half in length; and that of the breech or middle of the back part of the thigh, three inches and three quarters: of an ewe of the same age, about one quarter of an inch shorter; the average according very exactly with the specimens taken from newly imported Spanish sheep. An instance of the extraordinary length of staple, of four inches and three quarters, is related, which from the scoured fleece produced a sample more than five inches long. The proportion of fine wool in the fleeces of the Spanish sheep is much greater than those of any pure English breed. Thus, while in the Ryeland, which is probably divided into four or five sorts, the finest wool from the neck and shoulder does not make above one eighth part of the whole fleece, in that of his majesty's flock the fine wool formed near four fifths of the whole." It is farther observed that "of Dr. Parry's wool, consisting of whole fleeces taken from sheep, which had not more than three or four crosses of the Spaniard, and divided into three sorts, (*R. F. T.*) according to the Spanish method, 155½ lb. produced of *R.* or Rafinos, or superfine, 104lbs. more than two thirds of the whole. And the uniformity of fineness in the improved wool is such, that in shewing specimens from these different parts of the same animal (the shoulder and the breech) which are generally considered as producing the best and the worst wool; the doctor never met with three persons who could agree which was the finest, and many good judges actually decided in favour of the latter. This wool contains a great deal of yolk or oil, which is apt to entangle the dust of the fields,

so as often to form a kind of mat of nearly an inch in thickness ; it is remarkably, or rather wholly free from stitchel hairs or kemps. Brownness in the wool of any particular sheep is an indication of superior fineness (and such was the colour of the ancient fine woolled sheep, and we need not look for the cause in any peculiar quality of soil or composition mixed with the wool) ; it will nevertheless scour white."

According to Lord Somerville, this dark brown tinge on the surface of the best fleeces, amounts "almost to a black, which is formed by dust adhering to the greasy yolky properties of its pile : and the contrast between it and the rich white colour within, as well as that rosy hue of the skin, peculiarly denoting high proof, surprise at first sight. The harder the fleece is, the more it resists any outward pressure of the hand, the more close and fine will be the wool. Here and there a fine pile may be formed with an open fleece, though but rarely."

In Mr. Tollet's Spanish flock purchased from Lord Somerville, the average weight of each Spanish fleece in the grease was 5lb. 13oz. and the lightest ewe fleece weighed 3lb. 4oz. and the heaviest ram fleece 11lb. 12oz. of very good quality. This ram was not quite 13 months old at shear day, and was adjudged to weigh 20lb. per quarter. Mr. Tollet declined the price of two hundred guineas for him, likewise that of one hundred for the use of him during the tupping season : he does not wash his Merino sheep before shearing, since from the closeness of the fleece, it is not much liable to the intrusion of dirt : as it does not loose quite half its weight in scouring by the manufacturer, an estimate may be made after that rate of the value of the fleece in the yolk. The fleece of the young ram produced upwards of thirty-five shillings, and the average produce of the whole unwashed Merino wool 18*s*. 9*d*. each fleece. The price of the superfine more than four fifths of the whole, 6*s*. 3*d*. and 6*s*. per lb. of the third sort, or *fribs*, which was but about one pound in the whole quantity.

Mr. Bartley has somewhere mentioned that four wethers of this breed produced the quantity of 35¾lb. wool ; and of several ewes which produced 8lb. each and of a wether which gave 10½lb.

In the introduction of this breed his majesty has taken the lead, and from his flock a great number of the improvers of it have been supplied in the different sales that have been made since its first establishment. In the sale of 1803 in Kew Lane, under the direction of Sir Joseph Banks, the numbers sold, according to Mr. Lawrence, "were 24. shearling rams, which produced the sum of 402*l*. 9*s*.—seven full mouthed and four toothed rams 171*l*. 13*s*. 6*d*.—fourteen ewes 118*l*. 8*s*. amounting in all for the forty-five sheep to 692*l*. 10*s*. 6*d*. the highest price of the shearling was forty-two guineas, the lowest 6*l*. 7*s*. Of the full mouthed rams 38 guineas was the highest, and 7½ the lowest price. Of the ewes, 11 guineas the highest, 6 the lowest. The rams were put up at 6 guineas, the ewes at 2 guineas ; the former prices at which they were allowed. Next year a larger number of ewes are intended for sale. The wool has been sold this year unscoured at 4*s*. 6*d*. per lb.

"The size of the ewes somewhat under our pure Ryelands, but above several of our small breeds, heads sharp and well shaped, with occasionally a black spot or two ; wool externally having a dirty tinge, but without that red brown hue which has been before mentioned ; ears pendulous ; perfect ewe neck, with the sinking or cavity both before and behind the shoulder, the top of which is generally higher than the rump; capacious belly ; the animal standing wide and well upon the legs.

"The rams generally of good size, some of them large enough for any purpose whatever, and of a great bone, but flat and symmetrical ; several of them were of as good and useful form as need be seen, having compact loins and shoulders, and straight backs. Two or three individuals resembled very strikingly our Dorset and Hampshire stock ; the characteristic velvet or silken gloss on the shorn faces of the rams was remarkable, and their countenance put one in mind of the fair haired human complexion. Mouths by no means fine."

It has been observed that the large tuft of wool covering the face of Merino sheep is extremely inconvenient in northern countries, where they have frequent heavy drifts of snow. And that it is Lord Somerville's practice to clip this and the leg wool two or three times a year, beginning, about six weeks after shearing. But that in winter and in very rigorous climates it may not be proper to leave the head too bare and exposed, as it may produce disease. These clippings may be proper for inferior purposes, and the fleece be rendered more pure and valuable without them. The tuft on the head, and even the *throatiness*, or protuberance in the throat, characteristic of the Spanish sort are, it is asserted, discoverable in degrees, in some of the native breeds, particularly the Ryeland, shewing its origin.

A good judge, Mr. Knight, contends that the produce of a cross with this breed and the *Archenfield* or true Ryeland sort are extremely ugly, and according to his information subject to the foot-rot. On some rich pastures in Middlesex this has also been found to be the case in both the true and crossed breed.

Mugged-breed, This is a singular breed of sheep which formerly prevailed throughout all the low lands of Northumberland. They had a short, coarse curled wool covering their heads, faces, and legs, and grew down to their feet ; in form they resembled hill sheep : their shoulders low and sharp ; sides flat ; back rather arched ; loins thin. It has been suggested that this mugged appearance, may have been the result of a Spanish cross. This sort of sheep have extended to Yorkshire ; and traces of them are still visible, although they have long since given place to sheep of the long woolled kinds.

Welch sheep. The most general breed in the hill districts, are small horned, and all over of a white colour. They are neat compact sheep.

There is likewise a polled short woolled sort of sheep in these parts of the country. And the genuine

Welch mutton, from its smallness and delicate flavour, is highly esteemed and sold at a high price.

The fattening of the small Welch sheep has not in general been found to answer in the southern districts of the kingdom.

This breed stands in need of much improvement, and is capable of admitting of it with much advantage to the sheep farmers of that district.

Irish breed. This is a breed of sheep which is thus described by Culley. "These sheep are supported by very long, thick, crooked, grey legs; their heads long and ugly, with large flagging ears, grey faces, and eyes sunk; necks long, and set on below the shoulders; breasts narrow and short, hollow before and behind the shoulders; flat sided, with high, narrow, herring backs; hind quarters drooping, and tail set low. In short, they are almost in every respect contrary to what he apprehends a well-formed sheep should be."

The spirit of improvement in sheep stock has however now extended itself to Ireland, and there can be no doubt but that they will soon improve this as well as other sorts of live stock.

But independent of these numerous breeds and varieties of sheep, which are inhabitants of this island, there are in other countries many other kinds, which may be just noticed for the sake of curiosity.

The more cold districts of Iceland and Russia afford a *many horned breed* of sheep, mostly from four to seven or eight; having a coat of dark brown coloured long hairy wool, weighing about four pounds, and covering an interior one of short soft fur.

In Russian Tartary a large *lop eared, polled* aquiline-nosed breed of sheep, somewhat resembling the Wiltshire and Dorset breeds in their shape, are produced, and which have a long thick wool, of a black and white mixed or roan colour, and in the place of a tail, a large cushion of fat occupying the rump; hence, some naturalists have called them *fat rumped* sheep. They are said to be so prolific as to bring two or three young at once.

And in Wallachia, Crete, and through most of the Archipelagan islands, there is a breed of sheep which have singular horns, twisted in a spiral or screw-like manner, standing in a perpendicular or diverging extending manner from the fore part of the head, to some height. In size and shape tolerable, bearing a long shaggy but not coarse coat.

In the extended districts of Persia, Syria, Egypt, and Barbary the *broad tailed sheep* are met with, the tail in some of which grows to the breadth of a foot, and to a length sufficient to bring them to the weight of from twenty to fifty pounds, on which account the shepherds are sometimes under the necessity of supporting them on a carriage to prevent them from galling and exhausting the animal.

These appendages are esteemed a great delicacy, being of a nature between fat and marrow.

This breed of sheep, especially those of the mountainous sorts, have a wool of extraordinary length and fineness, from which are made the expensive Indian shawls.

The Guinea breed of sheep, said to be common in tropical climates, is large, strong, and swift, and though domesticated are often found in a wild state; having coarse, hairy coats, short horns, pendulous ears, and a sort of dewlap under the chin.

The Madagascar breed of sheep, is of good size, and well covered with a close pile of smooth glossy hair.

The Buckharian breed of sheep is also hairy, and kept in large flocks in Great Tartary. The island of Antigua has likewise a breed of the same kind. Sheep of this sort were imported from Spain by sir Joseph Banks, with coats as sleek and smooth as those of a horse, and which never at any season exhibited the least appearance of wool or down.

It has been stated in a late practical work that in breeds of sheep there are evident "differences in their sizes, forms, flesh, wool, and other properties, that admirably adapt them for different sorts of pastures, situations and uses" of the farmer. And that "the large long-woolled breeds, from their being more slow, heavy and tame in their dispositions than most other kinds, are in general the most proper for the rich inclosed pasture districts: the breeds which possess greater length in the legs, more activity in walking, and a less burthen of wool, are suited to the more elevated lands, such as the downs, moors and heaths in different parts of the island, where the pasturage is less fertile and luxuriant;" and that "the small light carcassed, hardy breeds are most adapted to the exposed mountainous situations, where the food is more sparing, and obtained with greater difficulty and expense. And in the Rural Economy of the Midland Counties it has been observed that a very long-woolled breed of sheep, as the *old Lincolnshire*, or *Teeswater* sort, is necessary also in the view of our finest worsted manufactures; and another, such as that of the *new Leicester*, for the inferior kind of grass lands, and the rich inclosed arable lands, where the folding system is not in use; for the supplying the materials of the coarser sorts of worsteds, stockings, baize, coarse cloths, blankets, carpets, and other articles of the same kind, while a middle-woolled breed, as the Wiltshire, the Norfolk, or the South Down, is wanted for the well soiled arable lands, where the practice of the fold is in use, in the view of making cloths of the narrow medium kinds; a very fine-woolled breed, as the Herefordshire Ryeland, for the finest cloths, and the Shropshire, or some of the more hardy breeds, for the heathy mountainous situations. The Spanish and Cheviot sorts may also be proper in the last intentions.

What is therefore necessary to be regarded in the introducing of new breeds of sheep, is to consider with attention, the nature and situation of the pastures on which they are to be supported, and to carefully avoid making use of larger or finer breeds than can be properly sustained; as upon due management in this respect much of the success in the improvement of sheep stock, must necessarily depend. Where bettering the form of the animal, and improving the quality of the wool or coat are the principal objects, they may be effected by judicious crossing with proper breeds for the particular purpose, on the principles that have been explained in speaking

of the nature of breeding, and is farther shown below. Indeed this last circumstance is one which should particularly engage the notice of the farmer in the business of stocking his lands with sheep, as it seems from numerous statements that wool of the finest quality may be produced in this country by means of Spanish sheep, and their being properly crossed with our fine woolled breeds, which is a matter of the greatest national importance, as affording a probable means of rendering us independent of the foreign supply of this expensive but indispensable article. The breeding sheep-farmer should therefore be particularly interested in promoting this sort of improvement, in all situations where the nature of his land will admit of it, which Lord Somerville has shown may be the case in most instances where the short-woolled breeds of sheep can be properly kept, or probably on more than one half of the pasture-lands of the island. And he has remarked that there is one inducement to this, which is that of its not interfering with the production of the most valuable sort of mutton, a point to which the sheep-breeders of this country have till lately been particularly attentive, almost without regarding the quality of the wool: as it has been found that the quality of the flesh in the different divisions of sheep inclines to the nature of the wool, the short woolled sheep being close in the grain of their flesh, of course heavy in the scale, and in the taste high flavoured; while the polled long woolled sort are more open and loose in this respect, larger in size, and the mutton more coarse, and in general less saleable in the different markets of the kingdom.

In regard to the most proper sort of sheep stock for the general purposes of the farmer, it is a point far from being well ascertained in respect to the different sorts of pasture. On the supposition of its being impossible to have both fine wool and mutton, where improvements of grass lands have been made, the large long woolled sheep have been mostly introduced, though often a stock disadvantageously large and unfavourable in the coarse nature of the wool, where the soils were suitable for those of the finer woolled sorts: to this the want of a fuller information on the subject of size, and that of the scarcity of good rams of the fine woolled breeds, but which has been much obviated lately by the Spanish, has in some measure contributed, and led to the belief that, the rich soils and marsh lands cannot be advantageously sheep-stocked, except by the large and long woolled breeds; and thus a sort of custom been established, which it has been observed may either be right or wrong, for any thing hitherto proved to the contrary, by actual trials.

That there is much uncertainty and difference of opinion on the most suitable and advantageous breeds of sheep, under different circumstances of pasture or other lands, will be seen in a still more striking point of view in the practice given below, of different districts, where sheep are a material object to the farmers.

It is remarked in the able Survey of the County of Norfolk lately published, that "the South Down breed is getting rapidly in possession of all the country from Swafham to Holkham; but that from Brandon to Swafham many Norfolks remain. However, some mixture was observed even in that district." And it is stated that Mr. Coke is well satisfied of the advantage of the breed from Leicester ewes and Bakewell tups. His "flock of 160 New Leicester ewes, produced in 1802, 100 lambs; his flock of 630 South Downs produced 830 lambs living in June. The same farm, it is added, yields a most interesting comparison between Norfolks and South Downs; his former flock was 800 Norfolks, SELLING *all* the *produce*: he planted 700 acres, and now has 800 South Downs, KEEPING *all* the *produce*." Further that "his New Leicester hogs and theaves produced 8lb. of wool each in the same year, yet they had been hard kept on seeds fed very bare."

And it is stated that though he had a high opinion formerly of the cross between the new Leicester tup and Norfolk ewe, now (1803) "his opinion is changed from much experience; so that he prefers the cross of a South Down ram on a Norfolk ewe to that of a Leicester ram." And it is added that "Mr. Hoste has had the same cross, and they come to 32lb. a quarter, at two-shear. He put a Norfolk tup and a Bakewell tup at the same time to the same parcel of Norfolk ewes, and at St. Ive's fair sold the lambs fat at six or seven months old, and the Bakewells brought just double the price of the Norfolks."

In April 1799, Mr. Coke, "on sending Norfolk, South Down, and New Leicester three-shear wethers to Smithfield, that had been fed together, the return was:

	£.	s.	d.
Average per head, Norfolks	3	0	0
Leicesters	4	2	2
South Downs	3	7	2
Ditto, fleeces included, the others being in their coats	3	15	3

And in May following above 100 going, the South Downs beat the new Leicesters by 2*s.* a head."

It is also observed that at Waterden, "Mr. Money Hill, with about 500 acres less land than at present, kept 27 score breeding Norfolk ewes, and sold the produce of lambs: now he has 35 score South Down ewes, and keeps their produce, selling his wool at 5*s.* a tod more than the Norfolk."

It is added by the surveyor that Mr. Bevan "in 1792 had a South Down flock, of 30 score, on one farm, and having a flock of Norfolks on an adjoining farm at Knattishall, he had an opportunity of comparing the wool exactly: 34 score of Norfolks produced 43 tod at 28lb.; and 34 score of South Downs produced 61 tod; which 61, kept till November, became 64, but the summer very wet.

South Down	1708 lb.
Norfolk	1204 lb.
Superiority, just ¼lb. each	504 lb."

And that "in 1791, the shepherd would not let his

own Norfolk ewes take the South Down ram; but in 1792 he was ready enough. He said, they would eat harder than the Norfolks; and would eat what the Norfolks would not; that they are more quiet and obedient than the Norfolks; so that he has done with them what he could not do with the Norfolks; folded them almost to an inch without hurdles."

That "a neighbouring farmer bought three rams of Mr. Bevan, at 5l. 5s. each; but afterwards repenting, because they would *stain* his *flock*, Mr. Bevan offered him 6d. a head, for all their lambs, more than he sold his Norfolks for, in the same flock, at Ipswich fair. The offer was accepted; the price proved 6s. 3d. for the ewe lambs, and 9s. for the wethers. Mr. Bevan re-sold the ewes for 9s. and the wethers for 10s. 6d. or 2s. 1½d. a head in favour of the half-breds." Further that "when his sheep were Norfolks, he kept 500; but in 1794, he had 960 South Downs." That "the produce of 116 ewe lambs, bred by Mr. Bevan, at Riddlesworth, 1792, was:

		£.	s.	d.
Wool, 12 tod 16lb.		26	8	0
48 Lambs, sold for		32	2	0
5 Ram lambs, ditto		8	8	0
6 Refuse ditto		2	10	0
7 Refuse shearlings, ditto		5	10	0
10 Good ditto		10	10	0
1 Ditto		1	0	0
87 Ditto		91	7	0
105	£.	177	15	0
9 Died	Cost	57	14	0
2 Dunt				
Actual profit	£.	120	1	0
116				

It is also added that he "was early in trying South Down sheep, but finding them tender at lambing, went into a new Leicester cross: these he abandoned and got back to South Downs, but still esteems them a tender breed, and that they ought to have yards sheltered and littered for lambing in bad weather; remarking, that all the farmers he knows on the South Downs, have these yards for that purpose."

It is stated that "Mr. Bircham, at Hackford, declares against having any favourites; he has generally bought Norfolks, and half-bred lambs; some few South Downs, but they did not answer: has had some Leicesters: any sort he can get worth his money. Little farmers who keep a few sheep, find the polled breeds very convenient from their quietness, and therefore prefer them. Norfolk lambs bred near Cromer, were bought by Mr. G. Jones at 14s. were run on stubbles in the autumn, and put to turnips at Christmas, then to layers of the first year, probably as the best food for sheep, and sold shearling wethers at Michaelmas at 55s. each; 20 to 24lb. a quarter." And that "Colonel Butler, at Haydon, is convinced that Norfolks answer better than South Downs: shearlings come sometimes to 20 and 25lb. a quarter, and have had 19½lb. of tallow; he has a breeding flock of 400: sold his wether lambs at 26s. and his ewe lambs at 21s. Mr. Johnson, of Thurning, has 40 score of South Downs, which he has been rearing these six years, having bought many ewes and got good tups. He has, however, a good opinion of Norfolks, and will not be surprized to see them come into fashion again. In May 1792, he sold two shear Norfolks at Smithfield, for 3l. each. He admits their rambling disposition, which is much against them; and he is clear that he cannot keep so many on his farm as of South Downs. The South Down wool is not, on *good keep*, so good as Norfolk wool, but the fleece is heavier. Five years ago he got a lot of Yorkshires from the Wolds, white faces, polled, and the wool very coarse, but they throve wonderfully; never having had any sheep that did better, insomuch, that he was sorry when he parted with them. Norfolks, he thinks, will bear folding better than South Downs. The latter will, however, come to hand rather sooner, but not on ling: has had three shear South Downs of 28lb. a quarter."

At Snettisham, Mr. Styleman, the writer says, "keeps 2000 of various breeds, South Downs, New Leicesters, and half and half; in number considerably more than when, on the same land, he kept Norfolks: his farm may, and probably does, produce more sheep-food than it did at that time; but he is perfectly clear in the great superiority of the number, this circumstance deducted, and that the profit is considerably greater. Clear also in the superior hardiness and kindliness of feeding of the new breeds. Of all cross breeds, he thinks the first cross of the Leicester tup on the Norfolk ewe the best, and that wool now (1802) sells at 46s. a tod; fleeces 4lb."

And "at Hillingdon, all either Norfolks or half-breds, a Leicester tup on a Norfolk ewe. Captain Beacher thinks there are no sheep in the island which the Leicester will not improve. He has grazed many Wiltshires, and thinks them the best of all for cole-grazing in the fens."

But "Mr. Beck, of Castle Rising, has had South Downs 13 years, beginning with some from Mr. Tyrrels, of Lamport, and has imported three or four times since. He has now 800, and is quite convinced of their superiority to Norfolks: when he was in that breed he had not half the number; but after abating fully for improved husbandry, and every other circumstance, he is clear that there is a superiority of four to three. His fences are and must be bad, and in such a farm quietness is a vast object: his farm 486 acres. He gained the first prize for ewes both the last and this year at Swafham, and also at Holkham. The surveyor examined his flock attentively, and it certainly is a very beautiful one. His wool now averages eight to a tod equally of hogs and ewes: his Norfolks todded twelve: he is clear that, take the country through, they average half as much again as Norfolks. Before he took the farm there were 50 sheep on it, and a dairy of cows. What an improvement!"

However, "in the vicinity of Downham are found all sorts of breeds: towards the river, Lincolns and Leicesters; higher up, Norfolks and South Downs.

Mr. Saffory likes the South Downs best, but thinks that if as much care and attention had been exerted to improve the breed of Norfolks as the South Downs have experienced, they would by this time have been a very different sheep. Norfolk three-shear wethers sold in April last, at St. Ives, at 4*l.* 4*s.* to 4l. 10s. each."

At Bretenham, Mr. Twist "keeps 60 score of breeding Norfolk ewes on 1800 acres of poor land. He had a South Down tup some years ago, from Mr. Crow, but he could not perceive that the breed did better than Norfolks, though they stood the fold to the full as well."

In *Marshland*, "Mr. Dennis, of Wigenhall, St. Mary, grazes only the best Lincoln wethers: he buys from May-day to Midsummer; keeps them over-year, clipping twice, average price 50s. to 60s. and sells at 65s. to 75s. getting 18lb. in the two fleeces: his good land will carry six per acre, on an average, in summer; in winter two on three acres, and these will quite preserve their flesh: if the season be favourable, will get something; he thinks that there is no other breed so profitable here; even a stain of the new Leicester is hurtful, as they will not stand the winter so well. Sheep the chief stock, though some Lincoln bullocks. He never gives hay to sheep; nothing but grass; 32lb. a quarter, his average of fat wethers." But "Mr. Swayne, of Walpole, prefers the cross between Lincoln and Leicester: he buys them shearling wethers, about Lady-day; last year 3l. to 3l. 10s. each, but has had them at 36s. and 38s. He clips the best twice; three to a tod, which he likes better than heavier fleeces of sheep demanding more food. Some give 17 or 18lb. of wool. At Michaelmas he culls the worst, or buys cole for them, if reasonable: sells all by Midsummer, making 8s. or 10s. a head, when bought in high, besides the wool. Very few beasts."

And in Hertfordshire some prefer the South Downs to Wiltshires, as the latter have the goggles often, but the South Downs never. But the long legged Wiltshires suffer less in folding on wet land.

In other places the result of the comparison seems to be, that South Downs do better on grass land than Wiltshires, and will in that case thrive more, and better support the hardships of short food; but on arable land, with plenty of turnips, clover, rye, tares, &c. in ample provision, the Wiltshires are more profitable than the South Downs. The Wiltshires are large sheep, and consequently require to be well kept.

In the trials of Mr. Hale, of King's Waldon, for five or six years, "nothing beats South Downs, where there is much grass; but on artificial grass and turnips, without a breadth of natural grass, they will not do like the Wiltshires; for which reason Mr. Roberts on his own farm, keeps Wiltshire ewes, and crosses them with South Down rams; so that they lamb in March. When put to grass, they are folded, and some lambs are sold at 34s. in the beginning of harvest; some twins at 31s. 6d. and the best are kept. He approves so much of them, that he intends to continue them. Mr. Hale's flock is a capital one, and the wool remarkably fine." And "between thirty and forty years since, Mr. Calvert of Albury, had Lincoln sheep, but sold them, from conviction that they did not answer: he was then for about 20 years in the Wiltshire breed; and, lastly, he changed these for the South Downs, which he has had for the last seven or eight years, and prefers them to all. He has no other but Lord Pelham's breed, both lambs and ewes, and considers the more modern attempts to raise a *finer* race, as likely to prove mischievous: he will not have any thing to do with them. His six toothed wethers weigh eleven stone and a half. He finds the breed extremely healthy; they very rarely die; and are subject to much fewer distempers than the Wiltshires."

And "Mr. Smith has changed Wiltshires for South Downs. He has about 400 in all, some few of them Wiltshires; they are *fed and worked together*, and folded on wet lands. The South Downs in exceeding good order, but the Wiltshires very inferior."

But "about Barkway, South Downs are not yet introduced; Mr. Whittle however gave it as his decided opinion that *feed and work* Wiltshires and South Downs together in the same manner, and the former will prove to be the most profitable; the latter are much injured by the dirt, as they are too short in hair and legs; it was tried at Kimpton Hoo, and such was the result. He has sold Wiltshire wethers thrice shorn at 7l. 14s. each." And "Mr. Doe of Bygrave, keeps Wiltshire ewes, which he crosses every year by new Leicester rams; but goes no farther than the first cross. These answer greatly, whether the sale be fat lambs or shearlings. He does not approve of South Downs on account of their inferior weight."

From the high character which South Down sheep have lately attained, it may not be uninteresting to give Mr. Young's account of their first introduction into Norfolk. He remarks that "when once an improvement has spread so much as to become an object of importance, there are generally many claimants for the merit; and if such claimants are only heard of many years after, but little attention is due to them. With regard to the neighbouring county of Suffolk, he can speak with some accuracy, but should not mention it on this occasion, were not the fact connected with the introduction into Norfolk. In May, 1785, he published an account of an observation he made in 1784, the year he brought them into Suffolk from Sussex; and it being printed at the time, the fact will admit no doubt. He recommended them strongly to every gentleman and farmer he conversed with on the subject, and, at his persuasion (as many well know), the late Mr. Macro, of Barrow, purchased that flock which the Earl of Orford, after his death, bought and established at Houghton. Mr Macro died in 1789.

"In a paper printed in the *Annals*, in 1790, he remarks "I have had six and twenty years experience in Norfolk sheep, and once thought so well of them as to carry them into Hertfordshire; but in the advance of my practice, I began gradually to doubt the superior merit of that breed. I thought that of all the sheep which I had examined particularly, none promised to answer so well for the general purpose of the counties of Norfolk and Suffolk as the

South Downs. I began the import in 1784, and in 1790 had 350. I had too much friendship for the late Mr. Macro, to advise him to try any experiment that I was not clear would answer to him. I repeatedly urged him to try the South Downs; he listened to me with attention for some time, but would not determine, till having seen the number I kept proportionably to the quantity of land, and at the same time with some Norfolks, it proved to him that the South Downs were worth attending to; and the journey I persuaded him to take into Sussex, giving him an opportunity to converse with various noted sheep masters there, he determined to make the experiment: he went over, previous to Lewes fair, and bought a flock of them. The lambs sold well at Ipswich fair. Mr. Le Blanc, at Cavenham, also turned South Down rams to 700 Norfolk ewes: he found no difficulty at Ipswich; and his shepherd, after three years obstinate preference to Norfolks, gave up his old friends, and actually set South Downs for his shepherd's stock. Whether the breed should or should not in the long run establish itself, I have the satisfaction of feeling that I have done no ill office to my brother farmers by introducing it. From the daily accounts I receive, I have good reason to believe that it will be established."

In respect to wool, it has been advised, that the sheep farmer should "make himself more minutely acquainted with its properties, in order that he may avail himself of the knowledge of every step which leads to profit and improvement." And that when "one of the two species of sheep, the long or the short woolled, has been chosen, as most appropriate to the situation, and wool being made an object; it is most advantageous to select such flocks as are as pure as possible of the species to which they belong, and not a mixture of the long and short woolled breeds, which must generally produce an inferior fleece, disadvantageous to the manufacturer. Length of staple in the long, and fineness, elasticity and closeness in the short-woolled fleece, will be the best guides in this case." But, that "whether the wool be long or short, the carcass of the animal ought to be amply and regularly covered; it is a great defect when the belly is bare, and a still greater, when the wool is thin and open along the ridge of the back, admitting rain and moisture to a most susceptible part, indeed to descend upon all parts of the body." And in the providing rams, "a thick fleece, covering all parts with as much equality as possible, containing plenty of *yolk*, or retained and inspissated perspiration, is the object. If ewes, equally well-bred, can be procured, the sheepmaster anticipates and reaps an immediate benefit; if not, he must patiently wait the improvement of his wool, through the medium of the superior blood of his rams." It is further advised, "at the time of clipping to examine the bottom of the fleece, or the lower extremity of the filaments of wool; if it be *stitchy-haired*, of mixed quality, or if the sheep have a coarse breech, or be not well covered, it must be rejected, as improper for a breeding stock, where it would perpetuate its defects. The quantity of yolk or grease is a good proof of the thickness of the fleece, since by the closeness and thickness of the wool, the grease or perspirable matter of the animal is retained; hence fine, close, curled wool has ever the greatest quantity of yolk: as the use of this unctuous matter to the wool may be, to strengthen the filament, by its rendering it, in a certain degree, supple, and by preventing too great rigidity and brittleness."

These are circumstances that should be constantly in the mind of the farmer in his introduction of this sort of stock, as his success must be much regulated by them.

It is stated by the author of the General Treatise on Cattle, that "wool bearing being the natural, characteristic property of a genus of animals, is in course dependant on genus solely and absolutely, and unchangeable in essentials by soil, food, or climate; quality of wool, a characteristic of species, is dependant also on species solely. We know, says he, by experience, that all the various climates produce wool-bearing animals, and indifferently, all their different species, in respect to quality of wool. Yet, that wool may be, and indubitably is, affected, within certain degrees, although not radically, by the accidents above mentioned, is allowed; indeed it is obvious, that one certain invariable standard of quality cannot, in the nature of things, be preserved even under the most favourable circumstances of congenial soil and climate." And that in regard to those slight or superficial changes effected on wool by adventitious circumstances, they seem, he supposes, to be that, excess of heat or cold which may impair both its fineness and weight; that high and luxurious keep may increase the length of the staple, and the weight of the fleece, but sometimes reduce in long wool the fineness of the filament or elasticity merely. At least such effects have been asserted, and may probably have ensued; but it is equally certain, he contends, that "the most forcing keep has been given in numberless instances unattended with the smallest change in the quality or price of the wool." It is supposed a far more certain maxim, as being founded on invariable experience of this and other countries, "that insufficient keep and the exposure of sheep to the extreme rigour of the seasons," or what is termed "keeping them hard," will decrease the quantity of wool, of either species, render it coarse and shaggy, and insufficient as a covering in various parts of the carcass." But that they will be still wool-bearing animals; they will still, under the influence of some or all of these causes of superficial change, retain their specific distinction of long or short wool, provided that no mixture by alien-intercopulation takes place, which is the only means of radical or specific change, and which may, he thinks, be extended to an endless variety. This, he says, is supported by the reasoning of Dr. Anderson on the absurdity of the wool of sheep being changed into hair after remaining some time in Jamaica, while the breed remains pure and unmixed.

"That sheep of any species, if strictly preserved from foreign intercopulation, would retain their natural characteristic wool for ever, upon the island of Jamaica, he should conceive there is not the slightest reason to

doubt, since such phenomenon accords with the constant tenor of our experience."

These errors have, it is supposed, arisen from the notion of some occult power of assimilation residing in the soil, product, air, water, or perhaps the name of a county or district. From which it has been maintained, that you may introduce live stock of a different variety from another district, but that you will ever find, in course of time, that you have "got your own again;" which is, that no effectual change has been accomplished in the established breed of the situation, while all traces of the alien sorts introduced are lost.

But had these alien kinds been kept perfectly distinct, and suffered only to breed among themselves, it is contended that they would have retained their original character in spite of the operation of the above causes.

And further, that on the other hand, had the introduction of the new sorts been sufficiently "numerous and constant," in the course of time, the "particular sort" of the district would have been totally lost, as has actually been the consequence in numerous cases.

In fact, it has been supposed that "the product of the soil is capable of effecting radical, instead of merely superficial and temporary changes in the body of the animal feeding upon it."

And from an idea that large long-woolled sheep are the natural growth of rich pastures, the notion has proceeded that on the improvement of a soil, sheep of an increased size are most proper and advantageous. Consequently, that under such circumstances rams of a larger variety, and of the long-woolled sort, have been occasionally introduced among stock of the short-woolled kind. By which means in time, it is observed, "the whole breed of a district becomes thoroughly changed from short to long-woolled sheep: the country entirely 'loses its own.' Thus it happened, says the writer, in the Cotswold hills, Gloucestershire." But he adds, "the circumstance of an alien cross is often overlooked by our speculators on the subject, and the change of size and wool attributed to gross keep solely." Even at this period, says he, "we often hear complaints of the Ryeland and South Down fleeces having degenerated in fineness from marsh, clover, or oil-cake feeding; whilst the real cause of the change, the late prevalent introduction of new Leicester tups amongst those breeds, more particularly the former, seems to be totally forgotten, or esteemed of no consequence in the question. It is already a difficult matter to procure any considerable number of genuine fine woolled sheep, or Ryelands, in Herefordshire; the common rage for increasing size in sheep has prevailed for some years, amongst many of the South Down breeders; the Leicester cross is coming into use, in order to accelerate the growth of lambs for the butcher, from Down ewes; and if this old system be still pursued, we may live, he thinks, to see the extinction of the South Down breed, justly celebrated as it is."

It is suggested by the same writer that the result of some such experiment as the following would be interesting in showing the advantage of having recourse to one sort of woolled sheep in preference to another, as the small fine woolled against the large coarse woolled breeds.

"Twenty Cotswold, Warwick, or New Lincoln, (by Dishley tups) two year old wedders, of the average size, against the same store weight of Spanish South Downs (first cross) of like age, each lot to be wintered together in the usual way, and in the spring to be turned into the richest marsh keep, and slaughtered at the end of five months." And that "in an experiment like this, no mode can be fairer, or more likely to demonstrate to us, the desired results, than to place on measured portions of grass, equal in goodness, either the same living weight of sheep, in each lot, or even the same store weight determined by capable judges. To make up the store weight of 20 large sheep, would be required, we will, says he, suppose, 30 of the small, and we may again suppose within the line of probability, that the average weight of the large, when fat, would be 11 stone, or 220 stone the 20 sheep: the average of the small when fat, 7 stone 4lbs. or 225 stone the 30 sheep. The small mutton would be sold at market for full 4*d.* per stone more than the large. The wool of the 20 large sheep, at 9lb. the fleece, or 180lb. at 1*s.* 6*d.* per lb. would amount to 13*l.* 10*s.* The wool of 30 small sheep, 4lb. the fleece, or 120lb. at 3*s.* 6*d.* per lb. would amount to 21*l.* Should 30 small sheep consume more grass than the 20 large, in course the surplus would be charged to their account; on the contrary, some assert, that as is probable, 32 small sheep would be required, in this experiment, to make up the store weight of the 20 large, even in that case the former would not require more food than the latter. Experiment would clearly decide this important point. Again, in great probability, the small sheep might make an average of 8 stone of mutton. If of the large species, still larger individuals should be chosen, as for example, a score which would average at 15 stone of mutton, a greater number in proportion of the small stock would be required to complete the store weight." And "for curiosity sake, let us, continues he, speculate on the result of a similar experiment, the small sheep being pure Spanish. More than 35 of these would be required to make the store weight, but say 35, which being fat, would, at 6 stone 4lb. each, make a total weight of 227½ stone, worth more per lb. in the market, than any mutton we have in this country. The wool, at the present price, might fairly be reckoned to fetch near, or altogether 35*l.*" Nay, he conceives, that extraordinary as these supposed results may seem, "the sequel is still more so: even handed, twenty against twenty, the Spaniards at 6 stone 4lb. wool at the present rate, will equal, within a few odd pounds, the value of the large sheep, at 11 stone each." And that "by improving the pure Spaniard *secundum artem*, we shall obtain a heavier carcase and more wool, from the same quantity of food."

And further that "should the fine woolled, or small sheep, stand but upon a level of profit with the large, in this experiment, it would establish a most

important and incontestible superiority in their favour, by proving them adapted to all situations, whereas their competitors, the large, can be fit only for rich and luxuriant keep. It would demonstrate that an error has often been committed, by introducing large, long woolled tups, when an improvement of the original small stock, and an increase of the number kept apportioned to the amelioration of the soil, would be consistent with its nature, and more advantageous. Experience has, he says, taught that rich pastures greatly augment the bulk of the fine woolled fleece; now if an equal weight of fine, as of coarse wool, per acre, can be gained, (no improbable speculation) the instant advantage is obvious, and it may give rise to prospective views of manufacture, of the utmost national consequence."

In the crossing of Spanish sheep with the view of wool, much has been done to advantage by different breeders. And in this view those breeds the best adapted are, in the opinion of those who have had the largest experience, the Ryeland and South Down. But where size is likewise an object, the Dorset sort may be employed as affording the largest half breds in the trials that have been made. And in these cases, where the wool is inferior to that with the Ryeland in point of fineness, an additional tint of the Spanish may bring them to an equality. The Mendip and Cheviot breeds may also be had recourse to for the purpose of crossing with the Spanish, in the intention of procuring an improvement in the fineness of the wool. Some have likewise recommended other smaller breeds or varieties for the same purpose, but the trials with them have been much too few, to justify their recommendation upon. In an experiment which is noted of three two years old sheep, a real Dorset, a half Spanish and half Dorset, and a half Mendip, it is stated that the first on being slaughtered, reckoning the two years wool, yielded 4*l.* 5*s.* 6*d.*; the second, 4*l.* 3*s.* 8*d.*; the third, 3*l.* 19*s.* 2*d.* It was a trial of a very encouraging nature, as the two crosses must weigh upwards of eleven stone each, to make up the sum; and as they approached so near the value of the Dorset, a breed which is almost double the size of the Spanish, and further the mixed wool, seems to have been rated much under its real value.

And in Mr. Ridgeway's trial in Herefordshire, in which two sheep of equal weight, a Ryeland, and a half Spanish half Ryeland were fed together, the half Spanish produced in a year 2lb. 12oz. more wool, and 5lb. more mutton than the Ryeland.

From some years experience of the Spanish cross, from rams of the Windsor stock, we find that the wool of his flock of about sixteen score sheep, has been so much increased, both in quantity and quality, as to have produced nearly twice as much money for each clip since that as it usually did before.

In the experiment of Lord Somerville with half bred Spanish and Ryeland, half Spanish and South Down, and the same and Mendip sheep, the wool of the Spanish South Down was found to be worth 3*s.* the pound, and that of the Spanish Ryelands 3*s.* 2*d.* And it is stated that "eighty-six ewe-hogs of the mixed breed, carried 235lbs. 3oz. of well-washed wool, or about 2¾lb. each, at 3*s.* 2*d.* lb. making within a few shillings, 37*l.* per pack. At a subsequent shearing, the clip of a number, something short of 800 sheep, amounted to 12 packs 1 score, which was sold for 412*l.*" It is also added that in "respect to both wool and carcase, the produce of the Ryeland and South Down ewes crossed by the Spanish ram, keep such equal pace that his lordship declares himself unable to assign a preference to either. The Ryelands are, on an average, one third less in size than the South Downs, but this inequality is *perfectly levelled*, by stocking of those one third more per acre. The Ryelands are good nurses, and both those and the South Downs are healthy and quiet stock, partaking of the docile temper of the Spanish sort. "The produce of the crosses, in stocking, bear the same proportion per acre, as the parent stock, but the hogs are larger in size, than the Ryeland or Spanish full mouthed sheep. Fifty Mendip ewes were put to the Spanish ram, and the produce for size, early feeding, and quickness of proof, did full credit to that excellent breed of hill sheep." Mr. Lawrence further states that "the wedders of these crosses come to market in mutton, at the same period with our earliest breeds, namely, at or before two years old, and like the South Downs, usually die well within, with good backs and loins, weight from 15 to 20lb. per quarter. They may be stocked, he says, very hard per acre. The same land which carried, but indifferently, 45 long woolled ewes, maintained, in good plight, 150 Ryelands, the lambs of which were weaned in the best order. The ewes were stocked, during the succeeding summer, at the rate of ten per acre, and left the land in good store state. Their lambs also were summered on the same land, at more than twelve per acre, and although kept hard during winter, the wedders fatted to 16lb. per quarter, from which to 20lb. per quarter, is indubitably the most advantageous size for the public, and in strong probability, for the breeder and grazier likewise." And, he says, he has "since been assured, from undoubted authority, that from 221 acres of pasture, vetches and turnip land, being the whole of the land over which the sheep ran, last year, the profit of a flock of this breed amounted to 1592*l.* 9*s.* 2*d.* but working oxen and other horned cattle ran over the same land, for which must be deducted 31 acres, so that there remain but 190 acres chargeable to the sheep, making a return of 7*l.* 4*s.* per acre, in the most disadvantageous season, on account of the drought, which has occurred for many years. In general, land worth a guinea and a half per acre, will, he thinks, carry and keep in good store state, six and a half Spanish Ryelands, and from four to four and a half Spanish South Downs, allowing turnips, pease haulm, or the like, in the dead winter months. The largest breed of South Downs are stocked in Sussex at the rate of four per acre." But "of pure Merinos, an acre of land will carry a proportionally greater number." And "the pure Spanish fleeces have not been sold for less than one guinea each, the average weight being upwards of 6lbs. in the yolk; after this rate, ten

guineas per acre might be made, including the expense of a quantity of roots or hay for winter keep."

A variety of useful facts, experiments and observations on the nature and management of fine-woolled sheep, as well as the improvement of their wool, may be found in Dr. Parry's able work on the Spanish Breed of Sheep.

Mr. Whitaker of Bath has also for a number of years tried the Spanish cross with the Wiltshire breed, nearly trebling his wool in quantity, and improving it very greatly in quality; the carcases of the sheep are reduced in size, but improved in mould, and the disposition to fatten much increased. It is suggested that breeders should not, however, flatter themselves with the hope of rivalling Spanish wool, by one or two crosses of the Spanish ram on the English breeds, though they may, by going so far, much improve the quantity as well as quality of their wool. But in order to produce a fleece of *real* fine wool, it is essentially necessary that the sheep have at *least* five sixths of the Spanish blood in them.

In Mr. Tollet's account of the Spanish South Down, in the first cross, the heaviest fleece weighed 4lb; the heaviest ram fleece of do. 5lb. 3 oz. the fleece of the mother of his shearling ram weighed 2lb. 7oz. And of the Spanish Ryeland, in the first cross, the heaviest fleece weighed 4lb. 1oz.; the heaviest ram fleece, 4lb. 5oz. The average weight of the two, 3lb. 6oz. each fleece. The price of the first sort of Spanish-Ryeland wool 4*s*. 2*d*. per lb.; and of the second 3*s*. The price of the first sort of Spanish-South Down 3*s*. 10*d*. per lb.; and of the second sort 2*s*. 8*d*. The average value of this improved wool of the first cross 11*s*. 6*d*. each fleece, or upwards of 150 per cent. advance on the value of wool, from one cross only. And the same experimenter conceives that an acre of land, which will keep three South Down sheep, would be sufficient to keep four Spanish. The produce in wool of the South Downs would be 13*s*. 6*d*. per acre, that of the Merinos 3*l*. 15*s*. 6*d*. That the climate of this country is better calculated for the growth of superfine wool than that of Spain; in consequence of which, wool would be more likely to improve, than degenerate, in it as well as the carcase; that in the course of time, we shall be able to produce as much mutton per acre, from the Spanish, as from any of the native breeds; and that the Ryeland and South Down are the most proper breeds to put to the Spanish ram.

This intelligent breeder is extending his Spanish stock, and hopes to finish his valuable experiment in the course of ten years.

And in Somersetshire, Mr. White Parsons, "made use of Dorset ewes, in the Spanish cross, and obtained a breed bearing 6lb. of wool, weight of carcase 20lb. a quarter."

These advantages have been equally met with in the trials of others, as may be seen in Mr. Lawrence's General Treatise on Cattle.

It is stated in the Tenth Volume of the Agricultural Magazine, by Mr. Bartly, that "a flock, the offspring of the first cross by the Spanish ram, would be the most profitable to the farmer. Because a competent number of this description are to be much more speedily obtained; and that the first cross acquires an indefinitely small fraction more of the Spanish blood, than all the subsequent crosses taken together, however numerous; in other words, the fleece on the first cross is presumed to have acquired very nearly one half of the amount of its improvement, in a single year, both in weight and in advance of value per lb. whereas, to acquire the remaining half, many years, perhaps six to eight, would be requisite.

"Rejecting fractional minutiæ, he assumes the present value of the *unwashed* Spanish fleece to be 4*s*. per lb. and of the *washed* Ryeland 2*s*. and farther, the weight of the former to be 8lb. and of the latter 2lb. then the following sketch will serve to convey some idea of the progressive improvement:

			s.	*d*.		*£*.	*s*.	*d*.
Spanish 8*lb*. Ryeland 2*lb*.	medium weight 5*lb*.	viz. 5*lb*.	3	0	or	0	15	0
		First cross.						
Spanish, price 4*s*. Ryeland 2*s*.	medium price 3*s*.	viz. $6\frac{1}{2}$*lb*.	3	6	or	1	2	9
		Second cross.						
Spanish 8*l*. 1st. adm. 5*lb*.	medium weight $6\frac{1}{2}$*lb*.							
Spanish, price 4*s*. 1st adm. 3	medium price 3*s*. 6*d*.							
Spanish 8*lb*. 2d adm. $6\frac{1}{2}$*lb*.	medium weight $7\frac{1}{4}$*lb*.	viz. $7\frac{1}{4}$*lb*.	3	9	or	1	7	$2\frac{1}{2}$
		Third cross.						
Spanish price 4*s*. 2d adm. 8*lb*.	medium price 3*s*. 9*d*.	viz. $7\frac{5}{8}$*lb*.	3	$10\frac{1}{2}$	or	1	9	$6\frac{1}{4}$
		Fourth cross.						
Spanish 8*lb*. 3d adm. $7\frac{1}{4}$	medium weight $7\frac{5}{8}$*lb*.							
Spanish price 4*s*. 3d adm. 3*s*. 9*d*.	medium price 3*s*. $10\frac{1}{2}$*d*.							
Spanish 8*lb*. 4th adm. $7\frac{5}{8}$	medium weight $7\frac{13}{16}$*lb*.	viz. $7\frac{13}{16}$*lb*.	3	$11\frac{1}{2}$	or	1	10	9
		Fifth cross.						
Spanish price 4*s*. 4th adm. 4 *lb*. $10\frac{1}{4}$*oz*.	medium price 3*s*. $11\frac{1}{8}$*d*.							

He has sheep that produces upwards of 10*lb*.

"Pursuing this calculation indefinitely, and to

speak in mathematical terms, it is evident, he says, that the fleece of the production would never completely reach the value of the original, or 32s. but be continually approximating. But that such less than hair breadth distinctions, are not of the slightest importance in practice.

"The 4th cross, he presumes, is perfectly sufficient for every practical purpose, even for the finest fabric of the woollen manufacture, as well as for extending the propagation of the race.

"In point of practice he even inclines to think with some men of experience who have asserted the fact, that by attentive selection, individuals of the offspring in the fourth or fifth generation may sometimes, be found to exceed the male progenitors both in weight and fineness of fleece."

In the practice of sheep husbandry different systems are had recourse to, according to the extent and nature of the farms on which they are kept, and the methods of farming that are adopted on them; but under all circumstances the best sheep-masters constantly endeavour to preserve them in as good condition as possible at all seasons. With the pasture kinds of sheep this is particularly the case; and with the view of accomplishing it in the most complete manner, it is useful to divide them into different parcels or lots in respect to their ages and sorts, as by that practice they may be kept with greater convenience and benefit than in large flocks together under a mixture of different kinds; as in this way there is not only less waste of food, but the animals thrive better, and the pastures are fed with much more ease. The advantage of this management has been fully experienced in many of the northern districts, where they usually divide the sheep-stock into lambs, yearlings, wethers, and breeding ewes: and in this method it appears not improbable that a much larger proportion of stock may be kept, and the sheep be preserved in a more healthy condition.

With a breeding stock the sheep-master must act according to his circumstances, situation, and capital which he possesses, either selling the lambs to go to keep, fattening them for grass lamb, suckling them for house lamb, or keeping them on to be grazed and sold as store or fat wethers; the ewes being sold lean as they are called, or fattened as circumstances, profit, and convenience may point out.

Another practice, but which requires much capital as well as knowledge, experience and attention, is that of breeding and fattening off all lambs, both wethers and ewes, especially where markets for their sale when fat, are conveniently situated. But where this system is too extensive it may be partially acted upon, varying the plan according to capital, circumstances, and the nature of the times. In which case, whenever store stock become extravagantly high, it is mostly a good way to sell.

But a method which is attended with the least trouble and hazard, is that of purchasing a store flock, as lambs, wethers, and what are termed crones or old ewes; some of the last sort often proving with lamb, may be fattened off with them to good account. It is likewise often the case that ewes are disposed of in lamb, or with lambs by their sides, in what are termed couples, in which circumstances it is frequently a good practice to make annual purchases of them, in order to the fattening of both, and selling them in that state within the year. The system of breeding can only be had recourse to with effect and advantage in situations or on farms, where there are extensive tracts of land fit for the pasturing and support of these animals, but not the fattening of them. The more rich deep grass lands being adapted to their fattening, and thereby affording a better profit, especially when quickly performed with a proper sort of this kind of stock, as that of good wethers.

In the purchasing of sheep, which is often done from very distant fairs and markets, much care and circumspection is necessary, whatever the sort or intention with which they are bought may be. In these cases much advantage, especially when at a considerable distance, may be derived by employing a salesman upon the spot.

The appearances which show the sheep to be in a proper sound state of health, are a rather wild or lively briskness, a brilliant clearness in the eye, a florid ruddy colour on the inside of the eyelids and what are termed the eye strings, as well as in the gums, a fastness in the teeth, a sweet fragrance in the breath, a dryness of the nose and eyes, breathing easy and regular, a coolness in the feet, dung properly formed, coat or fleece firmly attached to the skin and unbroken, the skin exhibiting a florid red appearance, especially upon the brisket. Where there are discharges from the nose and eyes, it indicates their having taken cold, and should be attended to by putting them in dry sheltered situations. This is a necessary precaution also in bringing them from one situation to another while on the road.

With sheep-farmers the common practice, except in particular instances, has been to leave the ewes for the purpose of breeding without any selection; but where good sheep-stock is the object, much attention should be paid in choosing such as are the most perfect, and possess in the highest degree those qualities or properties which are wanted, whatever the breed or variety of sheep may be; as it is only in this way that a good stock can be raised and preserved. And it is a business that should always be performed at the time they are turned to the ram, if it has not been done before: and this is equally necessary in regard to the rams, that they may be adapted to the ewes. The author of the Farmer's Calendar has observed that the late Duke of Bedford, in attending to this object, had every ram with the lambs got by him the preceding year put in distinct pens, that he might not only examine them but their progeny, previous to his deciding "what ewes to draw off for him," which is certainly a method highly deserving of imitation by sheep-farmers in general. "Such attention, united with a careful selection of cull lambs must, the writer thinks, keep a stock in a state of progressive improvement, proportioned to the accuracy of judgment, eye, and hand of the farmer who practises it." And it is observed in the Report of Norfolk lately published, that Mr. Coke readily assists not only his

tenants, but other neighbouring farmers, in sorting and selecting their South Down ewes, &c. and distributing them in lots to the rams according to the shapes and qualities of each. He puts on his shepherd's smock, and superintends the pens, to the sure improvement of the flock: his judgment is superior and admitted." The writer has "seen him and the late Duke of Bedford thus accoutred work all the day, and not quit the business till the darkness forced them to dinner."

It has been remarked in a late practical work that "the most advantageous and proper age for ewes taking the ram in the different breeds has not been fully shown; but from a year to a year and a half old may be sufficient, according to the forwardness of the breed and the goodness of the keep." Some judge of this by the production of *broad* or sheep's teeth. It should not perhaps be done while too young in any case.

In regard to the season of putting the rams to the ewes, it must be directed by the period at which the fall of the lambs may be most desirable, which must depend on the nature of the keep which the particular situation affords; but the most usual time "is about the beginning of October; except in the Dorsetshire ewes, where the intention is suckling for house-lamb, in which case it should be much earlier, in order that the lambs may be sufficiently forward. But, by being kept very well, any of the breeds will take the ram at a much earlier period." Where the rams are young, the number of ewes should seldom exceed sixty for each ram; but in older rams a greater number may be admitted without inconvenience, as from one to two hundred; but letting them have too many should be cautiously avoided, as by such means the farmer may sustain great loss in the number of the lambs.

It is found that the ewe goes with lamb about the space of five months, consequently the most common lambing-season is March, or the early part of April; but "it has been observed that in many of the more southern districts, where sheep-husbandry is carried on to a considerable extent, some parts of the ewe-stock are put to the rams at much earlier periods, so as to lamb a month or six weeks sooner; a practice which is attended with much profit and advantage in many situations where early grass-lamb is in great demand. It is usual for the rams to remain with the ewes for a month or six weeks, and in some cases longer, in order to complete the business of impregnation, which in some districts is ascertained by smearing the fore-bows of the rams with some colouring substance."

The method formerly in practice, and which is too commonly the case at present, of turning a number of rams among the flocks, is highly exceptionable, as tending to prevent the main object, and injure the rams. A better way is to let each ram have a proper number of ewes, and with very choice stock to keep the ram in an inclosed small pasture, turning a few ewes to him, and as they are served replacing them with others. By this means there is more certainty, and more ewes may be impregnated. In such sort of fine stock, it is likewise of great utility to keep the rams during this season in a high manner. In this view a little oats in the straw, or a mixture of barley and pea meal, are excellent. Where ewes are backwards in taking the ram, the best means to be employed are those of good stimulating keep. The rams should always be continued with the ewes a sufficient length of time.

It is stated in the "General Treatise on Cattle" that the ewe "will breed twice and even thrice a year, if it be made a point to produce such an effect by attention and high keep, since she will receive the male indifferently at any season, and like the rabbit, very soon after bringing forth." And it is added that "Lisle gives an instance of three of his ewes, well kept, lambing at Christmas, fattening off their lambs at Lady-day, and producing lambs again, the first week in June. It seems they stole the ram immediately after lambing, but brought the second time only single lambs, although of a breed that generally produces twins." The former writer thinks there is no doubt but the sheep would produce young thrice a year, were the bad practice resorted to, which has been so currently recommended with the rabbit, of allowing the male immediately after parturition; the ready way to render both the female and her progeny worthless. Could the lambs be advantageously weaned at two months, sufficient time would, he conceives, remain for the ewe to bring forth twice within the year: for example, suppose the young ewe tupped in August, the lamb would be dropped in the middle of January, and might be weaned in mid March, the ewe again receiving the ram on the turn of the milk, like the sow, perhaps in or before April, she would then bring forth within the twelve months or in August. This plan would, says he, at least injure the dam infinitely less than suckling during gestation."

It is necessary that during the time the ewes are in lamb they should be kept in the pastures, and as free from disturbance as possible, being carefully attended to, in order to prevent accidents which are liable to take place at this time, such as those of their being cast in the furrows, &c. Where any of the ewes slip their lambs, it is advised by Mr. Bannister that they should be immediately removed from the flock. They also require, under these circumstances, to be kept as well as the nature of the farm will admit, in order that there may be less loss at lambing-time from the ewes being stronger, and the lambs more healthy, and better capable of contending with the state of the season at which they may be dropped.

The shepherd should at this period be particularly careful and attentive to afford his assistance where it may be necessary. He should constantly have regard to the suckling of the lambs and to see that the udders of the ewes are not diseased. His attendance will often be required in the night as well as the day. At this season covered sheep folds are often of very great advantage, in saving and protecting both ewes and their lambs.

In respect to the number of lambs, it is remarked by Mr. Lawrence that "the ewe brings most com-

monly one, next in degree of frequency, two, rarely from three to five lambs at a birth. This property of double birth is, he says, in some instances specific; the Dorset sheep usually yeaning twins, and the large polled Belgic sheep, with their descendants, our Tees-water, doing the same, and producing occasionally more at a birth. Other breeds bring twins, in the proportion of one third of the flock, which is supposed to depend considerably on good keep. A certain number of ewes per centum prove barren annually: the cause very rarely, natural defect; sometimes over fatness, a morbid state of body from poverty or neglect of the ram, in other words want of system in the shepherd."

It has been recommended that where rich pastures or other sorts of good grass-lands cannot be reserved for their support, turnips or other kinds of green food should be provided for the purpose, and given them in a suitable manner; but where it can be done, it is always better to leave this sort of food untouched till about the period of lambing, when it should be regularly supplied in proportion to the necessity there may be for it. The ewes also demand at this time much care to see that they are put upon a dry sheltered pasture, free from disturbance, and that neither they or their lambs sustain injury from the too great severity of the season. Whenever this is the case, they should be carefully removed into a proper degree of warmth and shelter until perfectly restored. It is likewise a necessary as well as useful practice, as they lamb down, to take them and their lambs away from the common stock, putting them into a piece of turnips or fresh dry pasture where there is shelter when necessary, as by this means much fewer lambs will be lost than would otherwise be the case. It is also found that by a proper supply of turnips or other similar green food at this period, the milk of the ewes is much increased, and the growth of the lambs greatly promoted; which is of much future importance, as when they are stinted at this early period of their existence they never turn out so well afterwards for the farmer. With the green and root crops and preserved after-grass, hay, straw, corn, and oil cake, are in some cases made use of in the winter support of sheep stock.

With turnips, where the soil is not sufficiently dry to admit the sheep, it is the practice to draw them and convey them to a sound firm pasture, that the ewes may be baited upon them once or twice in the day, as there may be occasion, care being taken that they are eaten up clean, as the circumstance of their being thus eaten may serve as a guide to the farmer for the supply that may be daily necessary. In this way this sort of food will be consumed with the greatest economy. Where the land is perfectly dry, and the intention is to manure it for a grain crop, eating the turnips on the land, by means of portions hurdled off as wanted, is a good practice.

With this sort of food, especially where it produces scouring in the ewes, green rouen hay, cut straw, or pease haulm should constantly be given, and also with rape, &c.

Mr. Young has stated that "in some parts of the kingdom, the best farmers give their ewes and lambs bran and oats, or oil-cake, in troughs, while they are feeding on turnips;" but he suggests at the same time that "it must be a good breed for such a practice to repay." It has been advised, when the weather is very wet, stormy, or there is much snow upon the ground, that the ewes and lambs should have hay given them in baits as may be necessary, which is mostly done in covered moveable racks, a portion being given fresh every day. It is however much better to have it cut into chaff and given in troughs, as much less waste is made. There is still a higher practice of feeding made use of by some farmers with ewe stock of the more improved kinds, and which is said to have been found to answer better than the common keep in particular cases, which is that of employing parsnips or carrots with hay of the green rouen kind, or a portion of pea, bean or barley meal, also malt combs with potatoes and hay, &c. These sorts of keep are however obviously much too expensive, except under particular circumstances.

Where shelter can be provided, it will always be of much benefit to the sheep. It has been observed that "the practice of letting them to the hay-stacks, which is common with some farmers, is slovenly and wasteful, and which, though it may afford a degree of shelter, should never be attempted where the other methods can be had recourse to." And "it has been suggested by Mr. Young, as an excellent method, though not essentially necessary, to allow the sheep, whether the weather be bad or not, a small proportion of hay daily while at turnips."

And it is added that "by this careful management and the use of stubble turnips when necessary, the ewe and lamb-stock may be well supported through the severity of the winter, and be brought on in the best possible condition until the turnips are finished in March, which should always be the case, when the preserved grass or rouen may be ready to receive them; which is considered by some as the most to be depended upon through this and the following month, which, with the first week in May, is the most difficult period of the year to the stock-farmer. On dry meadows and pastures it is invaluable in this view, though at first sight it may have an unpromising appearance from the covering of decayed autumnal grass that is upon it; but which, when removed, presents a new growth of fresh green grass, five or six inches in height, brought up by the shelter and warmth afforded by the covering of old grass. This is found to agree remarkably well with the sheep, as they consume both together, having, as it were, both hay and grass in the same bite." He supposes it impossible "to keep a full stock of sheep so cheaply in April by any other method as by this. Tolerable rouen will carry ten ewes an acre, with their lambs, through the whole month. Such rouen may be worth in autumn ten or twelve shillings an acre; in April it is worth thirty or forty shillings, and if it be a backward season, a farmer that has it, would not be tempted to sell it for much more. But in the support of his sheep and lamb stock, if the farmer be provided with a sufficient extent of watered meadow, he may fully depend upon that without any other provision for this period."

"However, where these cannot be fully depended on for the support of the sheep-stock at this difficult season, the most improved practice is, in place of depending on turnips and hay with rye sown for the purpose, young wheats and the run of the pastures, to let the turnips continue so as that their shoots may become an object of sheep food, and to have annually a portion of tolerable good land sufficient to the extent of the flock, under rye-grass and clover, so as to be ready in the spring to take the sheep from turnips, and support them till the time of turning upon the pastures." The same writer remarks that "this conduct is an improvement on the other, as it gets rid of three great evils: depending on rye, which is soon eaten; feeding on wheat, which is pernicious to the crops; and turning too soon into the general pastures. But at the same time that it effects this advantage, it is open to some objections, which make farther improvement necessary. Keeping the turnips long in the spring is very bad husbandry. It damages greatly the barley crop, both in robbing the land, and preventing it from being sown in proper time: nor is the food of great consequence, for many acres of turnip-tops are requisite, the number of which must be in proportion to the stock of sheep; and as to the roots, they grow so sticky and hard after the tops are at all advanced, that their value is trifling. With respect to ray grass, the clover mixed with it is seldom above three inches high at this season; and a great breadth of ground to a given stock must be assigned to keep the sheep through April. The number of acres of that young growth necessary to keep a hundred sheep and lambs is, he says, surprising; so that these farmers, although they manage to spring-feed more sheep than the worst of their brethren, yet effect it at a great expense, and at last not in any degree comparable to what might be done. A turnip should never be seen on the ground after March. For the month of April the farmer should have a field of cabbages ready, which, yielding a great produce on a small breadth of ground, reduces the evil of a late spring sowing; and, if he manages as he ought, totally excludes it. The turnip cabbage, and ruta baga, will last as long as wanted; and, though they run to seed, yet the bulbs will not be sticky. The green boorcole may be fed off several times: it is impenetrable to frost, and will make shoots in the winter." And, "another crop, continues Mr. Young, for feeding sheep in spring, which is of particular merit, is burnet. An acre of it managed properly, will at this season yield much more food than an acre of clover and ray-grass. It should be four or five inches high in November, and left so through the winter. Burnet has the singular quality of maintaining its green leaves through the winter; so that, under deep snows, you find some luxuriance of vegetation. From November to February the crop will gain two or three inches in growth in the young leaves, and then be ready for sheep. It will be better in March, and if kept, ready in April, not only for sheep, but horses, cows, or any other stock." These systems of feeding and management are, however, in practice much varied according to the nature of the farm and the kind of sheep that are kept. In Norfolk, with Mr. Bevan's flock, which consists of forty-five score of the South Down kind, the following is the arrangement: "The tups are put to the ewes about the tenth of September, for two months, being fed on the layers and pastures, and are folded on the old layers for wheat: after wheat-sowing they are folded on the pastures and layers till the time of yeaning, during which they lie on the pastures without fold, and have turnips thrown to them, with plenty of good hay. The fattening sheep are on turnips and hay from Michaelmas to the end of March, followed by the hoggits. In April the couples go to cole-seed in hurdles; from cole to rye, from rye to the new layers, if forward enough, otherwise to the water-meadows, till the beginning of May, and from thence to the new layers, being still in hurdles, with a good deal of room to fall back, and continue so on the layers till about the 10th of June, when the ewes are washed for clipping, and until the lambs are weaned: the ewes then go to fold with the shearlings on the fallows intended for turnips, and the lambs are put to fresh grass reserved for that purpose: all the sheep on turnips and cole having hay, they consume about 25 tons. The general winter provision is 80 acres of turnips, 20 of cole, and 30 of rye, for the spring. Mr. Bevan ploughs in his rye-stubbles before the shocks are carried to turn in the scattered seed, harrowing in half a peck of cole seed for sheep-feed in the spring, and finds it of very great service. The latter, after feeding, stands for a crop. He values his turnips on the average at 30s. per acre, and cole at 25s. After turnip-sowing the flock is folded on old layers for rye, till the end of August, when the ewes intended for breeding are put to good pasture till the tups are let in." But in 1802, "the tups now put to the ewes about a week later, and the lambs not weaned till the latter end of June. Provision this year, 100 acres of turnips, 30 cole, 30 rye, for 25 score breeding ewes, 15 score hoggits, 20 tups, 10 score fatting stock; 51 score in all."

It is observed that, by the means which have been stated above, the sheep and lambs are capable of being continued in good healthy condition, a matter of great consequence to the stock, until the period of turning on the pastures, when they should be separated, where the lands are inclosed into proper divisions, in proportion to the quantity each pasture can support, care being taken not to overstock the fields, though hard stocking in some cases may be beneficial. With some farmers they are put upon the richest pastures of the farm, while with others it is the custom to let them have those of the inferior kinds. This must depend much upon circumstances; but whatever mode is adopted the point of having the stock preserved in good condition, is never to be lost sight of. It is advised that "in keeping sheep on inclosed pastures, particularly where the lands are much occupied with wood, constant care is necessary in order to guard against the mischief of the fly, as its effects are

often irremediable in the course of a very short time in such situations, if not attended to, in hot seasons." With the view of fully guarding against this insect a very frequent and particular examination must be made by the shepherd.

The next circumstance in the management of these animals is that of weaning the lambs, which is a business that should be effected when they are three or four months old, as about July, but it is done more early in some districts than others. And to effect it in the best and most beneficial manner, a proper reserve of some fresh pasture grass, where there may be a good bite for the lambs to feed upon should be had recourse to, as it is of much consequence that an ample provision of this sort be had, in order that the growth of this young stock may not suffer any check on being taken from the mother. Where they have been continued so long as to graze with the dams, little check will be sustained in their separation if turned upon such good feed. Some advise clover in blossom as the most forcing sort of food in this intention, and with others saintfoin rouen is highly valued for the same purpose. When good feed is not provided, of some of these kinds, the lambs soon decline in flesh, or in the technical language of the flock are said to *pitch;* and when once this happens they never afterwards thrive so well, however good the management may be. With regard to the ewes, they should be removed to such distant pastures or other places as that they may not be heard by the lambs, which would cause them to be disturbed in their feeding. And where the ewes sustain any inconvenience from their milk, as by their udders swelling, it should be drawn once or twice, as by this means bad consequences may be prevented. And as soon as the lambs have been removed, the ewes are returned upon the pastures destined for their summer support. There is, however, one caution to be attended to in first turning the lambs upon rich keep, which is that of letting them be in some degree satisfied with food, previously that they may not be surfeited by too quick and full feeding, and *heave* or *hove* as it is termed; keeping them gently moving about the field has also been advised in this intention. In some places where the lands are of the more poor kind, it is a custom to send the lambs to the more rich vale or marsh districts, to be brought forward in condition or fattened. In those cases, where the lambs of the male kind are reared on the home lands, as wethers, they are usually restored to the flock in the latter end of the year, but which is not by any means a good practice, as they often suffer for want of proper keep in the winter, and lose what they had previously gained in growth and condition.

In the usual management of sheep-flocks it is the common practice to remove a certain number of the old ewes or crones every year, replacing them by the best lambs, in order that they may be kept up in the greatest perfection; it is of course a matter of considerable importance to have this done in a proper manner. And in almost all the sheep districts in the southern parts of the island, this selection or *setting* of the *lamb stock* is performed about August, at which period the fairs for the sale of lambs mostly take place. And at this time the whole are collected together for drawing into different lots, it is a very suitable period for selecting or choosing those that are to supply such deficiencies in the breeding flocks. In his excellent Calendar of Husbandry, Mr. Young has well remarked that "in making this selection the farmer or his shepherd usually (whatever the breed may be) rejects all that manifest any departure from certain signs of the true breed: thus, in a Norfolk flock, a white leg, and a face not of a hue sufficiently dark, would be excluded, however well formed; in the same manner a white face on the South Downs; in Wiltshire a black face would be an exclusion, or a horn that does not fall back; in Dorsetshire a horn that does not project, &c. &c. And where the produce is annually sold lean, there is, he says, reason in all this; for customers who have been used to, and prefer certain breeds, as having paid them well, are apt to be fastidious when they purchase. Some farmers in this selection look chiefly at size, always keeping the largest frames; but this is probably erroneous, unless they *keep* very high. It connects with a question by no means ascertained, whether sheep do or do not eat a quantity of food proportioned to their weight? In general, it is a safer rule to choose a well-formed lamb, or that indicates the probability of making a well-formed ewe, rather than to select for size. The attention that is to be paid to wool, in the breeds that produce the carding sort, will depend on the price to be received: if the farmer lives in a district where the price of the year is given equally to all flocks, there is little encouragement to lessen quantity for the sake of quality; retaining, however, in idea, the fact that both are attainable, that it is very common to see coarse *breeched* sheep with light fleeces, and those of a fine quality heavy in weight. The Spanish fleeces, which are finer than any other, are heavier than those of our finest woolled sheep. With combing wool the importance of the fleece depends still more on price; we have seen it at 8*s*. a tod; and it has lately been 36*s*. Quality is of very little consequence indeed, compared with quantity; and when wool sells high, no prudent breeder will set his stock without being governed considerably by this object." And it is ably added by the same writer that "the high prices at which new Leicester and new South Down rams let and sell has opened a field of speculation in sheep-breeding. It is sufficient to remark, that this spirit of breeding, whether it shall prove durable or not, whether much money shall or shall not be made in it in future, is not what any prudent man beginning business will adventure in but with great caution: men of such immense fortune are now taking a lead in it, and are in many respects doing it on such liberal principles, that the wisest conduct of such farmers as he may be supposed to address, is to take proper opportunities of converting their experiments to their own (the farmer's) profit. Leave the expense to them; but, when you can, convert the profit to your own advantage. In setting a stock of lambs, therefore, you may mark a score of the best, for a future ram to be picked up when opportu-

nity offers; or, better still, to send to the tup of some ram letter that takes them in at a reasonable price per head. By every year selecting five or six *per cent.* and by every year covering that number by a ram better than any of your own, the flock must be on the improving hand; and this may be done at a very small expense."

At this period, besides filling up the deficiencies in the ewe stock, the increasing or diminishing the quantity of stock usually kept, by reserving a larger or smaller number than that of the old sheep which are disposed of, is also a point that demands particular notice. Mr. Young has given the following useful directions on this subject in his Calendar.

"On a farm, says he, with a given stationary sheep-walk, it is probably regulated by circumstances that rarely change; but on inclosed farms, where the sheep are supported by fields alternately in grass and tillage, variations may easily be supposed, and the question of hard or light stocking, that is of close feeding or a head of grass, then comes in to decide the number kept. If the produce or profit per head is looked to, the conduct to be pursued is evidently to stock lightly; but if the return is looked for in corn from fields laid down for refreshment by rest, then close feeding is a very material point, and the number kept will depend on it. With all grasses, &c. that do not decline from age, the more sheep you keep the more you may keep, and the more corn you will reap when such are ploughed; a circumstance too important to be forgotten. But the young farmer will remember that upon this system he must not have a *show* flock, or let the variety of a farm have the least influence with him: if in this way he will have something to talk of, a score or two of pampered favourites, the fewer the better, for they may cost him more than they are worth."

As soon as this has been properly executed, the ewe and wether lambs that are left are mostly sent to the neighbouring lamb fairs to be sold off. But where the fairs for this purpose happen later than the above period, as in the beginning or latter end of September, as is the case in some situations, it has been advised by the writer first mentioned, that great care be taken to keep them in forcing food, as in spring-tares, early sown rape, good grass of the right degree of bite, &c. &c. in order to promote their growth and increase their value; but to sell in August is more beneficial." In the statement given below, the prices of these lambs sold from Mr. Bevan's farm in Norfolk, for several years, is shown.

Sale of Cull-lambs, Ewes, and Wethers.

		L.	s.	d.
1796,	Sold at Kenninghall Fair, July 18	0	16	0
1797,		0	13	9
1798,	In September,	0	18	0
1799,	In September,	0	16	0
1800,	In July,	0	16	6
1801,	In September,	1	0	0
1802,	In July, many twins,	0	14	6

With South Downs in the county of Hertford, some buy wether lambs of that breed in August, and put them on grass after the herd flock, and fold them till near Christmas then put them to turnips, and in the spring on reserved grass on poor land; to fold them again till Michaelmas, and then to turnip them for the butcher, so as to clear all off before they shall be two years old. They expect to buy at 21s. and to sell at 45s. The fleece weighs three pounds and a half each, and the tod of 28lb. sells for 47s.

And Mr. Kingsman, with a breeding stock of the same kind, "sells off all his lambs fat excepting only the ewe lambs, reserved for keeping up the flock. These lambs are sold fat in the course of the summer: the ewes have never any hay in winter, and are put on turnips only as they lamb.

"The reserve consists of 50 lambs, which are kept through the winter on grass, with either hay or turnips. The lambs sold have neither cake nor corn, yet are sold in the course of the summer, for 29s. and 30s. to 34s. The prices of this year are as under:

1801.	June 3,	15, at 29s.
—	—— 13,	10, — 30s.
	July 2,	10, — 29s.
	Sept. 15,	10, — 34s.
1800.	Aug. 4,	4, — 27s.
	Sept. 13,	10, — 26s.
	Oct. 18,	12, — 25s.
	———	6, — 23s.
	———	5, — 22s.

It is obvious from what has been stated above, that in the management of breeding flocks, the lambs come to be disposed of at different periods; first those that have been suckled or fattened in the house, in which system of fattening, much attention is required to have them early, to their being well, regularly, and very cleanly kept and suckled, as well as to the ewes being of the right sort, and the best milkers that can be provided, and to their being fully supplied with food of the most nourishing and succulent kinds. Their tails and udders should have the wool well clipped away from them in order that they may be preserved in a perfectly clean state. The lambs also require, especially towards the close of their fattening, to have regular supplies of barley, wheat, and peas meal ground together in combination with fine green rouen hay. See *Lamb Suckling*.

When these have been sold off, the lambs which have been fattened on the best grass land will be ready to succeed them at the markets, in the spring and summer months; and these will be followed by the sale of the store lambs at the different autumnal fairs.

There are different local practices also adopted in different counties to suit the particular methods in which their sheep husbandry is conducted, as well as the particular objects of it. The following is given as a hint from Sir Joseph Banks by the writer of the Lincolnshire Survey, on the sheep system of that extensive district: that "as tups are there always hired by the breeders, the lambs may be said to be

purchased before they are born; as a year's credit, however, is given on this occasion, they are not paid for till the actual value can be fairly estimated; if, therefore, any one who has hired a tup at a considerable price, finds the lambs he has got not sufficiently above the ordinary sort to pay him the difference, with interest, he complains to the tup-man, who generally views the lambs with him, and makes a fair abatement, which is generally settled in the price of the hire of the next year's tup; this regulates the price of letting, and makes the tup-men a most useful set of people. The great mass of breeders in Lincolnshire sell their heeder-lambs about old Michaelmas time, or a little after; a succession of fairs for that purpose are held in a village called Partney. These lambs are resold in the spring at Lincoln fair, under the name of hogs; at Midsummer their owners clip, and then winter them; the succeeding spring, they are carried to Boston, where, in a long succession of markets, they are sold to the graziers, with their wool on, under the name of shearlings, and immediately turned into the marsh to fatten; the graziers take their fleeces, and having wintered them, get the kindliest to Smithfield in the course of the succeeding spring; those that do not fat so easily, yield the grazier a fleece at Midsummer, and are got off the ground in the course of the next autumn. Here you see a combined system of sheep agriculture, for as the animals are eternally either changing hands, or yielding fleeces, they make a return of some kind or other to their owners nearly half yearly from the time of their birth, to that of their final dissolution at Smithfield" See *Ram*.

There is some difference in the method of managing heath, down, and mountain flocks of sheep, from those which are pursued on the inclosed pasture lands, though in the selecting and providing the rams and breeding stock, the same practices are followed by the best sheep masters. The principal difference consists in the manner of keeping them, by putting them as early as possible in the spring months, as in the beginning of April, upon the downs, heaths, and common, and keeping them upon them until the approach of the autumn, as the beginning of October; the fine short sweet herbage in these cases preserving them in a state of tolerably good condition. And where it begins to grow scanty and decline in goodness, other sorts of feed which have been previously provided are had recourse to, such as turnips, cole, &c. on which they are folded during the autumn and winter till consumed; when hay which has been stacked for the purpose in such situations, is employed until the grass has again advanced to a proper bite. In these cases the system of folding is generally recurred to during the whole year, in the summer and autumn chiefly on the ground in a state of preparation for the wheat crops, but in the winter season often on the stubbles, though more extensively upon the downs and pastures; while in the spring season the lands under preparation for the barley crops receive them. This system is considered as very beneficial by the farmers in those districts where it is in use.

And in the hilly and elevated situations in the northern parts of the kingdom, other methods of management with this sort of stock are employed.

In Argyleshire the principal circumstances attended to by the most intelligent sheep farmers are these: "to stock lightly, which will mend the size of the sheep, with the quantity and quality of the wool; and also render them less subject to diseases. In all these respects, it is allowed by good judges, that 500 kept well, will return more profit than 600 kept indifferently. To select the best lambs, and such as have the finest, closest, and whitest wool, for tups and breeding ewes, and to cut and spay the worst.—To get a change of rams frequently, and of breeding ewes occasionally.—To put the best tups to the best ewes, which is considered as necessary for bringing any breed to perfection.—Not to tup their year-old ewes; which, in bad seasons especially, would render the lambs produced by them of little value, as the ewes would not have a sufficiency of milk; and would also tend to lessen the size of the stock.—To keep no rams above three, or at most four years old, nor any breeding ewes above five or six.—To separate the rams from the 10th of October, for a month or six weeks, to prevent the lambs from coming too early in spring.—To separate the lambs between the 15th and 25th of June; to have good grass prepared for them; and, if they can, to keep them separate and on good grass, all winter; that they may be better attended to, and have the better chance of avoiding diseases. A few, whose possessions enable them to do it, keep not only their lambs or hogs, but also their wedders, ewes, &c. in separate hirsels; by which every shepherd, having his own charge, can attend to it better than if all were in common; and each kind had the pasture that best suits it."

And "in Linton, the following management, according to the Survey of that district, is observed: "In summer the flock is divided into three *hirsels*. In the first are all the hogs and yield sheep; in the second, the milk ewes; in the third, the lambs. In winter they are kept only in two *hirsels*. In the one are the hogs, in the other the ewes and yield sheep. The lambs are weaned about the end of June, the ewes milked from the 1st of July to the middle of August, and the milk made into cheese. The sheep are clipped from the end of June to the end of July, according to the weather and condition of the flock. The tups are let to the ewes from the 15th to the end of November, according to the situation of the ground, and the nature of the grass. From 40 to 50 ewes are allowed to one tup. The breeding stock is changed every five years, by selling off the superannuated ewes. Some ewes, however, are kept longer than five years, and some shorter, according to their condition; for they do not all decline equally soon."

In East Lothian "sheep are in much esteem, and kept in considerable numbers every where, especially on the coast lands. Permanent flocks, however, and regular sheep management, may be said to be al-

most confined still to the higher parts of the country. In the low country they are kept chiefly to eat the turnips, and sometimes sown grass, which is permitted to lie a year or two for pasture. Flying flocks therefore are generally kept, and as soon as they are fattened for the market, which is usually within the year, they are sold off. A considerable number of lambs likewise are reared, only so far however as to render them fit for the butcher," or to be sold fat.

It is added that, " as the great object, in the lower districts, is feeding, little attention is paid to particular kinds; every farmer keeps those which he thinks are likely to pay best for the food which they consume. The black-faced, or Tweeddale breed, are most generally preferred for feeding on turnips, because they are most esteemed in the market; but many of the Cheviot breed are likewise kept, and even some of the improved Leicesters."

It is, however, only in the Lammermuir district that sheep-husbandry can be said to be regularly practised, the management of which is this, according to Mr Hay, of Hopes.

" All store farmers of any extent keep two flocks, viz. one of ewes, and another of yield sheep; and this flock they sometimes divide, and have a flock of what is called *hogs;* that is lambs of one year old.

" The common practice is to fold the ewes upon a break of arable land, during the summer; they cut the lambs about the 26th of May, and they wean them in the first week of July, and then they shear the whole flock.

" The lambs, after weaning, are sent to a healthy pasture, called the *birn*, which has been kept for them, where they remain till the end of August, when they are moved down to the best low pasture, called the *hogfence*, which has been saved from the weaning, and here they remain during the winter.

" The ewes are milked for about eight weeks after the weaning, and sometimes longer, and then are put out with the lambs, into the *hog-fence*, for the winter.

" All the sheep are smeared, that is salved, immediately after the harvest, at the rate of two pounds, tron weight, of butter, to a Scotch pint of tar, which salves from six to eight sheep, at the expense of about five-pence each.

" The wool sells at from five shillings to eight shillings per stone, tron weight; and usually takes from six to eight fleeces to a stone; so, deducting the expence of salving, the net proportion upon the wool may amount to from eight-pence to ten-pence per head, sometimes a little more or less, varying according to the price of wool.

" Upon dry heathy grounds, the ewes are drafted and sold to graziers, in the month of March; but upon wet grounds, which are dangerous, and subject to the distemper called the rot, they are drafted and sold in October.

" Few storemasters (*i. e.* tenants) in Lammermuir breed as many sheep as keep up their stock; so they have to buy yearly a parcel of hogs, which are mostly wedders. Linton, in Tweeddale, is the great market for these wedder hogs. These wedders they keep for two years, and sell them to the feeders.

" Some of the most judicious storemasters have totally given up the practice of milking the ewes, after weaning; and others milk for a shorter space than formerly; and they now allow the lambs to suck longer, which considerably increases their bone, and is thought not so pernicious to the ewes as the milking."

This practice still prevails in Wales; the cheese made from ewe milk being highly esteemed, such milk being said to be four times as rich as that of cows. The sheep are stated to give a quart of milk per day each, and being milked three months, the return is stated at ten shillings per ewe.

It is added by the writer of the above Report, that " the method of managing the arable land, in that district, has been changed much for the better within these few years; when in grass it is folded, and when taken up, it gives three crops; and is then fallowed and sown out, the first crop, with grass-seeds; and they generally follow the same practice with the new grounds taken in by fallow and lime, which has now become a general practice through Lammermuir; and lime, when applied to dry ground, is certain of making a lasting improvement upon the grass, which is, and always ought to be, the great object upon store farms."

Since this account was given, much improvement has been made in this sort of husbandry, which " is now carried on in a very systematic manner."

The practice of *smearing* or salving is now, even in these situations, much on the decline, and in the more southern parts of the island, not at all employed. See *Salving of Sheep.*

And in the sheep districts in the more elevated and exposed northern parts of the island a still inferior practice is had recourse to, the sheep being mostly left to provide for themselves, even in the most severe and inclement seasons, when the bleak tracts on which they live are deeply covered with snow. According to the writer of the Perthshire Report, in these cases the sheep have their chief dependance for subsistence on their own habits, which lead them to remove the snow by their feet with great facility till they reach the heath or withered herbage.

But when the snow is falling or blown by a storm, the shepherds drive their flocks, without intermission, round the top of a hill in a circle, in order to keep them from lowering and being drifted up or smothered. It has been the practice in some districts to erect a sort of circular folds on the tops of low hills for the same purpose: and when the heath is all covered, they sometimes rake or harrow the snow in order to bring up the heath, with a sort of long toothed rake or small harrow. With some sheep farmers it is the mode to have recourse to feeding with hay or unthreshed oats, which is deposited in handfuls upon the snow. Mr. Marshall has suggested that cultivating plots of furze, broom, juniper, &c. by sod-burning, and rippling the surface, or by other more eligible means,

could not fail of proving beneficial upon the wintering grounds of a sheep farm. By means of these, as a resource in the deepest snow, when the herbage of the *braes* was buried too deep and too evenly to be uncovered by the scraping of the sheep, by keeping the most exposed parts of the *braes* in full herbage for less general coverings of snow, and by reserve of rape for the season of lambing, even ewe flocks might be supported through the winter with some degree of certainty, without dry fodder, and without being left to the uncertainty of the seasons and the mercy of the winds and weather, as they are at present."

It is obvious that there are a variety of circumstances in the practice of sheep husbandry, that must affect any statement that can be made in respect to the profit that may be derived from it; the nature of the system of management pursued, and that of the breed of sheep employed, must operate so much in this way as to leave the profits of no two sheep farmers scarcely the same. It may not however be altogether unuseful to introduce a few statements on the subject.

From the details given in the Annals of Agriculture where this sort of system was practised extensively, it appears that in Sussex, in Mr. Ellman's management 560 ewes afforded 147*l.* or 3*s.* 3*d.* per head. But in that of the Duke of Grafton 40 score only produced 134*l.* or 3*s.* 4*d.* per head. Much improvement has since been made, which must have greatly increased the profits.

In the statements which are more fully detailed in the subsequent account, the profits of the sheep system in Lincolnshire are more clearly shown, as they stood some years ago, by Mr. Parkinson.

Estimate.

Sheep in 1781, 2, 3, 4, 5. An acre of land worth 20*s.*

	L.	*s.*	*d.*	*L.*	*s.*	*d.*
1. An acre keeps two ewes and produces two lambs, 12*s.*	1	4	0			
Two fleeces, four to tod, 10*s.*	0	5	0			
	1	9	0			
				1	9	0
2. Two lamb hogs bought in 18*s.* kept one year, sold again at 26*s.*	0	16	0			
Two fleeces, three to tod, 14*s.*	0	9	6			
				1	5	6
				2	14	6
3. Graziers buy said shearlings at 26*s.* sold at 28*s.* two of them; profit by carcase	0	4	0			
Carried forward				2	18	6

	£.	*s.*	*d.*	*£.*	*s.*	*d.*
Brought forward				2	18	6
Four fleeces, or one and an half tod wool, at 12*s.*	0	18	0			
				0	18	0
				3	16	6
Profit by beasts and horses nearly the same as below; to be bought in April, grazed the summer months, and sold out in the autumn				1	5	6

Sheep, 1794, 5, 6, 7, now worth 30*s.* per acre.

One acre of land of the best average pasture in the county of Lincoln, will keep and produce as follows, according to these present times:

1. An acre keeps two ewes, produce two lambs, at 24*s.*	2	8	0			
Sell at Michaelmns and two fleeces, at the rate of four to a tod	0	9	0			
				2	17	0
2. Two lamb hogs bought in at 34*s.* kept one year, sell out again shearlings 50*s.* profit 16*s.* makes :	1	12	0			
Two fleeces 7*s.* each, suppose three to tod	0	14	0			
				2	6	0

N.B. If clipped again before sold, would be 14*s.* more.

3. Buy said shearlings at 50*s.*; sold three shearlings out again, about 56*s.* profit of two sheep	0	12	0			
Four fleeces of wool, about one and a half tod, 19*s.*	1	8	6			
				2	0	6

N.B. Every two acres of this sort of land is supposed to fatten a small heifer, and leave a net profit of about 50*s.* in each acre, 25*s.* added to the mean of

Sheep profit	2	17	0	7	3	6	= to	2 7 6
	2	6	0					
	2	0	6					
Besides extra summer keep for horses, &c.								2 12 6

N. B. It is always understood in Lincolnshire, that all sorts of grazing occupations should pay two years rent, and rabbit warrens the same. But arable farms ought to produce three years rent.

AN ESTIMATE OF THE PROBABLE GAIN BY GRAZING A FARM WITH THIS SORT OF STOCK.

THE RENT. Dr. PROFIT. Cr.

Grazing land.	A.	r.	p.	Val. p. ac.	£.	s.	d.	Acr.
1. To land for keeping the breeding ewes	160	0	0	16	128	0	0	160
1. To ditto for keeping the tups -	15	0	0	30	22	10	0	15
1. To ditto for the she hogs -	58	0	0	16	46	8	0	58
1. To ditto for the he-hogs - -	55	0	0	25	68	15	0	55
2. To ditto for the shearlings - -	55	0	0	25	68	15	0	55
3. To ditto for the two-shear - -	55	0	0	25	68	15	0	55
4. To ditto for the three-shear - -	45	0	0	36	81	0	0	45
1. To ditto for the drape ewes - -	50	0	0	30	75	0	0	50
Total - -	493	0	0		559	3	0	493

Breeding Ewes	Loss	Net		Tods
300.	37	263	Half 4 to a tod / Half 3 to a tod	76½
Tups 30		30	Half 2 to a tod / Half 3 to a tod	12½
She lambs 131	16	115	Half 2 to a tod / Half 4 to a tod	33
			He lambs the same	33
Two-shear sheep 105.	10	95	At 3 to a tod	31½
Three-shear 95	5	90	Half 3 to a tod / Half 2 to a tod	37
Drape ewes 120	20	100	At 3 to a tod	33
			Total -	256½

							£.	s.	d.
				at 20s. per tod.			256	10	0
30	1	Tups let at the average price of £.4 each	-	-	-		120	0	0
116		He lambs at 6 months old, at 21s.	-		121	16	0		
110	1	Hogs at ——— 30s.	-		165	0	0		
105	2	Shearlings at ——— 40s.	-	-	210	0	0		
95	3	Two-shear at ——— 50s.	-	-	237	10	0		
90	4	Three-shear at ——— 60s.	-	-			-	270	0	0
700	1	Drape ewes at ——— 30s.	-	-			-	150	0	0
					Total profits, Cr.		-	796	10	0
					Deduct rent, Dr.		-	559	3	0
					Net Gain by sheep		-	237	7	0

The same quantity of sheep.	Profits. £.	s.	d.	Rent. £.	s.	d.	Gain. £.	s.	d.
1. By selling hogs 12 months old -	590	0	0	363	13	8	226	0	0
2. By selling shearlings - - -	688	0	0	409	8	0	258	12	0
3. By selling two-shears - - -	727	0	0	478	3	0	248	17	0
4. By selling three-shears - - -	796	10	0	559	3	0	237	7	0

Remains to be accounted for in the farmer's profit, the feeding of beasts in the pastures with sheep, and it may be observed in an arable farm, the fallows of 15 acres in turnips will supply the winter keeping of 55 acres of grass, to winter the lamb hogs.

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Mr. Robson, in considering the business of sheep husbandry, in the first Agricultural Report of Argyleshire, remarks, that "stocking a sheep farm with that number which requires one good shepherd, stating the capital employed, and the average expenses and losses incurred, he considers to be his duty: in attempting which, he is well aware, that it will expose him to much censure, not only from such proprietors as may have screwed their rents too high, but also from such tenants as have cheap bargains; yet, as he thinks a fair statement ought to satisfy, and may be of service to both parties, he will venture to give an opinion respecting the general system of sheep stock, in the average situation of Highland grazings; leaving it to those who are particularly placed, in point of advantages or disadvantages, to add or deduct accordingly.

Graziers in Highland districts may, he says, as circumstances dictate, either turn their views to the advantage arising from a breeding stock, where the lambs are the principal object of sale, or to a rearing stock, where the wedders are looked up to as the principal source of profit. But it may not be improper to observe, that a grazier, in choosing between these stocks, ought to prefer the wedder system where the grazing is high, cold, and destitute of good spring resources for the ewes, either at or after lambing time.

In the district which he has surveyed, 600 sheep are in general considered a sufficient charge for one shepherd. Taking then this number as the average proper charge of a shepherd, if kept as a breeding stock, they ought, he supposes, to be divided as follows:

Breeding Stock.

		L.	s.	d.
14 tups, 410 milk ewes,	at 14*l.* the score; hence -	296	16	0
50 gelt ewes & 126 ewe hogs,	at 9*s.* 6*d.* each, 1 to the score -	79	12	4½
600	Total value, *L.*	376	8	4½

Annual Sales, &c.

	L.	s.	d.
53 Shot lambs, 50 only payable, at 3*s.* each - - -	7	10	0
189 Lambs, at 5*s.* each, one to the score	45	0	0
84 Old ewes, at 6*s.* 6*d.* each, one to the score - - - -	26	0	0
21 Gelt (yield) ewes, at 9*s.* 6*d.* each, one to the score - -	9	10	0
4 Aged tups, at 10*s.* each -	2	0	0
	90	0	0
460 White fleeces, at 10*d.* each -	19	3	4
140 Laid or smeared fleeces, at 10*d.* each - - -	5	16	8
L.	115	0	0

Charges and Expenses.

Call the capital employed in stock, for ease of calculation, 376*l.* 10*s.* This, on account of extraordinary loss that may happen, and bad payments, state at 37*l.* 13*s.* being 10 per cent. on the capital employed.

	L.	s.	d.
To interest of capital, at 10 per cent.	37	13	0
To eight bolls meal to the shepherd, at 16*s.* per boll; one and a half of this being allowed for dogs - -	6	8	0
To laying with butter and tar 168 lambs, and 14 tups, labour included, at 4*d.* each - - -	3	0	8
Gatherings, clippings, luck-pennies, &c	5	0	0
L.	52	1	8

No allowance is, he says, made for the shepherd's wages, because on a grazing where it is intended to put 600 sheep, it is supposed that the shepherd can have the keep of 60 more in lieu of wages.

	L.	s.	d.
Amount of sales, as above - -	115	0	0
Charges and expenses, ditto -	52	1	8
Remains for rent -	62	18	4

On this it is observed in the Corrected Report, that Mr. Robson should have added, *and for profit*; for which there ought certainly to be some allowance, which would bring the rent lower than is here stated.

This rent amounts, according to Mr. Robson, to about 2*s.* per sheep, and the wool is valued nearly at the rate of 7*s.* per stone, tron weight, for white wool, and the laid wool at 5*s.* ditto, one pound to the stone of each.

Wedder Stock.

For the sake of a practical view of this kind of stock, which must be the most general in the Highlands, he shall take his statement as nearly as he can judge, from a stock as actually kept.

	L.	s.	d.
To 690 milk ewes, at 14*s.* each, none to the score -	483	0	0
To 25 tups, at 14*s.* each, none to the score - -	17	10	0
To 85 gelt ewes, at 9*s.* 6*d.* each, one to the score - -	38	9	1
To 380 wedder hogs, at 9*s.* 6*d.* each, one to the score -	171	18	2
To 340 dimmonds, at 12*s.* one to the score - -	194	5	8
To 320 three year old, at 14*s.* one to the score -	213	6	8
To 160 ewe hogs at 9*s.* 6*d.* one to the score - -	72	8	1
2000 Value	*L.* 1190	17	6

Annual Sales	L.	s.	d.
To 315 there-year old wehters, at 14*s.* one to the score	210	0	0
To 105 old ewes, at 6*s.* 6*d.* one to the score	32	10	0
To 21 gelt ewes, at 9*s.* 6*d.* one to the score	9	10	0
To 6 aged tups, at 10*s.* none to the score	3	0	0
To 84 shot lambs, at 3*s.* one to the score	12	0	0
To 84 ewe lambs, at 5*s.* one to the score	20	0	0
To 1435 white fleeces, at 10*d.* each	59	15	10
To 565 laid or smeared ditto, at 10*d.* each	23	10	10
	L. 370	6	8

Charges and Expenses.			
Interest of 1190*l.* at 10 per cent.	119	2	0
To 189 wedder lambs bought in to keep up the stock, at 5*s.* each, one to the score	45	0	0
To 24 bolls meal, at 16*s.* per boll, for three shepherds and dogs	19	4	0
To laying 736 hogs and tups, at 4*d.* each	12	5	4
To gatherings, clippings, luck-pennies, &c.	15	0	0
	L. 210	11	4

From amount of sales	370	6	8
Deduct charges and expenses	210	11	4
Remains for rent	L. 159	15	4

By this statement it appears, he concludes, that about 20*d.* per sheep is a fair rent for such a stock.

The prices in these statements are not, it is remarked, made upon the sales of the year 1793 (when they were drawn up), but upon an average of six years preceding; the peculiar circumstances of that year, making it proper to leave it out of the question.

In the seventeenth volume of the Statistical Account of Scotland, for the Parish of Luss, the following statement is given of a stock of the same number.

A breeding stock of 600 sheep, for taking care of which one good shepherd is reckoned sufficient, commonly consists at Whitsunday, of the following proportions

Breeding ewes	500
Year-old ewes, for supplying the place of older ewes	80
Tups	20
	600

Statement of the yearly Expense of Managing.

	L.	s.	d.
To herd's wages, or pasture of 60 sheep	7	10	0
To his own and his dog's maintenance, 6*l.* 10*s.* and a plaid 6*s.*	6	16	0
Carried forward	14	6	0

	L.	s.	d.
Brought forward	14	6	0
To expense of smearing (140 of the stock,)	2	6	0
To gathering, clipping, and bringing to market	2	7	0
To interest of stock, valued at 376*l.*	18	16	0
To rent	52	10	0
	L. 90	5	0

Annual Sales.

By 300 draught lambs, at 4*l.* 10*s.* per clad score, and 30 shots, at 2*l.* 5*s.* per ditto	67	10	0
54 draught or slack ewes, at 6*s.* 6*d.*	17	11	0
10 yield ewes, at 11*s.* and six old tups, at 12*s.*	9	2	0
460 white fleeces, making 46 stones, at 7*s.*	16	2	0
140 fleeces laid, making 20 stones, at 5*s.*	5	0	0
	L. 115	5	0
Expense as above	90	5	0
Profit	L. 25	0	0

In this is included risk and loss, as only 5 per cent. interest was allowed on the capital. And it is remarked that "the profit arising from such a stock seems inadequate to the trouble and risk; but it is to be observed, that in most sheep farms, there are some low and arable grass grounds, the produce of which, in estimating their value, is seldom taken into the account. Much depends upon the times, and much upon the management. In the event of a severe winter or spring, the number of lambs for sale falls often one-third short of the foregoing statement."

In all sorts of sheep management it is essential to have a very frequent inspection of the flocks, as every or every other day, in order to prevent or guard against the various accidents that they are constantly subject to, and obviate loss as much as possible by being on the spot to execute promptly whatever may be needful to be performed.

And in the general management of sheep flocks it is a good practice, especially when the season is dry or they are upon any sort of dry keep, to let them have plenty of pure water to drink at: and where the home folding system is in use, it is a good method not to turn out the sheep in the autumn and winter seasons before the heavy dews and hoar frosts have been removed, as by these means sheep are frequently much injured, especially in the northern districts. The use of some sort of dry food in these cases may be then of much utility in preventing disease.

On damp wet swampy lands, and where the grass grows in a rank rapid manner, or where the lands have been flooded, or there are young shoots of any sort of grain, but especially barley, there is said to be great danger in feeding the sheep upon them,

as they are very apt to produce the rot. The best methods of preventing this effect, is to suffer the sheep to remain as short a time as possible upon them, where that cannot be wholly avoided; by removing them to high dry grounds, where they should remain in the nights; being supplied with some sort of dry kind of food. And to prevent the scowering effects of feeding down the young rye or wheat crops in the spring, when they are very luxuriant, the same caution becomes necessary.

In this sort of husbandry, salt has also been asserted to be of considerable utility in preserving the health of the animals, as well as in rendering the pasture more agreeable to them, especially under a close system of feeding, which is of great advantage in many cases; but *too* close stocking may be prejudicial in some cases, by rendering the grass so nasty as to be incapable of being fed, or what has been termed *stenching* it. See *Salt* and *Pasture*.

In the business of fattening store sheep, there are many circumstances that should be carefully attended to, as well as in that of managing the breeding and other flocks. The kind of sheep that are most advantageous under the different sorts of keep, situations and kinds of land, must be well considered: The differences in the sorts of food in regard to the improvement of the sheep; and the most beneficial methods of employing it in different cases; and lastly the markets.

As the sheep under this treatment should never be suffered to have any sort of want of fresh food, they should never be kept too long upon any inclosure or grass piece, or any other sort of keep, so as to be compelled to feed upon the sullied or trampled food, as it always greatly retards the fattening of the animals, or what is termed proof, which is constantly the most promoted by the allowance of only the prime fresh food.

There are many different sorts of food made use of in this business, such as the different sorts of turnips, which are very extensively applied in this system, and some use them alone; but it is probably a better practice to give some sort of dry food with them, especially where the common turnip is employed, as it is more watery and less nutritient than that of the Swedish kind. Cut hay, chaff, bran, corn, oil-cake, all answer well in this intention, and of the first two or three sorts, they should have a pretty full supply; but the latter, from their expense, should be more sparingly given; several pounds of oats will however be required for each sheep per day, according to the kind and size. It is stated in the Norfolk Survey, lately published, that "Captain Beacher having 700 fatting sheep, and turnips running short, put 200 of them to oats (not ground); he found that the practice would not answer if oats were more than 6s. per coomb, and then not for longer than six weeks: they were fed on a pasture, and the improvement of it very great. He thinks grey pease, or beans would have answered much better."

With oil cake some give half a cake a day to each sheep, but the quantity must depend in some measure upon the other keep which they have. All food of this sort should be given in moveable troughs, divided in the middle, so that the sheep may feed on each side, with a sloping roof over them, so as to cover the sheep's heads and necks while feeding, as wet is not only prejudicial to the sheep, but spoils the cake. A rack for hay fixed over the trough, might probably be made to answer in this intention, while it would be very convenient for holding that material, and preventing waste. The whole should be fixed on wheels, and be made to stand steady, and a sufficient number for the quantity of sheep be always in readiness.

Steamed or baked potatoes, cheap convenient contrivances for the preparation of which have been lately invented, have been supposed by some to be preferable to turnips as a food in this intention. And they have been employed raw in the proportion of eight or ten pounds per sheep in the course of the day and night; but they are certainly a much better food in their prepared state. The quantity of common turnips consumed by each sheep in the same length of time, is usually about eighteen or twenty pounds. Where this last sort of crop is good, an acre is supposed to support about five score sheep, in the field, six or seven weeks in the winter season: an acre of good grass supporting at the rate of one hundred couples from five days to a week.

In the fattening of wedders, the use of barley meal, with grass or some other sort of green food, has likewise been found highly beneficial, and when it can be procured at a reasonable rate, should not be neglected, as it is quick in rendering them fat, and the mutton is excellent.

The following statements given in the Survey of the great sheep district of Lincolnshire, showing the practice of different places, may be useful in this respect as well as that of showing the superior advantage which is there derived from a breeding or ewe stock to that of the fattening system.

Feeding.

Knaith. 1lb. of oil cake a day per wether, with turnips more profitable than the latter alone.

Tathwell. 450 acres including corn, &c. &c. support 400 Lincoln ewes and 360 lambs. Nothing makes wool grow so fast as feeding upon oil-cake.

Dalby. 2400 clipped on 1400 acres, grass and arable.

Asgarby. The food being weighed to two sheep of 34lb. a quarter, and to two of 24lb. a quarter, the difference eaten was not near to the proportion of weight, the largest ate least proportionably.

Sudbrook. After-grass with oil cake, 5 acres and a ton of cake 20 wethers. Cake at 8*l.* as cheap as turnips at 4*l.* Grass

thus advanced from 12*s.* an acre to 27*s.*

Swinop. 1462 sheep go over 1300 acres, including every thing.

AGE AT WHICH SOLD.

	Worth at 6 month	at 12 month	at 18 month	at 24 month	at 30 month	at 36 month
	s.	*s.*	*s.*	*s.*	*s.*	*s.*
Ewerby -	17	30	35	45	45	55
Berthorpe	17	27	32	40	43	
Belton -	12	20	25	35	35	35
Belesby -	14	22	28	35	45	50
Dalby -	20	30	33	46		
Spilsby -	28	35	40	48	56	60
Ranby -	25	30	38	48	50	60
Claypool	19	28	29	40		
Average	17	25	29	37	39	52
Add wool	0	7	0	7	0	7
Together	17	32	29	44	39	59
Increase by each six months	17	4	4	14	2	19
Ditto by each year -	31		18		21	

It is supposed "sufficiently evident from this table that to keep breeding ewes, where the lambs will sell at 17*s.* is more profitable than any other sheep system, supposing the land to be proper for the stock; 7*s.* for the ewe's fleece makes this 24*s.* per head for half the flock, the other half producing ewe lambs, do not pay equally; but let the average be reduced to 20*s.* still it is far better than any other system the writer has noted, as, admitting the 19*s.* for the last column, yet it is not to be attained without passing through the periods which answer so much worse than any others; and though both ewe and lamb are to be well kept for six months, yet the ewe is kept at a moderate expense the other six; whereas fatting sheep must be favoured in food."

The following experiment on six different breeds of sheep, made by Mr. Billingsley in 1792, with the view of ascertaining the difference of proof is interesting in respect to the consumption of food.

Five Leicester Sheep eat from April 3d to 10th—Cabbages 29lb.—Hay 91lb.
June 20 to 27—Green vetches 840lb.
Decem. 1 to 8th—Cabbages 445lb.—Hay 35lb.

Five Gloucester Cotswold April 3d to 10th—Cabbages 29lb.—Hay 120lb.
June 20 to 27—Green vetches 1050lb.
Dec. 1 to 8th—Cabbages 615lb.—Hay 51lb.

Four South Down April 3 to 10th—Do. 29lb.—Do. 70lb.
June 20 to 27—Green vetches 750lb.
Decem. 1 to 8th—Cabbages 388lb.—Hay 41lb.

Five Wilts April 3 to 10th—Cabbages 29lb.—Hay 125lb.
June 20 to 27—Green vetches 1035lb.
Decem. 1 to 8th—Cabbages 516lb.—Hay 42½lb.

Five Dorset April 3 to 10—Cabbages 29lb.—Hay 123lb.
June 20 to 27—Green vetches 1050lb
Dec. 1 to 8th—Cabbages 526lb.—Hay 43½lb.

Five Mendip April 3 to 10—Ditto 29lb.—Ditto 87½lb.
June 20 to 27—Green vetches 870lb.
Dec. 1 to 8th—Cabbages 417lb.—Hay 41lb.

And the following experiment by Mr. Crow of Norfolk shows it in comparison with the particular breed of that county. "About Michaelmas he put ten Norfolk, ten Leicestershire, and ten South Down wether hoggit lambs to turnips, that they might learn to eat them readily, and let them remain together till the 6th of November, when the ten Leicestershire, the ten South Down, and nine of the Norfolk (one having died) were numbered, weighed, and put each sort by themselves, into three pieces of wheat stubble, of

one acre each, separated by hurdles, and he provided at the same time three other pieces of the like size, and separated in the same manner, to shift them into. They were fed upon turnips, topped, and tailed, measured to them in bushel skeps, with great exactness, from that time till the 14th March, and then weighed again."

LEICESTERSHIRE.

"Weight of each sheep, 6th November.				"Weight of each sheep, 14th March.			
No.	Stone.	Lbs.	Ozs.	No.	Stone.	Lbs.	Ozs.
1.	4	13	4	1.	7	0	8
2.	5	4	4	2.	6	9	0
3.	5	5	0	3.	7	7	8
4.	5	7	8	4.	6	12	8
5.	5	8	0	5.	6	12	0
6.	5	9	0	6.	7	6	0
7.	5	10	4	7.	7	2	8
8.	6	0	0	8.	7	9	0
9.	6	2	8	9.	7	8	8
10.	6	4	0	10.	8	1	0
"Average weight, 6th of November, about 5st. 9lb. 3 oz. each.				"Average weight, 14th of March, about 7st. 4lb. 1 oz. each.			

"Average increase of weight in eighteen weeks two days, about 1 st. 8 lb. 14 oz. each.

SOUTH DOWN.

"Weight of each sheep, 6th of November.				"Weight of each sheep, 14th of March.			
No.	Stone.	Lbs.	Ozs.	No.	Stone.	Lbs.	Ozs.
1.	4	13	0	1.	6	13	12
2.	5	0	0	2.	6	11	8
3.	5	1	8	3.	6	13	8
4.	5	2	12	4.	7	2	0
5.	5	4	12	5.	6	9	4
6.	5	5	12	6.	6	12	0
7.	5	7	0	7.	7	2	0
8.	5	7	0	8.	6	10	8
9.	5	7	4	9.	7	3	8
10	5	8	8	10.	7	0	8
"Average weight, 6th of November, about 5st. 4lb. $5\frac{1}{2}$ oz.				"Average weight, 14th of March, about 6st. 12lb. 7 oz. each.			

"Average increase of weight, in eighteen weeks two days, about 1st. 8lb. $1\frac{1}{2}$ oz. each.

NORFOLK.

"Weight of each sheep, 6th of November.				"Weight of each sheep, 14th of March.			
No.	Stone.	Lbs.	Ozs.	No.	Stone.	Lbs.	Ozs.
1.	6	4	8	1.	8	2	0
2.	6	6	0	2.	7	10	8
3.	6	6	4	3.	7	4	0
4.	6	6	8	4.	7	5	8
5.	6	7	0	5.	7	11	8
6.	6	8	12	6.	7	9	0
7.	6	11	8	7.	8	2	0
8.	6	12	8	8.	8	0	0
9.	7	2	0	9.	8	9	8
"Average weight, 6th of November, about 6st. 8lb. 9 oz. each.				"Average weight, 14th of March, about 7st. 12lb. 4 oz. each.			

"Average increase of weight, in eighteen weeks two days, about 1st. 3lb. 11 oz. each.

Quantity ate in eighteen weeks two days:

"The ten Leicestershire ate 588 bushels of turnips.

"The ten South Down ate 589 bushels of turnips.

"The nine Norfolk ate 607 bushels of turnips.

"The offal turnips were, at different times, collected, measured, and deducted from the account of the quantities given to them.

"If nine Norfolk consumed 607 bushels, ten would, in the same proportion, have consumed above 674 bushels, or 85 bushels more than the South Down, and 86 bushels more than the Leicesters.

"The Norfolk and South Down are about the same age; Leicestershire about six weeks younger. He should have observed that they were both times weighed after having stood some time in pens to empty themselves. The Leicestershire and Norfolk were bred by Mr. Coke, of Holkham; the South Down by Mr. Ellman of Glynd; and as they were all picked out for the purpose, he doubts not but it will be allowed they were prime stock of their kinds. The Norfolks were chosen out of about seven hundred lambs, the Leicestershire and South Down out of about one hundred each."

There is also a very interesting trial stated in the 26th volume of the Annals of Agriculture with four different breeds of sheep made by the direction of the late Duke of Bedford. For this purpose twenty South Downs bred on the farm at Woburn from sheep procured on the South Downs, were selected, and an equal number of Leicesters from Leicestershire, also of Worcestershires and Wiltshires from their different counties were procured, great care being had to have good stock of the same age of the respective kinds. At the commencement of the experiments, the Leicesters were fat; the South Downs in good order, and the Worcesters and Wiltshires, lean.

And to render the food consumed, as well in summer as winter, a part of the trial, sixteen acres in the park were hurdled off into four divisions; the soil, herbage, &c. as equal as could be fixed upon.

The trial began November 19th, 1794, when 20 of each sort were put into four acres, and continued there till killed, except for nineteen days, when the several pastures being too bare they were drawn off, for that time, to refresh the bite.

SHE

Nov. 19, 1794, *Weights of eighty Lambs, after fasting eighteen hours.*

No.	South Down.		Leicester-shire.		Worcester-shire.		Wilt-shire.	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
1	98	8	97	0	97	0	113	0
2	92	0	106	8	87	8	95	0
3	89	8	101	0	87	8	113	8
4	93	0	95	8	90	0	102	8
5	93	0	89	8	88	0	125	0
6	102	0	97	0	94	0	133	8
7	94	0	92	8	100	0	112	0
8	99	0	98	8	85	8	108	0
9	103	8	102	8	91	8	97	0
10	99	0	100	0	89	8	105	0
11	99	0	109	8	90	8	102	0
12	97	0	80	8	94	0	107	8
13	98	0	93	0	91	8	109	8
14	91	0	99	0	95	8	104	8
15	94	0	88	8	91	0	100	8
16	92	8	105	0	93	8	105	8
17	101	8	98	0	104	8	110	8
18	101	8	87	0	85	8	98	0
19	95	0	104	8	95	0	108	8
20	100	8	109	0	104	0	113	0
	1933	8	1954	0	1855	8	2163	8
Aver.	96	0	97	0	92	0	108	0

They were put to turnips, strewed on the grass of each division, till February 24th, 1795; when on being weighed, the result was as below.

February 25th, Seventy-six Sheep weighed.

No.	South Down.		Leceister-shire.		Worcester-shire.		Wilt-shire.	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
1	88	3	83	4	77	12	99	0
2	80	12	88	2	78	0	86	0
3	71	8	89	4	81	8	94	0
4	79	10	85	4	89	8	80	0
5	84	0	78	4	87	0	101	8
6	97	8	88	0	91	12	122	0
7	94	6	82	10	87	0	87	0
8	91	8	86	0	75	8	93	8
9	94	12	92	4	74	10	88	0
10	89	12	85	0	82	8	101	4
11	93	6	97	12	85	8	91	0
12	92	14	67	4	82	12	101	4
13	86	0	77	4	89	0	95	8
14	77	4	82	0	78	0	90	6
15	90	8	72	8	83	0	87	12
16	80	10	86	12	74	12	89	4
17	83	0	82	0	91	8	1508	6
18	89	0	73	12	76	8		
19	83	8	90	12	86	10		
20	91	12	97	0	81	4		
	1739	3	1685	0	1654	0		

Only sixteen Wiltshires were now weighed, as it was found that that number of them eat in proportion to twenty of the others.

The consumption of turnips between December 4th, 1794, and February 24th, 1795, was as below with the different sorts:

	lb.
South Downs	10,945
Leicesters	11,500
Worcesters	11,498
Wiltshires	11,518

All the four lots 120lb. of hay each.

	Weight lb.	oz.
20 South Downs, Nov. 19	1933	8
Feb. 25	1739	3
Lost	194	5
20 Leicesters, Nov. 19	1954	0
Feb. 25	1685	0
Lost	269	0
20 Worcesters, Nov. 19	1855	8
Feb. 25	1654	0
Lost	201	8
16 Wiltshires (to No. 16) Nov. 19	1733	8
	1508	6
Lost	225	2

Of course the South Downs did better than any of them.

It is to be noted, the writer says, that in this experiment the loss of weight by feeding on turnips is remarkable, though the mode of feeding them by drawing is supposed the best in so far as the stock is concerned.

Loss in each sort.

	lb.	oz.
The South Downs	194	5
The Leicesters	269	0
The Worcesters	201	8
The Wiltshires	225	2
76 sheep lost	889	15
Call it	890	0
Which is per head	11	12

Which dead would be of mutton, it is said, above 6lb.; and at 5*d.* per lb. 2*s.* 6*d.*; which for fourteen weeks, the time they were at turnips, is 2*d.* per week, and a fraction. It is noted that throughout the trial mutton is reckoned at 5*d.* per lb. But that it is a matter of perfect indifference what the price is, provided it be the same for all, the comparison of

the breeds being the principal object. The real price, owing to the scarcity, was when sold much higher; but as 5*d.* per pound is more common, and perhaps above the average of the kingdom for years together, the trial may be more generally useful by supposing a price nearer a general one, than the particular ratio of the time.

"The sheep consequently lost, it is supposed, nearly as much as is given for keeping hoggits on turnips; when they are plentiful, they may be kept for 3*d.* per week; but on an average of crops drawn and given on the grass, as these were, 3½*d.* or 4*d.* would be given; to which add 2*d.* and a fraction loss, and the account shows, it is observed, what sort of a food turnips often prove in sheep feeding.

"From this time they were turned to turnips, &c. with the store flock, and April the 9th. to pasture; the paddocks not being forward enough to receive them till May 13th, when they were weighed again.

May 13th, 1795, Seventy-six Sheep weighed.

No.	South Down.		Leicester-shire.		Worcester-shire.		Wiltshire.	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
1	94	4	82	0	86	10	107	8
2	83	0	71	0	86	12	105	0
3	82	8	86	4	85	4	96	12
4	87	6	88	4	97	4	97	0
5	86	8	80	12	95	12	99	0
6	103	12	86	8	90	0	92	0
7	96	12	85	12	97	8	132	4
8	101	12	81	12	94	4	106	0
9	101	0	86	12	82	14	109	0
10	90	4	88	0	89	8	107	8
11	98	8	95	12	92	8	103	0
12	101	0	80	0	87	0	100	2
13	92	4	83	8	98	10	96	8
14	83	4	84	8	93	6	96	10
15	87	4	77	8	86	0	110	8
16	91	6	91	6	76	12	132	0
17	89	2	84	0	107	12		
18	96	0	99	0	80	8	1690	12
19	92	12	81	0	96	12		
20	104	4	97	8	102	8		
	1862	14	1711	2	1827	8		

		Weight. lb.	oz.
20 South Downs	May 13	1862	14
	Feb. 25	1739	3
	Gain	123	11
20 Leicesters	May 13	1711	2
	Feb. 25	1685	0
	Gain	26	2
20 Worcesters	May 13	1827	8
	Feb. 25	1654	0
	Gain	173	8
16 Wiltshires	May 13	1690	12
	Feb. 25	1508	6
	Gain	182	6

"Consequently in this first putting to grass, the Leicesters did the worst, and the Wiltshires the best

		lb.	oz.
Gain by	20 South Downs	123	11
	20 Leicesters	26	2
	20 Worcesters	173	8
	16 Wiltshires	182	6
		505	11

"Which, the writer says, is per head 6½*d. lb.* or dead weight 3½ *lb.* and at 5*d.* per *lb.* is 1*s.* 5½*d.* which for 6½ weeks is per week nearly 2½*d.*

"Reduced therefore as they were by turnips, it is observed that they gained more per week by the grass than they had lost per week on that root, yet that the gain is small unless the weather was cold and raw.

"July 3d weighed again:—

1795, July 3d. 76 Sheep and their wool weighed after being shorn,

South Down.					Leicestershire.				Worcestershire.				Wiltshire.			
No.	Sheep.		Wool.		Sheep.		Wool.		Sheep.		Wool.		Sheep.		Wool.	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz	lb.	oz.
1	108	4	4	11	91	0	7	1	104	12	6	9	126	8	4	12
2	101	0	4	10	85	0	4	0	96	4	6	0	119	8	5	2
3	89	8	4	10	96	0	7	8	86	12	6	10	120	4	3	15
4	99	0	3	12	91	0	5	14	111	12	7	0	113	8	4	15
5	105	4	4	10	97	4	7	4	109	0	8	1	117	6	5	0
6	115	0	5	6	96	0	6	7	111	2	6	14	106	10	4	6
7	104	12	5	11	98	4	6	4	112	12	6	2	146	4	5	1
8	110	12	6	6	96	0	6	8	107	12	6	12	121	8	5	2
9	113	10	5	0	101	6	5	8	97	2	6	8	115	10	5	0
10	105	4	5	8	100	6	7	7	101	0	6	0	122	8	6	10
11	115	4	4	12	119	2	6	7	103	6	6	13	120	0	0	0
12	114	0	4	3	90	8	6	6	97	12	6	13	118	0	5	15
13	101	4	5	1	91	0	5	2	98	2	8	3	113	4	5	14
14	95	0	4	8	95	0	7	0	106	0	6	6	113	12	5	3
15	96	8	6	0	84	0	6	4	115	0	6	7	129	0	5	6
16	108	8	3	15	98	6	7	4	98	10	6	0	151	0	5	12
17	106	10	4	0	94	8	7	11	116	0	9	5				
18	107	8	4	4	105	2	6	4	95	12	4	15	1954	10	82	1
19	102	0	4	10	90	10	7	10	105	0	8	0				
20	119	0	3	4	114	12	7	6	110	0	8	2				
	2118	0	94	13	1934	4	131	3	2083	14	137	8				

	Weight. lbs.	ozs.
20 South Downs	2118	0
Their wool	94	13
	2212	13
20 Leicesters	1934	4
Their wool	131	3
	2065	7
20 Worcesters	2083	14
Their wool	137	8
	2221	6
16 Wiltshires	1954	10
Their wool	82	1
	2036	11

		Weight. lb.	oz.
20 South Downs,	July 3	2212	13
	May 13	1862	14
	Gain	349	15

		Weight. lb.	oz.
20 Leicesters,	July 3	2065	7
	May 13	1711	2
	Gain	354	5
20 Worcesters,	July 3	2221	6
	May 13	1827	8
	Gain	393	14
16 Wiltshires,	July 3	2036	11
	May 13	1690	12
	Gain	345	15

October 15th, summer food finished, and turnips began to be given. Weighed again:

1795, *October* 15*th*, 76 *Sheep weighed, and put to turnips.*

No.	South Down.	Leicester-shire.	Worcester-shire.	Wiltshire.
	lb. oz.	lb. oz.	lb. oz.	lb. oz.
1	135 0	120 2	128 8	153 0
2	120 0	106 0	133 0	148 8
3	110 0	122 8	118 0	145 8
4	119 12	127 0	144 0	144 0
5	128 4	126 8	137 8	146 0
6	134 0	122 10	145 0	130 8
7	129 0	129 8	143 0	172 0
8	130 4	118 8	143 4	157 0
9	137 0	133 0	127 12	143 8
10	128 8	128 0	133 0	153 0
11	137 4	141 12	128 8	147 0
12	138 4	118 0	124 0	149 12
13	125 8	118 12	127 8	147 0
14	118 4	127 8	139 0	141 8
15	122 0	110 4	150 0	160 0
16	129 0	124 4	123 4	180 0
17	133 0	131 8	153 0	
18	135 8	135 8	132 0	2418 4
19	122 0	117 8	138 0	
20	140 2	146 8	149 8	
	2572 10	2505 4	2717 12	

		Weight. lb. oz.
20 South Downs,	October 15 - -	2572 10
	July 3 - - -	2212 13
	Gain - -	359 13
20 Leicesters,	October 15 - -	2505 4
	July 3 - - -	2065 7
	Gain - -	439 13
20 Worcesters,	October 15 - -	2717 12
	July 3 - - -	2221 6
	Gain - -	496 6
16 Wiltshires,	October 15 - -	2418 4
	July 3 - - -	2036 11
	Gain - -	381 9

The Worcesters through the summer, therefore, did very well.

The following state will show the gain on grass, from leaving off turnips in the spring to putting again to turnips, in the autumn.

		Weight. lb. oz.
20 South Downs,	October 15 - -	2572 10
	Feb. 25 - - -	1739 3
	Gain - -	833 7

Suppose the proportion of the dead to the live weight, to be as 12 to 20; this is dead 499lb. and at 5*d.* per lb. is 10*l.* 8*s.* per head, 10*s.* 4$d\frac{3}{4}$. per head per week, for 33 weeks, $3\frac{3}{4}d$.

		Weight. lb. oz.
20 Leicesters,	October 15 - -	2505 4
	Feb. 25 - - -	1685 0
	Gain - -	820 4

This is dead 637lb. and at 5*d.* per lb. is 13*l.* 5*s.* 5*d.* per head 13*s.* 3*d.* per head per week, $4\frac{3}{4}d$. and a fraction.

		Weight. lb. oz.
16 Wiltshires,	October 15 - -	2418 4
	Feb. 25 - - -	1508 6
	Gain -	909 14

This is dead 544lb. and at 5*d.* per lb. 11*l.* 6*s.* 8*d.* per head 14*s.* 2*d.* per head per week, more than 5*d.*

It is remarked in recapitulation that "South Downs, weighing each 86lb. on an average, February 25, pay per week $3\frac{3}{4}d$.

"Leicesters, weighing on an average each 84lb. February 25, pay per week $3\frac{3}{4}d$.

"Worcesters, weighing on an average 82lb. pay per week $4\frac{3}{4}d$.

"Wiltshires, weighing on an average 75lb. pay per week 5*d.*

For the three first the experiment is fair; but no conclusion is to be drawn from the Wiltshires, for as 16 had the same food as 20 of the others, the superiority here indicated is without meaning.

Leicester and South Down equal.—Worcester superior.

Being thus put to turnips a second time, they continued to be so fed till February 16, when they were sent to market being first weighed.

76 *Sheep weighed,* 16*th February* 1796, *and sent to market.*

No.	South Down.	Leicesters.	Worcesters.	Wiltshire.
	lb. oz.	lb. oz.	lb. oz.	lb. oz.
1	132 0	136 8	137 8	170 0
2	124 0	112 4	137 0	156 8
3	121 0	131 8	118 8	147 12
4	139 0	146 12	147 0	148 0
5	144 0	131 0	145 0	156 0
6	144 0	128 8	164 0	149 0
7	144 8	143 8	148 0	176 0
8	132 6	132 8	151 0	175 0
9	143 12	143 4	120 4	148 0
10	134 0	140 4	142 2	162 8
11	141 2	148 4	140 8	158 2
12	155 8	133 0	125 0	158 0
13	131 0	144 8	133 0	154 0
14	125 0	134 0	145 0	152 0
15	127 8	145 0	166 4	172 0
16	134 0	131 0	132 8	189 0
17	140 0	151 12	159 0	
18	141 0	157 0	196 0	2571 14
19	132 0	126 11	155 0	
20	155 0	152 0	161 0	
	2734 12	2769 4	2863 10	

SHE

		Weight. lb. oz.
20 South Downs	Feb. 16, 1796	2734 12
	Oct. 15	2572 10
	Gain	162 2

This is dead 97lb. and at 5d. per lb. is 2l. 0s. 5d. per head 2s. $\frac{1}{4}$d. per head per week, for 18 weeks, $1\frac{1}{4}$d.

20 Leicesters	Feb. 16	2769 4
	Oct. 15	2505 4
	Gain	264 0

This is dead 158lb. and at 5d. per lb. is 3l. 5s. 10d. per head 3s. $3\frac{1}{2}$d. per week something less than $2\frac{1}{4}$d.

20 Worcesters	Feb. 16	2863 10
	Oct. 15	2717 12
	Gain	145 14

This is dead 86lb. and at 5d. per lb. is 1l. 15s. 10d. per head 1s. $9\frac{1}{2}$d; per head per week 1d.

16 Wiltshires	Feb. 16	2571 14
	Oct. 15	2418 4
	Gain	153 10

This is dead 91b. and at 5d. per lb. is 1l. 18s.; per head 2s. $4\frac{1}{2}$d. per head per week $1\frac{1}{2}$d.

South Downs per week	$1\frac{1}{2}$d
Leicesters	$2\frac{1}{4}$d
Worcesters	1d
Wiltshires	$1\frac{1}{2}$d

In respect to all the calculations per week of what was paid by the sheep, it is stated only for the sake of comparison; there is an additional return by lean flesh at a lean price being converted into a saleable price, which adds considerably: but this equal to all in proportion to their weight.

In regard to the consumption of turnips they were, it is observed, weighed from October 19, 1795, to February 14th, 1796, as they were given to the sheep, and the remnants not eaten also are weighed and deducted. The following is the result:

	lb.
South Downs given	54,036
Taken away	1,812
Eaten	52,224
Leicesters given	54,036
Taken away	2,001
Eaten	52,035
Worcesters given	54,036
Taken away	1,361
Eaten	52,675
Wiltshires given	54,036
Taken away	1,189
Eaten	52,847

	Hay. lb.
South Downs	64
Leicesters	54
Worcesters	68
Wiltshires	76
	262

It is observed "the difference of the number of Wiltshires excepted, their stomachs were therefore on a par."

But "there is still one other comparison, the writer says, to make, and that is, their increase from the first to the last, including in one account the turnips of both winters, and the grass."

		Weight. lb.
20 South Downs	Feb. 16, 1796	2734
	Nov. 19, 1794	1933
	Gain	801

Which is dead 480lb. and at 5d. per lb. is 10l.; per head, 10s.; per head per week, for 64 weeks, under 2d.

20 Leicesters	Feb. 16, 1796	2769
	Nov. 19, 1794	1954
	Gain	815

Which is dead 488lb. and at 5d. per lb. is 10l. 3s. 4d.; per head 10s. 2d.; per head per week, for 64 weeks, under 2d.

20 Worcesters	Feb. 16, 1796	2863
	Nov. 19, 1794	1855
	Gain	1008

Which is dead 604lb. and at 5d. per lb. is 12l. 11s. 8d. per head 12s. 7d.; per head per week more than $2\frac{1}{4}$d.

16 Wiltshires	Feb. 16, 1796	2571
	Nov. 19, 1794	1733
	Gain	838

Which is dead 499lb. and at 5d. per lb. is 10l. 8s. per head something under 13s. per head per week. more than $2\frac{1}{4}$d.

		£.	s.	d.
South Down per week		2d.		
Leicesters		2d.		
Worcesters		$2\frac{1}{4}$d.		
Wiltshires		$2\frac{1}{4}$d.		
South Downs 96lb. sold at		2	7	0
	Wool	0	6	$2\frac{3}{4}$
		1	13	$2\frac{3}{4}$
Leicesters 97		2	10	8
	Wool	0	4	8
		2	15	4

		£.	s.	d.
Worcesters 92lb. sold at		2	4	9¾
	Wool,	0	5	1½
		2	9	10¾
Wiltshires 108		2	6	4¾
	Wool,	0	5	5½
		2	11	10¼

It is added that, "the experiment terminated here with their being driven to Smithfield; but in order to render it yet more satisfactory, one from each lot was chosen, the second best as nearly as could be, in order for killing and weighing more particularly; and that the question of bone might not depend on any general assertions, they were ordered to be carefully kept and weighed from every joint as eaten. The following is the result."

The weight of four of the experimental Sheep, killed 14th March, 1796.

Leicestershire.	lb.	oz.
No. 20, weighed alive	150	0
Skin	20	0
Fat	11	8
Head and pluck	9	6
Entrails	11	2
Blood	6	0
Four quarters	92	0
	150	0
Bones clean	5	9
Fat with the kidnies in	5	1
Kidnies	0	4

South Down.	lb.	oz.
No. 20., weighed alive	155	0
Skin	17	8
Fat	13	2
Head and pluck	10	8
Entrails	13	4
Blood	5	14
Four quarters	92	6
	152	10
Bones clean	6	5¾
Fat with the kidnies in	8	6
Kidnies	0	4¾

Worcestershire.	lb.	oz.
No. 20, weighed alive	161	0
Skin	23	0
Fat	12	8
Head and pluck	12	0
Entrails	15	0
Blood	8	0
Four quarters	89	0
	159	8
Bones clean	6	0
Fat with the kidnies in	6	12
Kidnies	0	5

Wiltshire.	lb.	oz.
No. 8, weighed alive	175	0
Skin	23	0
Fat	13	8
Head and pluck	14	0
Entrails	17	10
Blood	8	2
Four quarters	97	0
	* 173	4
Bones clean	9	8
Fat with the kidnies in	4	3½
Kidnies	0	5

* The waste in all the sheep is great, which the bailiff attributes to the butcher being too long a time in dressing them.

Proportion of live and dead weight.

South Down 155, alive, giving 92, dead, is 20 giving 11¾. Leicester 152 giving 92, is 20 giving 12; Worcester 161 giving 89, is 20 giving 11; Wiltshire 171 giving 97, is 20 giving 11.

Sale of Seventy-two sheep at Smithfield Feb. 22, 1796.

19. *Leicestershire*

	s.	d.	£.	s.	d.	£.	s.	d.
8 Mr. Wace, at	51	0	20	8	0			
11 Mr Darking, at	50	6	27	15	6			
						48	3	6

19 *South Down.*

	£.	s.	d.	£.	s.	d.
19 Mr. Circuit, at 47s.				44	13	0

15 *Wiltshire.*

7 Mr. Lomas, at 48s.	16	16	0			
8 Mr. Stackley, at 45s.	18	0	0			
				34	16	0

19 *Worcestershire.*

11 Mr. Brooks, at 45s.	24	15	0			
8 Mr. Vaughan, at 44s. 6d.	17	16	0			
				42	11	0

No. 20 Leicestershire—20 South Down—8, Wiltshire—20 Worcestershire—were all killed at home.

Weight alive, on sending to market.

	lb.
20 South Downs	2734
Deduct No. 20	155
Sold 19	2579
Dead weight	1546
Per head	81

Sold for 47*s.* which is 7*d.* per lb.

20 Leicesters	2769
Deduct No. 20	152
Sold 19	2617
Dead weight	1569
Per head	82

Sold at 50*s.* 8*d.* which is not quite 7½*d.* per lb.

16 Wiltshires	2571
Deduct No. 8	157
Sold 15	2414
Dead weight	1448
Per head	96

Sold at 46*s.* 4½*d.* which is something better than 5¾*d.* per lb.

	lb.
20 Worcesters	2863
Deduct No. 20	161
Sold 19	2702
Dead weight	1621
Per head	85

Sold at 44*s.* 9½*d.* which is more than 6¼*d.* per lb.

South Downs 7½*d.* per lb.; Leicesters 7½*d.*; Wiltshires 5¾*d.*; Worcesters 6¼*d.*

These are all calculated by the same ratio, the supposition that 20lb. alive is 12lb. dead; but from the trial of the four single sheep, this was the case only with the Leicesters; none of the others proving so well, and Wiltshire and Worcester, least.

Wool.

20 South Downs gave 94*lb.* 13*oz.*; at 37*s.* the tod of 28lb. is 6*l.* 4*s.* 10*d.* per fleece 6*s.* 2¾*d.*

20 Leicesters gave 131lb. 3oz. at 20*s.* the tod is 4*l.* 13*s.* 6¾*d.* per fleece 4*s.* 8*d.*

20 Worcesters gave 137lb. 8oz. at 21*s.* the tod is 5*l.* 2*s.* 9*d.* per fleece 5*s.* 1½*d.*

16 Wiltshires gave 82*lb.* 1*oz.* at 30*s.* the tod is 4*l.* 7*s.* 10*d.* per fleece 5*s.* 5½*d.*

	£.	s.	d.
South Downs per fleece, value	0	6	2¾
Leicesters	0	4	8
Worcesters	0	5	1½
Wiltshires	0	5	5½

It is remarked that one circumstance in addition to these remained to be ascertained after the sheep quitted the hands of the experimenter, which was the goodness of the mutton. That of the Leicesters has been considered as inferior for the table of the gentleman; while the South Down has been extolled as amongst the best in the island. A leg of each sort cut exactly in the same form was ordered by Lord Somerville to be dressed for dinner, to which the Duke of Bedford, and some of the best judges in the kingdom were invited; and on the two legs of mutton being put upon the table at the same time for the company to decide on their goodness, it was found that by much the largest part of the company pronounced in favour of the Leicester, supposing it at the time to be South Down. It is suggested that in fact the difference was very trifling, the flesh of the Leicester being closer in the texture, but of a rather paler colour, but the gravy of the South Down of a higher flavour.

The experiment is considered as highly interesting and important, though it did not show those strong features of distinction between the breeds which were expected, and which, if they exist, must, it is supposed, be drawn from various repetitions. It proved some points of importance, as that of their all losing on turnips the first winter, the South Downs the least, and the Wiltshires the most; that on the summer grass, sixteen Wiltshires on the same breadth of food as twenty of the others, did best, Worcesters next best, and South Downs and Leicesters equal; that in the second winter's turnips, the Leicesters did much the best, and the Worcesters the worst; that in joint sale of carcase and wool, in proportion to the original weight, the Leicesters are the best sort, and the South Downs the second best; that in quality of mutton, South Downs and Leicesters equal, and the Wiltshires worst; consequently that as far as the trial extends the Leicesters are the best breed, and the Wiltshires incomparably the worst of any.

It is stated that "the loss on the first winter's turnips, and their doing so ill the second, is a strong confirmation of the result of various trials that have been published in the Annals. Whenever sheep are weighed to and from turnips, loss appears, or at best a very small increase. This is a part of the business ill understood at present respecting the public; it wants much to be ascertained upon what circumstances of breed, season and management, a profitable application of this root, to fatten sheep, depends. In eighteen weeks they ate,

	lb.
20 South Downs -	52,224
20 Leicesters -	52,335
20 Worcesters -	52,675
16 Wiltshires -	52,847
	209,781
Eaten by each sheep	2760.

Or about 1¼ ton in 18 weeks. In all 93 tons 13 cwt. And they gained in those 18 weeks,

	Dead Weight. lb.
South Downs	97
Leicesters - -	158
Worcesters -	86
Wiltshires - -	91
	432

Which at 5d. per lb. is 9l. and for 93 tons of turnips, 1s. 11d. per ton. From which something might be deducted for the hay."

These statements may lead the sheep farmer in some measure not only to judge of different breeds of sheep, and the consumption of different sorts of food, but likewise to those which are the most advantageous under different circumstances.

In the management of sheep there is a practice made use of in some districts, which remains to be noticed; and which is that of folding. It was formerly thought to be indispensibly necessary to the success of the farmer in different districts; but of late a different opinion has prevailed except in particular cases, and it is considered as merely enriching one field at the expense of another. The practice may however be beneficial where there are downs, heaths, or commons. The ideas of farmers are not however uniform on this subject, as will be shown by the following details from the Norfolk and Hertfordshire Reports. In the former it is remarked that "near Brandon there is a practice introduced about ten years ago, said to be from Kent, which is, to fold their flocks for five or six hours in the middle of the day in hot weather." And that "in laying out the enclosures of the farm of Waterden, from 15 to 50 acres each, much attention was paid in the arrangement to have every field of the farm to open into a lane, that leads through the whole, so that by dividing the flock, for stocking, according to varying circumstances, Mr. Hill can keep at least one-fourth more than when all the breeding ewes and lambs were in one flock, and the food dirtied by driving to fold: by this means there is not a bent on the farm, the stocking being equal. He is not, however, entirely without a fold; when the lambs are weaned (usually about old Midsummer) the ewes are folded for about two months, principally to prevent their breaking pasture, when the lambs are taken from them: and while thus folded, he finds that it takes one-half more land to feed them, than if they were left allotted, as through the rest of the year. That folding lessens the value of the lambs, he has not a doubt, and that considerably; they do not bring so high a price as others not folded—this is not opinion, but fact. The ewes are also in doubly better condition from lying still and quiet. That the *teath* will, in certain cases, be unequally given, he does not deny; but it is not difficult to remedy this by the dung-cart; to fold a lot in its own lay, is also a remedy, and is the only sort of folding he can approve. In regard to the effect on wool, he is clearly of opinion, that folding does not render it finer—it makes the fleece lighter, but never finer." And "folding is generally given up by all who have South Downs; not because they will not bear it, for they bear it better than any sheep in the island; but because the stock is so valuable that it is worth the farmer's attention to contrive, by every means, to keep as many as possible." It is added that "one circumstance, though a small one, deserves mentioning, for the use of those who form separating sheep-pens; which is that Mr. Hill has sliding-gates from one to the other; the writer remarked that when a pen is full of sheep, the gates cannot be opened with convenience; but by their sliding in the fence, this is avoided" in a very easy manner.

It is stated that "Mr. England, of Binham, does not fold. When not folded, he thinks, sheep do with less food; and as to the common objection, of their drawing under hedges for shelter, in storms, &c. so much the better; it is what they ought not to be prevented from doing. The *tathe* is much more than lost in mutton. And Mr. Reeve, of Wighton, never folds: folding from layers, upon fallow, is only robbing one field to enrich another. He is clear in this point; and also in the fact, that if sheep (whatever the breed) are driven by foul weather to a hedge, there is the proper place for them, and not by penning left to abide the beating of the storm. Mr. H. Blythe, of Burnham, sometimes folds, but never from choice, but solely by reason of the openness of his farm; nor does he approve the practice. And he explained a point in his manuring for wheat, which, the writer says, comes home to the question:—he never sows tempered land with wheat, without either oil-cake or muck, except on pieces from which the sheep were not folded while feeding the layers." And "Mr. Dursgate remarks, that folded sheep certainly demand more food than those which are not folded; a quarter of a ton of rape cake is equal to the fold; and the flock, without any doubt, suffers more than that value by folding. In short, folding is to gain one shilling in manure, by the loss of two in flesh." Some however fold with large flocks. But Mr. Beck of Rising, does not fold; and he is very certain that if he did fold, he could not keep any thing like the number of his present flock. It is added that as the writer rode across a layer of 40 or 50 acres, on Mr. Overman's farm, he observed a great difference in the verdure, to a line across it, the appearance of one side of that line being so much superior to the other; and on his remark-

ing it, he was informed that it was an accidental experiment, which was well worth attention: there was no other difference in management, to make one part of that layer better than another, except the sheep that fed it being from one part of it folded on another arable field during the summer; but from the other part they were not folded at all, but left in the layer night and day. The difference was very considerable, and might have been discerned half a mile off. This experiment made that farmer give up folding, except when his flock was in a salt-marsh; and Mr. Tuttle, a neighbour, asserted, he would never fold at all had he no marshes. Nor does Mr. Etheridge, of Stanhow, fold. These facts should, the writer says, be combined with another, that of heaths and sheep-walks, that have been fed with sheep for centuries; but those sheep constantly folded on other lands, are so far from improving, that they are to all appearance as poor as they could have been at any former period."—It is further stated "that Mr. Styleman, at Snettisham, turned his flock loose, and without folding, in 20 acres of *ollond* every night, for the same period that would have folded it in the common manner. The sheep did much better than they would have done had they been folded; the face of the herbage materially improved during the period, and upon ploughing it up for wheat, the crop was equal to what it would have been with folding, and shewed, by a regular verdure, that they had distributed the manure equally in every part. He conceives that lambs sell 3s. a head lower on account of folding, than they would do without it; but this is only his opinion. He thinks also that the ewe is much injured."

But "Mr. Pitts, of Thorpe Abbots, finds that no mucking, on his burning gravels, will do so much good as the fold, and especially on a white clover and trefoil layer for barley."

And "in the clay district of the county of Hertford, Mr. Byde remarks that sheep have been too much lessened. Of all the common manures, he considers the fold as the best; and he has observed in many farms the general appearance of the crops decline, as the number of sheep kept has lessened." That "at the Hadhams, every man folds the sheep which he keeps; a little farmer will even set four hurdles, if he has not sheep for more." But that "good as the manure of the fold is, Mr. Chapman has found by trial in the same field, for turnips, that yard dung was much better than both fold and malt dust together." However, "Mr. Roberts, of King's Walden, thinks nothing is equal to the fold: he never reckoned it worth less than 40s. per acre, corn being cheap; but of late much more, he folds two poles of ground with 20 sheep." And "Mr. Sedgwick, of Rickmersworth, is clearly in favour of folding on all farms." See *Folding of Sheep.*

It has been observed by Mr. Ellman in the Annals of Agriculture, that "just 20 South Down sheep (if a large sort a less number will do) will fold one rood per night, 3200 will fold one English acre per night. We value the manure at from 35 to 50s. per acre, the goodness of which depends much on how the sheep are kept: if kept on artificial food, such as tares, rape, clover, turnips, &c. they will drop more soil than if fed on grass only. Suppose we estimate the folding at 40s. per acre, it will amount per year to 4*s.* 6¾*d* per sheep; 22*l.* 16*s.* 3*d.* per 100, of 223*l.* 2*s.* 6*d.* per 1000, supposing the sheep folded throughout the year. If it be a breeding flock, it might be well to omit folding for five or six weeks immediately after lambing, as the young lambs might suffer from being trampled upon, and from driving to and from fold, would often lose their dams and suffer in that way, more than if they remained quiet."

There is, however, another method of folding, by which all the advantages may be attained during winter on all soils without the inconveniences of the former plan. This is stated to be by confining them at night in a sheep yard, well and regularly littered with straw, stubble or fern; by which means you keep your flock warm and healthy in bad seasons, and at the same time raise a surprising quantity of dung, so great a quantity, if you have plenty of litter, that the profit will be better than folding on the land. A great improvement in this method would be giving the sheep all their food (except their pasture) in such yard, viz. hay and turnips, for which purpose they may be brought up not only at night but also at noon to be baited; but if their pasture be at a distance, they should then, instead of baiting at noon, come to the yard earlier in the evening, and go out later in the morning. This is a practice which cannot be too much recommended; for so warm a lodging is a great matter to young lambs, and will tend much to forward their growth; the sheep will also be kept in good health, and, what is a point of consequence to all farms, the quantity of dung raised will be very great. If this method is pursued through the months of December, January, February, March, and April, with plenty of litter, 100 sheep will make a dunghill of at least 60 loads of excellent stuff, which will amply manure two acres of land, whereas 100 sheep folded (supposing the grass dry enough) will not in that time equally manure one acre.

In Norfolk, Mr. Bevan finds a yard well fenced in for a standing fold for littering and folding in bad weather; and is fully convinced of the great advantage of it. He intends in future to have his flock in it for yearning, whether the season be good or bad. And in Hertfordshire, the Earl of Clarendon has a fold which contains good room for 300 sheep, the number kept in it: "an open shed surrounds it, except on one side, where a barn is the fence; the outside of the shed is formed of wattled hurdle-work, without straw or other materials, for coolness, lest a greater closeness should make the yard too hot: it is all kept well littered with stubble, and yields, from 300 sheep, 80 large cart loads of manure. This system agrees perfectly well with the sheep, and keeps them more healthy than when they were left in the fields in the common manner. His lordship has another yard for lambing, which has also a shed."

These sorts of yards, from their beneficial tendency in different views, should be more generally made use of by sheep farmers. See *Sheep-House.*

The great utility of hurdling off different kinds of crops in consuming them by sheep has been long known and practised; and equal advantage may be derived in many cases by having recourse to the same method on grass lands in large inclosures, so as to let the animals have a fresh space or bite every day. The sheep are found to thrive better, and the same extent of land to support considerably more in number, while the land is at the same time much improved. And it is not improbable, but that other sorts of stock may be managed in the same way with similar advantage. In these cases the hurdles must be set according to the nature of the grass, where it is bare, and thin larger pieces should be folded, than in the contrary circumstances. See *Hurdle*.

In respect to the proper period of clipping or shearing sheep, it must be directed by the state of the weather and the climate in the particular district, as by this means the danger of injury by cold from depriving the sheep of their coats at too early a season, and from heat by permitting them to continue on them too long, may be avoided in the best manner: but another circumstance that should likewise be attended to in this business, is that of the wool being fully grown or at the state of maturity; as where the clipping precedes that period, it is said in the Annals of Agriculture to be weak and scarcely capable of being spun, and if protracted later, it is yellow, felted, and of an imperfect nature. It has been stated that for the more warm sheltered situations in the southern parts of the kingdom, the beginning or middle of June, when the weather is fine, may be in general the most proper; but in the more exposed districts in the northern parts of the island, the middle or latter end of the same month may be more suitable, provided the season be favourable. But with the fattening sheep in the inclosures, it will mostly be necessary to perform the work at an earlier period in every situation, as the great increase of heat from the setting in of the summer weather added to the warmth of the fleece becomes very oppressive and injurious to them in their feeding.

From the fleeces of sheep becoming much loaded and filled with dust and dirt of various kinds, at this hot season, by way of preparation for shearing it is necessary to have recourse to the operation of *washing*. It was formerly the method of performing this business to have the washers standing up to the breast in the water; but from the inconvenience and danger of it the men requiring a large supply of spirituous liquors, and being liable to be attacked with colds, rheumatisms and other diseases, as well as being apt to dispatch the work with too much expedition, so as to leave the wool insufficiently clean; it has been proposed by Mr. Young in his useful Calendar "to rail off a portion of the water (in a stream or pond) for the sheep to walk into by a sloop mouth at one end, and to walk out by another at the other end, with a depth sufficient at one part for them to swim; and to pave the whole: the breadth need not be more than six or seven feet: at one spot to let in on each side of this passage, where the depth is just sufficient for the water to flow over the sheep's back, a cask either fixed or leaded, for a man to stand in dry; the sheep being in the water between them, they wash in perfection, and pushing them on, they swim through the deep part and walk out at the other mouth, where a clean pen, or a very clean dry pasture is to receive them; of course there is a bridge rail-way to the tubs, and a pen at the first mouth of the water, whence the sheep are turned into it, where they may be soaking a few minutes before being driven to the washers." But other more cheap contrivances may be provided where there is clean water at hand for the purposes. And sheep should on no account be driven on dry or dusty roads, after this operation.

But in all cases, before this work commences, the lambs should be separated from the ewes and other sheep, and each be put in separate pens. With these it is seldom necessary to do much more than just swill them through the water without their being touched by the washers. As soon as they have been washed, the sheep should have a clean hard pasture for a few days until they are perfectly dry, and in a proper condition to be shorn. The lambs are generally shorn, especially in the northern districts, a few weeks after the old sheep, and the operation is termed *sherling*. The lambs that are sold in Smithfield market are, we believe, seldom or ever shorn. See *Shearing of Sheep*.

The practice of washing the sheep before they are shorn is a custom that prevails over most part of the kingdom, especially with the long woolled breeds, and pretty generally with those of the short woolled kinds also, but which is performed with more difficulty in them from the close matted nature of the fleece. It is said however, to have been the custom in Devonshire for a great length of time never to wash the short woolled sheep, but to shear them dry as is constantly the case in Spain.

Good clean washing is however a matter of great consequence to the wool, and it is of much advantage to it as well as the sheep to have the weather fair and fine at the time it is performed, as they are much less liable to have colds.

It is an excellent practice with many good sheep farmers to clip off all the coarse soiled wool about the thighs and docks some weeks before the usual time of washing and clipping the sheep; as by this means the sheep are kept clean and cool when the season is hot, and with ewes the udders are prevented from becoming sore. This practice is common with some South Down sheep masters, as well as in Yorkshire. In the former situation, Mr. Ellman sells his, as locks, at $3\frac{1}{2}d.$ per lb. having about four ounces from each sheep.

It has been proposed to shear sheep two or three times in the course of the year, with the view of having finer as well as a larger quantity of wool; but it is probable that such a practice can never be of any general advantage, though the trials that have been made in Northumberland in this way seem to shew that advantages may be derived in both these intentions; but the disadvantages in respect to the sheep do not seem to have been sufficiently attended to.

And with the same view the clothing of sheep has been had recourse to. In experiments made in this way in Scotland, the advantage in respect to wool is stated to have been very considerable, and the expense not more than seven pence per sheep. By having recourse to this practice with that of the above, it has been suggested that combing wool may be rendered fit for the purpose of clothing, and at the same time the mutton rendered more valuable. The trials in these ways have however hitherto been but few.

In the general management of sheep it is usual after the shearing has been performed, to mark the sheep with ruddle ochre or some similar substance, and some also cut the ear in different ways. The marking with tar has been said to be prejudicial, but where a small quantity is only employed, little injury can be sustained.

In almost all the sheep districts of the kingdom except in Dorsetshire, the tails of sheep are shortened, which seems to be an useful practice in keeping the animals more clean behind, and of course less liable to be stricken with the fly. It has however been suggested in the ninth volume of Annals of Agriculture, that by this custom the sheep may be rendered less able to drive away the flies. The general prevalence of the practice, would however seem to prove its being of advantage. There is much difference in the manner of performing the business in different districts in respect to the length, but four or five inches being left, is quite sufficient. It is usually done while the animals are young. In all sheep pastures the hedges should be well cleared from briars, as their coats are often injured by being torn by them. And all sorts of pernicious reptiles should be as much as possible destroyed, and removed from such land.

In respect to the business of castrating or gelding the lambs, it may be performed any time from the age of a fortnight or three weeks to that of a month or six weeks, and in some districts it is deferred to a considerably later period. It is however the safest method to have it executed early, as there is less danger of too much inflammation taking place. But in all cases the lambs should be in a healthy state when it is done, as under other circumstances they are liable to be destroyed by it. The operation is usually performed by the shepherd, by opening the scrotum or cod, and drawing out the testicles with the spermatic cord. This he often does with his teeth in the young state of the animal.

But where the operation is performed at a later period, it is usual to have recourse to the knife, the arteries being taken up and secured by means of ligatures or the searing iron. The business, if possible, should be done in fine weather, when not too warm, and the gelded lambs be kept in a dry, sheltered, quiet situation for a few days, until the inflammation is gone off. If it should happen to be wet at the time, it may be advisable to have them under some sort of shelter, where they can have room to move freely about.

It is well known that the mode of ascertaining the age of these animals, is chiefly by their teeth; but they are likewise sometimes named from the number of coats or fleeces that have been shorn from them, as one shear, two shear, &c. The sheep of one shear having two broad teeth before; that of two shear, four; that of three, six; and that of four, eight; which is full mouthed. See *Age of Sheep.*

They have also different names in different districts. After being weaned, the ram or wedder lamb is sometimes termed *hog*, *hoggit or tug*, during the whole of the first year; and the female lamb, *an ewe* or *gimmer* lamb and *ewe teg*. The second year the wedder has the title of *shear hog*, or a *two toothed tag*, and the ewe is called a *thaive*, or *two toothed ewe*. In the third year, a *shear hog* or *four toothed wedder*; and a *four toothed ewe* or *thaive*. The fourth year, a *six toothed wedder* or *ewe*. And in some places, from the time of lambing till that of salving the males are called *tup-lambs*; and from that period till the time of shearing *tup-hogs*, and ever afterwards tups: the females in the same order being termed, *ewe-lambs*, *ewe-hogs*, *gimmers*, *young ewes*, *old ewes*. The gelded male lambs, *castrated wedder lambs*, *wedder-hogs*, *dummonds*, *wedders*. *Crones* also signify old ewes; and there are several other provincial names which are explained in their proper places.

In the management of this sort of stock it must be sufficiently evident that a great deal of the profit and advantage must depend upon having a careful attentive shepherd who perfectly understands his business, and is at all times willing to perform it. See *Shepherd.*

Sheep are subject to a variety of diseases, which should be carefully attended to by those who have the care of such sort of stock, as soon as ever they show themselves, as a very short time often renders them irremediable. The nature of them and the means of removal are described under the proper heads to which they belong.

In regard to the nature and quantity of wool, they are materially different in different breeds of sheep, as has been explained in describing the different sorts. The pasture or long woolled kinds have always the largest proportion, but those of the short woolled sorts the finest in quality. The particular breeds that afford the finest wools have been noticed above.

The following statement shows the produce in two of the principal long woolled breeds of sheep, as well as the whole quantity afforded by the county of Lincoln, a great long woolled district.

Wool.

Place.	Lincoln fleece.	Breed.	Leicester fleece.	Mixed.
	lb.		lb.	
Spalding	—	½ Linc. ½ Leic.	—	10
Boston	14	Linc.		
Holland Fen	12	ditto		
Wolds	9½	ditto		
Swineshead	1st 9	ditto		
	2d 11			
	3d 9			
Ewerby	—	Leic.	8½	
Hackington	9¼	Linc.		
	—	Leic.	8	
Belton	1st	ditto	8	
	2d	—	8	
	3d	—	7	
Norton	—	ditto	8	
Barton	—	ditto	6½	
Barrow	—	ditto	7	
Lumber	9½	Linc.		
	—	Leic.	6½	
Belesby	7¼	Linc.		
	—	Leic.	7¼	
Alesby	—	ditto	7	
	8	Linc.		
Humberston	9	ditto		
Tathwell	10	ditto		
Cockswold	—	Leic.	7	—
	10	Linc.		
Haffham	14	ditto		
Gayton	8	ditto		
Tathwell	8	ditto		
Dalby	—	mixed	—	11
Partney	11½	Linc.		
Driby	—	mixed	—	8
Spilsby	—	Leic.	9½	
Skirbeck	8	Linc.		
Stainsby	12	ditto	1160 tods of wool from 2400 acres of all sorts, or 14lb. an acre.	
Keal	—	Leic.	9	
Ranby	—	ditto	11	
Frampton	12	Linc.		
M. Cunliff	Average of the whole county 9lb.			
Blythe	Average of the whole county 8lb. And a fleece and half or 12lb. per acre the produce of the whole county.			
Riseholm	—	Leic.	7½ clip a sheep an acre on a corn farm.	
Claypool	—	ditto	9	
Woolsthorpe	—	ditto	8	
Grimsthorpe	—	mixed	—	9
	201¼		142¾	38
Average	10		7¾	9½

The writer thinks "the probability therefore is, that the average of the county may be as stated above, 9lb." And "upon the very remarkable fact, that the whole county carries a sheep and half per acre, at 9lb. per fleece, he may observe, that if this is true, or near the truth, it is probably stocked far beyond any other in the kingdom: instead of 1,848,000 acres, let us, says he, call it 1,600,000, allowing 248,000 acres for lands that do not probably come into the account at all; at a sheep and half, there are then 2,400,000 sheep in the county: producing 21,610,000lb. of wool, which at only 9*d.* per pound, or 810,000*l.* amounts to 10*s.* an acre over the whole. Such an account, or any thing near it, is not, he thinks, to be produced in any other district, probably of the world." This fact, says he, shows the immense consequence of a fair price of wool to that county.

The table given below, shews the prices of wool in Lincolnshire for a great number of years.

Date.	Price.			Date.	Price.		
	L.	*s.*	*d.*		*L.*	*s.*	*d.*
1758	1	0	0	1777	0	18	6
1759	1	0	0	1778	0	14	6
1760	0	19	0	1779	0	12	0
1761	0	16	0	1780	0	12	6
1762	0	17	0	1781	0	12	0
1763	0	18	9	1782	0	11	0
1764	0	19	6	1783	0	14	0
1765	1	0	0	1784	0	15	6
1766	1	1	6	1785	0	13	0
1767	0	17	6	1786	0	16	6
1768	0	15	0	1787	0	17	0
1769	0	15	0	1788	0	17	0
1770	0	14	6	1789	0	18	6
1771	0	15	0	1790	0	18	6
1772	0	15	0	1791	1	0	0
1773	0	15	6	1792	1	3	6
1774	0	18	0	1793	0	17	0
1775	0	17	6	1794	0	16	0
1776	0	17	6				

And in the subsequent table the prices of the short fine wool, of Mr. Bevan's flock, in Norfolk, is also shown for several years.

Price of wool, per tod of 28 lb.

		L.	*s.*	*d.*
1794	South Down	1	15	0
1795		2	2	0
1796		2	5	0
1797		1	18	0
1798		2	0	0
1799		2	10	0
1800 1101		2	8	0

The increasing price of wool, has lately drawn much attention to the growth and improvement of it, especially that of the fine or combing sort. See *Wool*.

SHEEPCADE, a name provincially applied to the large sheep louse.

Sheep-*Dung*, the manure afforded by sheep, which by means of proper folding in yards properly littered with straw, stubble, &c. may in many cases be increased to a considerable extent, so as to render it an object with the farmer. See *Dung*, *Sheep*, and *Folding of Sheep*.

Sheep-*Fescue Grass*, a sort of grass which while it has been much praised by some as useful in pastures, has

been condemned by others as of little importance from its smallness, and being liable to be burnt up in dry seasons. It is said to succeed with less moisture than most other sorts of grass. As forming a close matted turf, where no great produce is required, it may be found a beneficial plant. See *Festuca ovina* and *Grass*.

Sheep-*Farm*, that sort of farm which is principally conducted under some system of sheep management. Many situations are suited to some branch of this husbandry, which cannot be converted to the purposes of raising grain or fattening cattle, &c. See *Sheep* and *Farm*.

Sheep-*Fold*, a sort of yard or other contrivance for the purpose of confining and keeping sheep in during the nights or in bad weather, in order to afford them protection and shelter. They are sometimes fixed, being constructed of any convenient sort of light materials so as to inclose a space in proportion to the number of sheep in the form of a kind of yard or fold, which is kept constantly well littered with some sort of dry substance, such as stubble, refuse straw, dry sand, &c. during the time the sheep are folded and foddered in them, in order that as much manure may be raised as possible. In some cases also, for the more perfect protection of the sheep, they have sheds all round them, under which the sheep may lie without injury from rain, snow or any sort of moisture.

These usually are termed *standing folds*, and are either formed about the home-stalls, or in some dry rather elevated situations on the farms, having the bottoms well laid with some sort of material that is capable of keeping the sheep dry and clean. And in the *covered fold*, or what is termed *cotting*, which is in use in Herefordshire, they are sometimes formed into different divisions, so as to contain certain numbers or kinds of sheep.

They are, however, in other cases formed so as to be moveable, either by means of wheels or other contrivances, being drawn to different situations according as they may be wanted. See *Sheep House*.

There is likewise another sort of more imperfect sheep-fold, which is formed by the planting of trees in different methods, so as to afford the animals a sort of protection from the severity of the winter seasons as well as from the excessive heats of the summer. These were termed *treefolds*, and sometimes *plantation folds* from the manner in which they were formed. See *Tree fold*.

In the construction of the first sort of sheep folds, where formed in some distant part of the farm, in which cases they are denominated *standing out folds*, a cheap simple method was had recourse to by an excellent sheep farmer in Suffolk (Mr. Macro). He inclosed a double fold with thirteen dozen of old hurdles seven feet long each, formed of wands, and raised a haulm fence around them, composed of upwards of sixty loads of wheat stubble, the area of the fold being littered with about thirty loads more: in this the flock were to be lodged when the field fold was unsafe, or could not be removed from place to place, on account of frost, snow, or flood; and it is stated that he made during the same winter season, 493 loads of manure, improving at the same time the condition of his flock. The land, it is observed, laid at too great a distance to be manured from the home-stall. He likewise adds, that before he thought of this plan, his sheep were always obliged to lie in bad weather, upon a certain sheltered part of the heath, where the fold manure was not only lost to his farm, but the grass on which the dung was heaped in such quantity, became so coarse and sour that nothing would eat it: and that exclusive of this injury he used to lose by mortality, in a wet or severe season, during yeaning time, a much greater number of both sheep and lambs, for want of the dry, warm lodging of a sheltered fold, the advantage of which he estimated at thirty or forty pounds per year at least. He saved not less by his improved plan than thirty lambs in a year, besides sheep amounting to a greater number of lambs than he usually reared in one year during the period of his farming business.

And by the forming of these folds in any other cheap convenient manner, similar benefits may be derived by the sheep farmer.

In all these cases the sheep should be littered down as above as often as necessary, and be well fed twice in the day at least, with such food as has been provided, being let out during the middle of the day, except when the season is very stormy and severe.

It is stated in the Annals of Agriculture, that "one hundred and thirty-four sheep confined in this way for the period of six weeks, and littered with five loads of forty trusses each of oat straw, forty pounds to the truss, made twenty-eight large loads of manure, consuming two acres of turnips within the time."

The great superiority of this sort of fold over that of the naked moveable kind is therefore sufficiently obvious, and may probably be had recourse to at all seasons with some advantage. See *Sheep* and *Folding of Sheep*.

A sheep-fold has been lately invented by Mr. Plowman of Broome, Norfolk, upon an improved and very simple principle, combining many advantages over the old and expensive method of folding by hurdles; and as the whole fold can be removed with ease at all times, it will be found peculiarly useful in feeding off turnips on the land in frosty weather, when hurdles cannot be used.

It is stated that the expense in the first instance, will exceed that of hurdles, for the same given quantity of sheep; but having had one in use nearly three years, he is satisfied the saving will be very considerable: for, before he adopted this method of folding he lost from thirty to forty nights folding in the year, owing to the land being hard in dry seasons, such as the two last; which renders folding almost impracticable, as they never can be set without great labour and destruction of hurdles. He is also clearly of opinion, that the stock of sheep will be greatly increased when this method of folding becomes more known; and that it will enable many small farmers to keep from 50 to 100 sheep, who are now deterred from it, on account of the small quantity of feed they have, not answering to keep a man for that pur-

pose only; but by this plan, they may keep a boy at 3*s.* or 3*s.* 6*d.* per week, who can attend on 100 or 200 sheep, and move the fold himself without any assistance. In heavy gales of wind it frequently happens, he says, that the hurdles are blown down, and the sheep of course being at liberty to range over the crops do incalculable mischief, which cannot happen with his fold. And in some counties in England, where hogs are folded, great difficulties are experienced for want of stowage, for them to feed off winter tares, &c. &c. as they root up every stake or hurdle; and having tried the experiment he is certain his fold will keep them in and defy their attempts to displace it. And an astonishing quantity of time is saved, as a man can remove a fold to contain 300 sheep in five minutes, which by the old method frequently takes some hours to accomplish. Many are now using folds from his model; and he received for the invention, the gold medal of the Society for the Encouragement of Arts, &c.

In *Plate* XXIX. *fig.* 8. Twenty-one feet long and three feet eleven inches high, composed of a top-rail.

A. Three inches deep, and two inches thick.

B. The upper bar, three inches deep, and three quarters inch thick.

CC. The two lower bars, four inches by three quarters of an inch, which, with the upper bar, are morticed through the uprights

DDDD. Which uprights are oak, three inches by two.

E. The lower bar, three inches by three.

F. An upright bar, with the horizontal bar halved into it.

GG. Two oak uprights three by two inches.

Fig. 9. Shows the oak uprights GG.

H. The axle-tree, three inches by three, and three feet between the wheels.

I. An oak knee which connects the uprights GG with the axle-tree, by means of two screws and nuts.

Fig. 10. A plan, in which the axle H. is shown with two arms KK at right angles to H, which are made to act as pivots to the wheels, when intended to be moved in a direction at right-angles to the bars.

Fig. 11. Is a view of the same part described in *Fig.* 10.

The wheels marked W, in all the figures, are of cast iron, and cost 3*s.* 6*d.* each.

It is further remarked that where the fold is wanted to be used on very hilly ground, it must be begun at the top and worked down to the bottom for the ease of removing it, and then drawn up again with a horse. This, however, he has never had occasion to do, for his land is ploughed in a contrary direction, and he works the fold in the same course as the ridges. By this means the inconvenience is avoided of crossing the furrows; and they are also a guide to keep the fold in a straight direction. With respect to the sheep getting under, he does not recollect that circumstance to have ever happened, nor does he conceive that any land, which is cultivated, can be so uneven as to admit of it.

Sheep-*House*, a sort of slight wooden building constructed for the purpose of containing and protecting sheep in bad weather, &c. Houses of this kind are usually made low for the sake of warmth in the winter, being mostly a third part longer than they have breadth; they should also be sufficiently large for the quantity of sheep that they are to contain. The side should be lined with boards, and the bottoms be laid in an even manner with stone or some other material, that the litter may be well impregnated with the urine of the sheep. And it has been advised to have the sides exposed to the sun set with lined moveable hurdles, that when it shines the whole may be laid open, to afford due refreshment and give the sheep an opportunity of feeding upon the pasture wherein they stand. They should be well and securely covered with some sort of proper material upon the tops. They are sometimes fixed in particular situations, but in other cases, which is the more improved method, so constructed as to be capable of being removed as they may be wanted. One of the latter kind, employed on the farm of the Honourable George Villiers in Hertfordshire, which is very complete, and described with a plate, in the corrected Survey of that district lately published by the Board of Agriculture, may be seen in *Plate* XXIX, in which *fig.* 1. is the ground plan of the building; *fig.* 2, section of it sideways; *fig.* 3, section of the same crossways; *fig.* 4, side elevation; *fig.* 5, end elevation; *fig.* 6, view of the building in which

A. Is the wheels fixed to the sides, 16 inches diameter.

B. The wheels with axle-tree to harness the horse to.

C. Weather boarded flaps hung with hinges, to turn up and button against the sides when it is removed.

D. Folding doors to open when the sheep are let in or out.

E. Fixed weather boarding.

G. Cover boarded windows to open on hinges sideways, in order to put fodder into the racks.

H. Racks to hold the fodder.

I. Canvas roof.

K. Open railing for air.

It is observed that "the length of the building is from 20 feet to any length; the width to be such as to enable the building to pass through the field gates; the weather boarding and flaps to be made as thin as possible, and covered with pitch."

How far the advantages of houses of this sort may compensate the expences of constructing and keeping them in repair, has not been fully shown; nor has perhaps a sufficient number of trials been made to show the benefit of confining sheep in covered houses or folds, or whether the economy of the animals is well suited to such a system. Some circumstances of advantage attending the practice of housing sheep have certainly been stated, but no satisfactory comparative experiments have, so far as we know, been made. And from the plan being little or not at all adopted in many extensive sheep districts, and in others where it once prevailed being either wholly in-

disuse or much on the decline, as is well known to be the case in Gloucestershire and the county of Hereford, there seems reason at least to presume that it is not so necessary or so well suited to the habits of the animal, nor even so beneficial as has been supposed by some writers on the subject. See *Sheep* and *Folding of Sheep.*

Sheep-*Hurdles*, the flakes or sort of fence gates which are set up so as to confine sheep in the time of folding, or while they are feeding down or upon any particular sort of food. They are of several different kinds, and either close or open; but the former are in general to be preferred as affording the most shelter. It is obvious that the number required to inclose a certain space must depend upon the length. See *Hurdle.*

Sheep-*Husbandry*, that sort of farm management which relates to or has sheep for its principal object. There are various modifications of this sort of farming, depending upon the differences in the circumstances of the lands, their nature and situations, as well as other local matters. See *Sheep.*

Sheep-*Lease*, a term applied to pasture land, appropriated to the feeding of sheep.

Sheep-*Pens*, the divisions made by the small moveable gates or hurdles which are set up, to keep sheep in some particular situation. They are usually formed on a dry place about the corners where different inclosures of the pasture kinds meet, so as to be convenient for the whole. They are useful in examining and selecting the sheep, being divided so as to contain about three dozen sheep each, as by this means they are always at the command of the shepherd for any purposes he may have in view. The bottoms should be firm and dry, so that the sheep may not be soiled.

Sheep-*Shearing*, the business of clipping or cutting off the coats or fleeces of sheep by means of shears constructed for the purpose, which are termed *wool shears.* It also signifies the season in which this sort of work is usually performed, which was formerly, and is even in some cases at present, a sort of festival.

In addition to what has been observed already on this subject, it may be stated that much improvement has taken place in this art, especially in the more southern districts of the kingdom, in making use of the mode of clipping round the sheep, which has gradually extended itself from the northern districts of the island; by which less wool is lost by being left upon the sheep, and the business performed in a more expeditious and convenient manner. It was much the practice formerly to clip lengthways of the sheep, and in some cases in many different directions, according to the convenience of the person who executed the work, by which means it was often ill done. And in Ireland Mr. Parkinson states that they "clip in short strokes, catching a bit of wool first in one place and then in another; and if they are not looked narrowly after, they will leave many parts, such as the heads, tails, and insides of the thighs, untouched."

We have in speaking of sheep noticed the most proper periods of performing this very important operation; and the following remarks by Mr. Price, an excellent sheep farmer in Kent, with the comments of Mr. Culley, as stated in the Annals of Agriculture, will show the proper mode of managing the sheep in the time of shearing, as well as the manner of executing the business with these sheep masters.

It is stated by the former that the "sheep shearing, in Romney Marsh, commences about Midsummer, and finishes about the middle of July. Those who shear first, think they escape the effects of the fly, and those that shear late, apprehend they gain half a pound weight in every fleece, by the increased perspiration of the sheep. In early shearing, the wool has not the condition which it afterwards acquires, but the hot weather occasions a good deal of trouble in detecting the fly.

"In order to begin, the large pen is filled with sheep ready for the coming of the shearers, in number from four to twelve, in proportion to the extent of the flock. The time employed, two to four days. The sheep are let into a small pen thirty or forty at a time, and when taken out to be sheared, all except three, more are put in, because one or two only left would be apt to jump out. A boy keeps the gate and the account of the number sheared, with small leaden tellers.

"These shearers by profession differ much as to quantity and method of performance; never begin early, but are satisfied with eight or ten hours shearing: a good shearer will shear ten an hour, a bad one, seven. Their emulation tends only to dispatch and profit, not excellence of performance, and the sheep are too often pulled about in a rude and barbarous manner, and even wounded by the shears, with cuts, of the length of three or four inches, and the wool left unevenly shorn: tar, or some ointment, is then applied carelessly by the boy, in order to keep off the flies. The master's office is usually to give the pitch mark, and when one field is finished, the sheep are returned, and others are in readiness to take their place.

"The common method of *catching* the sheep is by the hinder leg, drawing the animal backward to the adjacent shearing place; the hand holding the leg to be kept low, when at the place it is turned on its back. Or they are moved bodily, or one hand placed on the neck, and another behind, and in that manner walked along; the first or common mode he thinks the most safe. Sheep fed on rich pastures, and fleshy, if handled hard and bruised, the parts are liable to fatal mortifications; an accident which often happens, on which accounts pens upon some lands are obliged to be lined with woollen, or many would die from bruises.

"The price of shearing 18d. a score, with a dinner, or 1d. a sheep without victual. A good winder will wind 400 fleeces a day, at the same price per hundred as the shearer has per score.

"The method of shearing—the left side of the sheep to the shearer's left leg, his left foot at the root of the sheep's tail, and his left knee at the sheep's left shoulder. The process commences with the shears at the crown of the sheep's head, with a straight cut along

to the loins, returning to the shoulder, and making a circular shear around the off side to the middle of the belly; the off hinder leg next: then the left hand holding the tail, a circular shear of the rump to the near *huck* of the sheep's hind leg; the two fore feet are next taken in the left hand, the sheep raised, and the shears set in at the breast, when the remaining part of the belly is sheared round to the near stifle; lastly, the operator kneeling down on his right knee, and the sheep's neck being laid over his left thigh, he shears along the remaining side."

On these statements Mr. Culley has made the following practical comments, viz. that "Mr. Price's observation is just, in regard to the benefit arising to wool from being late clipped, and it is consonant with the opinions of the Lincolnshire graziers and breeders, who have paid more attention to the subject, and understand it better than any other of the profession in this island: but very great attention is required from the shepherd to keep the sheep, under the circumstances of late clipping, free from the fly and maggots, also from the danger of being *beaten* by small flies, which fasten on those parts where the points of the shears have made the smallest scratch." But that "in regard to shearing seven or ten sheep in an hour, nothing can be more absurd and improper than such attempts, since it is impossible for the best shearer to clip the lowest number within the time, and perform it well, as it ought to be done. Forty years ago, the same absurd practice prevailed, he says, in Durham, and particular men would clip 60 or 70 of that large breed in a day; but the consequence of such improvident haste was, that besides imperfect shearing, large pieces of skin were cut, particularly from the bellies of the sheep, which, being constantly pestered and tortured in those parts, by the flies throughout the summer, suffered much injury in their health and condition, some of them never recovering. Several sheep have died immediately after shearing, owing, perhaps, to having their legs tied, which, with hurrying and tossing them about, brought on a colic or cramp, putting a period to their existence in a moment. At that time, in a flock of 200 sheep, we seldom escaped without the loss of one or two in a season; since, in the clipping of 3000 and upwards annually, we have not lost one these seven years. But, says he, instead of *tying* their legs and *trying* who could clip the *most* per *hour* or *day* we have wisely began to *try* who could clip the *best*, and from that change of system, instead of clipping 50 sheep per day, we think it a fair day's work to clip 25 upon an average. Where sheep are clipped by the great, and the men paid for number done, 30 or upwards may be sheared in the day; but ours are done by the day without hurry, and scarcely wounding a sheep in the day. Each shearer makes his peculiar mark on the sheep, red or blue, that bad shearing may be detected; an useful stimulus to exertion."

And, he thinks that "the sheep may be caught by the hinder leg, above the hough, but *not* by *any means* drawn backwards; on the contrary, as soon as the catcher has caught the sheep by the hough, he should draw it backwards, until he can with his left hand, reach the throat, then with the right hand behind its tail, he conveys it along with ease and safety."

He thus continues: "thirty years ago, it was the general practice in this county (Northumberland), and some old fashioned bigoted people adhere to it still, to shear the sheep thus: the clipper first opened the belly, and then, after tying all the four legs, sat down upon a sack filled with straw, the sheep lying between his legs; when in the most awkward manner, he slashed and tore the fleece off, beginning at the neck, and going down the left side first, finishing at the right. In stead of clipping around the sheep, as at present, they then clipped them mostly lengthways.

"The present method is to begin at the back part of the head, in order to give room for the shears to make their way down the right side of the neck, to the open of the breast. The man then sits down upon his right knee, laying the head of the sheep over his left knee bent, and beginning at the breast, clips the underside of the throat upwards to the left cheek; then takes off the back of the neck, and all the way down below the left shoulder. He then changes to the contrary side, and makes his way down to the open of the right flank. This done, he returns to the breast, and takes off the belly, after which it matters not which side he clips, because being able to clip with either hand, he meets his shear points exactly at the middle of the back, all the way, until he arrive at the thighs or legs. He then places the sheep on its left side, and putting his right foot over the neck, and the other forward to the undermost hind leg, clears the right side; then turning the sheep over, finishes the whole.

"Our price for clipping used to be one shilling per dozen, and a gill of ale about ten o'clock, and another at four in the afternoon. He supposes a man will have 1*s.* 6*d.* per dozen now; but *we* clip all with our men, mostly the shepherds, many of whom now do it most admirably: and we have in general prevailed upon them to clip with either hand; which is not only the easiest for the clipper, but enables him to do his work in the neatest and most complete manner."

These remarks deserve the regard of the sheep farmers in other districts, as well as the following hint by Mr. Price.

"It is, says he, astonishing to see a good shearer handle a sheep; he studies its ease, and the sheep seems delighted in its situation."

This should always be the case with these animals, which are often much injured by coarse management. and the most sober steady men be constantly employed.

The writer of the "General Treatise on Cattle," states, that "the royal flocks of fine woolled sheep in Spain are sheared in the beginning of May. There are shearing houses, each of which will contain twenty thousand sheep; and cost in building above five thousand pounds sterling. To shear a flock of sixteen thousand sheep, requires one hundred and

twenty-five men, a man shearing twelve ewes, or eight rams, in a day. The sheep are sweated previously to being sheared, in a long narrow, low gut, called the sweating place, where they remain a night, crowded as close together as the shepherd can keep them. The shorn sheep are permitted to go to pasture if the weather be fine, returning home in the evening, to pass the night within shelter of the walls or in the house, if cold or cloudy: they are so brought by degrees to endure the open air."

It is a point of great consequence in this business to have a person well conversant with the winding of the wool, in order that it may be well performed and look in a proper manner to the buyer.

SHEEPS-*Trotters*, a refuse material procured from fellmongers, which is made use of in some places as a manure to be turned into the land. They are bought at about 6d. the bushel, loosely heaped, in some places, and cost about 2d. more in carriage, being used in the proportion of from 20 to 40 bushels the acre, being afterwards pricked in to prevent their being eaten by dogs, crows, &c. They answer best on such lands as are rather dry, and where the season is rather moist. They contain a large proportion of lime, and are often adulterated by being mixed with sand, as well as oak sawdust; which last is said not to injure them. Furriers' cuttings are nearly the same, and made use of in a similar manner.

SHEER, a term used to signify pure, clean, unmixed.

SHELL, a term applied to a hard, and as it were stony covering, with which certain animals are defended, and thence called shell-fish. It is observed, that the vast beds of fossil shells found at great depths in the earth, as well as those found lying on the sea-shore, make an excellent manure for cold clayed lands. See *Sand* and *Clay*.

It is likewise a term applied to the light calcined pieces of calcareous stones which have been converted into lime; and also to the rind of turnips scooped by sheep. See *Lime*.

SHELL-*Toothed*, in *Horsemanship*, one that from four years to old age, naturally, and without any artifice, bears a mark in all his fore teeth, and there still keeps that hollow place with a black mark, which is called the eye of a bean, insomuch that at twelve or fifteen he appears with the mark of a horse that is not yet six

For in the nippers of other horses, the hollow place, is filled, and the mark disappears towards the sixth year, by reason of the wearing of the teeth.

About the same age it is half worn out in the middling teeth, and towards the eighth year it disappears in the corner teeth; but after a shell-toothed horse is marked, he marks still equally in the nippers, the middle and the corner teeth: which proceeds from this, that having harder teeth than the other horses, his teeth do not wear, and so he does not lose the black spot. It is remarked, that amongst the Polish, Hungarian and Croatian horses, a great many hollow toothed ones are found, and generally the mares are more apt to be such than the horses.

SHELL-*Marle*, a substance of the marley kind. Though Mr. Marshall has not seen this material made use of in any of the southern parts of this country, he supposes it highly probable that, in the more northern counties, it may be found in quantity; and that in different parts of Scotland, it is in common use, as a manure.

And he considers it as "usually found in low moist situations, under what is termed bog meadow, a sort of half-reclaimed morass; namely, tough coarse sward formed upon a depth of black moory earth, which rests on the marl: this being, in some instances, several feet in depth." In respect to appearance, "the colour is nearly white. Its consistence, in the pit, is that of soft curd, roughly broken: with the perceptible remains of small shells interspersed among it; and generally with some portion of earthy particles." It was found "by analysis, that one hundred grains of a specimen taken in 1793, from the extraordinary pits on the estate of Auchtertyre, belonging to the late Sir William Murray, on the southern skirts of the highlands of Perthshire, yielded eighty-two grains of calcareous earth: the residue being brown earthy matter, mostly, it is probable, animal mould, with a slight intermixture of vegetable fibres. One hundred grains, taken from a pit in Strath Tay, within the central highlands, yielded seventy-four grains of chalk; the residue being similar to the above. The search for this species of marl is, says he, so obvious and easy, that nothing but unpardonable neglect can suffer a quantity of it to remain within an estate (situated in a country where it is known to abound) unknown to its manager. Wherever, in vallies and dips of surface, level water-formed lands, (whether they are already swarded over, or yet remain in a state of morass) are found, there insert the borer: not in one place, only: but, in various parts of it; that no hollow receptacle of marl may be missed" by the farmer.

And with marls of the fossil kinds, it is remarked, that where by analysis, the proportion of chalk be found to be small, as not more than one third of the whole; if the earthy matter with which it is combined, appears to be of a rich fertilizing nature, such marl becomes, he thinks, a proper subject of trial in the field.

And a good method for making this sort of trial, is "to spread the marl, at a leisure time, as in winter, or the early part of summer, upon grass land; and, catching a favourable opportunity, when the fossil is in a mellow friable state, between wet and dry, to break down and spread the lumps, with the roller and harrow; to give freedom to the grass, and an opportunity of gathering off the stones and rubbish which may have been carried on with the marl; and in order that summer showers may wash the finer parts of it down into the soil, while it is open to receive them; repeating the operation, as often as it may be required. And he knows no better method, than this, by which to apply marls, on a large scale, in practice."

SHELL-*Sand*. See *Sand*.

SHELVINGS, a name applied to the moveable side rails of a waggon or cart, which are occasionally put on for top loads.

SHEPPECK, the provincial name of a prong or hay fork.

SHEPHERD, the person who has the care and management of a flock of sheep. Mr. Bannister says, that it is necessary to have for this employment "a person who is well skilled in the nature and management of sheep, and hath been brought up in that employment from his infancy; who is sober, diligent, and good natured; qualities essentially necessary in a shepherd, who although he may seem to lead a life of indolence, when contrasted with the more laborious servants on the farm, need rarely to have a minute's time hang heavily on his hands, if he will be attentive to his business, which will furnish him with sufficient employment throughout the day, particularly in the lambing season, or where there are two folds at work; nor will he want opportunity for the exercise of his patience and good temper in his attendance on the sheep, which is by nature an animal of great obstinacy and perverseness, and hath often paid the forfeit of its life to these innate qualities, where the shepherd was a man of a morose and surly disposition."

It is stated, that "on the continent they have schools wherein young shepherds are instructed in the necessary knowledge of their business, as well as the anatomy and physiology of sheep, the food and treatment proper for them, in different seasons, and the nature of their diseases, and the common operations respecting them, especially regarding the parturition of the ewes."

The author of the General Treatise on Cattle, remarks that "the method of encouragement, adopted in some districts, of allowing the shepherd to possess a small flock, or as many ewes as his means will allow, is probably one of the most powerful. It gives him, he says, a steadiness appertaining to property, and is an additional and strong incentive to the attainment of knowledge in his business. A shepherd should be naturally active, both in body and mind, clear headed and clear sighted; such an one, for instance, who can distinguish the individual countenances of a numerous flock, and running over them with his bodily and mental eye, instantly give the exact number and condition; or perceive, at a glance, a bird's nest in the thickest quickset. Fond of animals and attractive to them, (the latter quality is well known naturally to inhere in some persons) possessing a musical voice and shrill whistle; hardy, patient, watchful, satisfied with little sleep, and temperate in drink. He thinks he ought never to be suffered, if he profess, to practise physic, nor any but the most easy and common operations, a farce that too often ends in a tragedy; for if of two evils we ought to choose the least, the office of medical practice had better devolve on the master." And for "his comfort in the severe weather, in some situations, the moveable wooden house on wheels may be of use. He adds, that "he ought to be clad during winter, with substantial woollen next his skin, from his feet upwards, as the best defence against those rheumatic ails to which he must be necessarily subject; and he should always go provided with the instruments proper to his profession, ready for immediate occasions; namely, scissars, knife, steel, fleam, salve-box, &c."

And in folding, "as the shepherd will have the flock perpetually under his eye, the first writer says, he will be capable of judging with certainty and precision respecting the state of every individual, so that the earliest remedy may be applied to every disorder, and such sheep may be turned out of the fold which are found not to be able to go through their work without manifest injury to their health; and if a sheep or lamb be seized with a dangerous and incurable malady, to kill and dress it immediately; for it is one part of the business of a shepherd to be so far skilled in the butcher's trade, as to be able to slaughter, flea, and dress a sheep on occasion." And that "a good shepherd will be careful that his flock be driven late to fold of an evening, and released early in the morning from their confinement, in order that they may enjoy the coolest parts of the day on the food. He will be cautious that they are allowed a sufficient time to graze in the uplands previous to their being driven into the fold, that they may retire to rest with full bellies, by which the quantity of dung and urine will be considerably augmented. He will likewise be careful in reviewing the hurdles, and provide that these are fixed tight in the ground, lest by any accident they should be thrown down during the night, and the flock by these means get into mischief, or intermix with other sheep; he will count his sheep regularly every evening when he drives them to fold, and take a fresh tale in the morning when he turns them on their feed; he will, previous to dismissing them from the fold, worry them gently round the same, in order to cause them to dung and stale plentifully, that the manure may be left in the field, otherwise the greatest part of the trundles will be dropt on the road, or carried on to the marsh, where lying thin, this dressing can do but little service, and where in truth it is not wanted; he will bestow a particular attention on every individual in his flock, and for those which show any appearance of being stung by the fly, he will be prepared with a pair of shears to clip away the wool from the part, and having taken out the maggots, will anoint the place with a mixture of train oil and brimstone; but if slightly attacked, he will destroy the maggots by strewing on them powder of white lead; and if any of the flock should haply break with the scab, a disorder to which folding sheep are continually subject, and which seldom fails to shew itself in the spring and fall, he will be provided with a proper remedy to keep it under, and prevent the contagion from spreading." See *Scab*.

Mr. Bannister thinks, that one shepherd will be able to look after three hundred sheep.

It is observed by Mr. Lawrence, in respect to the "necessity of a dog, as an assistant to the shepherd, that it has of late very rationally become a question among the most intelligent sheep masters: it may probably, he thinks, be thus settled—there can be no occasion of any such aid, nor any necessity for in-

curring the danger of it, amidst convenient enclosures, or where quiet breeds of sheep are kept, and where it is made an object to render them tame and docile: and if upon extensive wastes and mountain districts, the service of dogs cannot well be dispensed with, it ought to be made a main point, that they be trained early to a kindness for the sheep, and to view them rather as their companions, than their prey; a thing which he knows by experience to be most easy; and he also knows that such dogs are infinitely of the greater use, as the sheep, far from dreading or shunning, will run to them, in case of need, for protection; and he has often witnessed the caresses and gambols of these and the lambs, with a delight which he never experienced in the combats of animals."

SHEPHERD'S-*Needle*, a plant of the weed kind, so called from the remarkable shape of the seeds.

SHERLING *of Lambs*, a term applied in the northern districts to the shearing or clipping the pure short wool of lambs. It is singular, that this beneficial practice is almost wholly in disuse in the lambs brought to Smithfield market.

SHETLAND-*Sheep*, a breed of fine woolled sheep peculiar to the Shetland Islands. See *Sheep*.

SHIFTS, such parts of a farm as are allotted for the reception of either stock or crops. It is also a term applied to the rotations of cropping lands; thus we have three, four, five, and six coarse shifts. See *Rotation of Crops*.

SHILL, provincially to separate the rind, husk, or skin, as of oats. It also signifies the turning a small portion of milk into curd.

SHIM, a tool of the tillage kind, used in breaking down and reducing the more stiff and heavy sorts of land, as well as cutting up and clearing them from weeds. They are made in different forms and constructions to suit different purposes.

In the Hertford Survey by the Board of Agriculture, the writer remarks that a tool of this kind is in use by Mr. Calvert, of Albury, which differs from those usually employed. It is represented at *fig.* 8, in *Plate* XXVII, in which A is the chair, and B the cutting iron or plate, which for the work it is adapted for, as that of cutting up weeds on two-bout or four-furrow Essex ridges, or of cleaning land without ploughing or burying the soil, is a small segment of a large circle. It dispatches a ridge at a time, and is an implement that performs its business well, and which deserves the notice of the tillage farmer. It is readily altered for flat work, and is said to be had recourse to by other farmers with success.

An useful tool of this sort has also been recommended by Mr. Young, in his Annals, the hint of which he took from the Berkshire one, and to which the beam and block is capable of being applied. In a wide interval, the three shares may be worked on a level. Between the rows of cabbages, after earthing up, the two external shares may be set to cut the weeds that are apt to rise on the sides of the ridges, without disturbing too much earth, and the centre share sunk to scrape the bottom of the furrow. The centre one may also be worked alone between narrow rows. In forging the shares of all shims, he has well observed, that the blacksmith should be careful to give them tendency enough *into* the ground, by bending them downwards: for want of this caution, he has found many of them to work badly; the wheel in the beam counteracts this tendency sufficiently when at work.

SHINGLE, a term sometimes applied to the thinnings of fir and other timber trees in the northern districts.

SHOE *of the Horse*, in *Farriery*, the crooked piece of iron attached to the hoof of the horse by means of nails. There are various forms and shapes of shoes in common use, and others which are adapted and accommodated to the particular purposes and circumstances of the hoofs. Different sorts of animals likewise require different forms in their shoes.

At *figs.* 1 and 2, in *Plate* XXX, are shewn the forms of shoes employed by Mr. Clark. At *figs.* 3 and 4, those recommended by Mr. St. Bel. At *figs.* 5 and 6, those advised by Mr. Taplin. And at *fig.* 7 is a representation of Mr. Moorcroft's. *Figs.* 8 and 9, also shew those in use by Mr Coleman. *Fig.* 10 is a short shoe. *Figs.* 11 and 12 represent different sorts of patent shoes. *Fig.* 13 is the bar shoe; and *fig.* 14 the hinge shoe. *Fig.* 15, a mule's shoe for the fore foot; and *fig.* 16, ditto for the hind foot.

In speaking of the shoe which is *concave* on its *lower surface*, Mr. St. Bel remarks that "there are certain proportions to be observed in its different parts. Its breadth should be considerably less than the breadth of the common shoe; it is totally unnecessary to cover any part of the sole, especially when care is taken to preserve its natural hardness. The breadth of the shoe at the heels should be one half of its breadth at the toe. Its thickness should decrease gradually from the toe, so as to be reduced one half at the extremity of the heels. As to the distribution of the stamp holes, every farrier knows that in shoes for the fore feet they should be at the toe, and quarters, because the wall, or crust, of the fore feet is stronger at the toe than at the heels. The reverse of this is to be observed in the hind shoes, because the heels and quarters of the hind feet are commonly stronger than the toe. It is impossible to lay down any general rule for disposing of these holes in bad feet; it must be the business of the farrier to distribute them in such a manner, as to be able to fix the nails in those parts of the crust where the horn is sound and firm. Farriers generally multiply these stamp holes too much, which brings the nails too close together, occasions the horn to break in splinters, and at length destroys the crust.

"He would recommend the following number for good feet, viz. for race horses, six; that is three on each side: for saddle horses, seven; four on the outside and three within, the quarter on this side being weaker than on the other: the same number for

coach horses of the middling size; for large coach horses, four on each side; and for cart horses, five on the out and four on the inside.

"It is also, he says, of principal importance to determine the *weight of the shoe*, for it is matter of astonishment to see some horses with shoes weighing each five pounds, making together, a burden of twenty pounds of iron attached to their four feet. It is obvious to common sense, that such an additional weight fixed to the extremity of the leg, must be productive of some inconvenience or other; and, in fact, the muscles are thereby compelled to greater exertion; the ligaments are stretched, and the articulations continually fatigued: and besides all these evil consequences, the shoe by its weight forces out the nails, and so entirely spoils the texture of the wall or crust, that it becomes often extremely difficult to fix the shoe to the hoof. Why then, he asks, do not practitioners of the present day, who are daily witnesses of these facts, and are indeed the principal authors of them, apply themselves to the correction of their own errors? The answer, he fears, is obvious; because he who is uneducated and destitute of sound principles in his art, cannot turn to real profit the experience he has acquired, nor abandon the path of prejudice and custom in which he has so long journied, but satisfies himself with continuing to imitate and repeat whatever he has seen done by others.

"The weight which he proposes for shoes of different kinds, is nearly as follows:

	lb.	*oz.*
1. For the strongest sort of cart horses -	2	12
2. For the smaller horses of this kind -	1	12
3. For the largest coach horses - -	1	12
4. For the smaller ditto - - -	1	4
5. For saddle horses of any height	1*lb.* 2*oz.* to	10
6. For race horses - - .	0 4 to	5

"By reducing the superfluous breadths of these shoes, their thickness may be increased without making any addition to their weight." See *Shoeing*.

Shoes *of Cattle*. The plates of iron that are fastened upon the feet of oxen or other cattle employed in field or road labour. A shoe of this sort is shown at *fig.* 17, in *Plate* XXX. It consists, according to Mr. Clark, of a flat piece of iron, with five or six stamp holes on the outward edge to receive the nails; at the toe is a projection of some inches, which passing in the cleft of the foot, is bent over the hoof, so as to keep the shoe in its proper place. This projection is not, however, employed in the general practice of making these shoes. See *Shoeing of Oxen*.

SHOEING, a term applied to the operation of fastening a piece of iron on the bottom part of the hoofs of horses.

Shoeing, in *Horsemanship*, the operation of fixing shoes to the feet of horses. These, and some other animals destined to labour, are shod with iron, in order to defend and preserve their hoofs. The shoes of horses should differ according to the feet. In a work on this subject by Mr. Clark of Edinburgh, the common form of shoes and the method of shoeing are wholly condemned, and a new method recommended, which appears founded on just principles, and to have been sanctioned by much experience. It is remarked that in "preparing the foot for the shoe according to the common method, the frog, the sole, and the bars or binders, are pared so much that the blood frequently appears. The common shoe by its form (being thick on the inside of the rim, and thin upon the outside), must of consequence be made concave or hollow on that side which is placed immediately next the foot, in order to prevent its resting upon the sole. The shoes are generally of an immoderate weight and length, and every means is used to prevent the frog from resting upon the ground, by making the shoe heels thick, broad, and strong, or raising cramps or caukers on them.

"From this form of the shoe, and from this method of treating the hoof, the frog is, says he, raised to a considerable height above the ground, the heels are deprived of that substance which was provided by nature to keep the crust extended at a proper wideness, and the foot is fixed as it were in a vice." And "by the pressure from the weight of the body, and resistance from the outer edges of the shoe, the heels are forced together, and retain that shape impressed upon them, which it is impossible ever afterwards to remove; hence a contraction of the heels, and of course lameness. But farther—The heels, as has been observed, being forced together, the crust presses upon the processes of the coffin and extremities of the nut-bone: the frog is confined, and raised so far from the ground, that it cannot have that support upon it which it ought to have: the circulation of the blood is impeded, and a wasting of the frog, and frequently of the whole foot, ensues. Hence, he contends, proceed all those diseases of the feet known by the names of founder, hoof-bound, narrow-heels, thrushes, corns, high soles, &c."

And he "has likewise frequently observed, from this compression of the internal parts of the foot, a swelling of the legs immediately above the hoof, attended with great pain and inflammation, with a discharge of thin, ichorous, fetid matter: from which symptoms, it is often concluded that the horse is in a bad habit of body (or what is termed a grease falling down), and must therefore undergo a course of medicine, &c." And "the bad effects of this practice are, he says, still more obvious upon the external parts of the hoof. The crust toward the toe, being the only part of the hoof free from compression, enjoys a free circulation of that fluid necessary for its nourishment, and grows broader and longer; from which extraordinary length of toe, the horse stumbles in his going, and cuts his legs. The smaller particles of sand insinuate themselves between the shoe and the heels, which grind them away, and thereby produce lameness. All this is entirely owing to the great spring the heels of the horse must unavoidably have upon the heels of a shoe made in this form. This concave shoe in time wears thin at the toe, and, yielding to the pressure made upon it, is forced wider, and of consequence breaks off all that part of the crust on the outside of the nails. Instances of this kind

daily occur, insomuch that there hardly remains crust sufficient to fix a shoe upon."

He adds that "it is generally thought, that the broader a shoe is, and the more it covers the sole and frog, a horse will travel the better. But, as has been remarked, the broader a shoe is of this form, it must be made the more concave; and, of consequence, the contracting power upon the heels must be the greater. It is likewise to be observed, that, by using strong bread-rimmed concave shoes in the summer-season, when the weather is hot and the roads very dry and hard, if a horse is obliged to go fast, the shoes, by repeated strokes (or friction) against the ground, acquire a great degree of heat, which is communicated to the internal parts of the foot; and, together with the contraction upon the heels occasioned by the form of the shoe, must certainly cause exquisite pain. This is frequently succeeded by a violent inflammation in the internal parts of the hoof, and is the cause of that disease in the feet so fatal to the very best of our horses, commonly termed a founder. This is also the reason why horses, after a journey or a hard ride, are observed to shift their feet so frequently, and to lie down much." And "if we attend further to the convex surface of this shoe, and the convexity of the pavement upon which horses walk, it will then be evident that it is impossible for them to keep their feet from slipping in this form of shoe, especially upon declivities of the streets. It is also a common practice, especially in this place, to turn up the heels of the shoes into what are called cramps or caukers, by which means the weight of the horse is confined to a very narrow surface, viz. the inner round edge of the shoe-rim and the points or caukers of each heel, which soon wear round and blunt; besides, they for the most part are made by far too thick and long. The consequence is, that it throws the horse forward upon the toes, and is apt to make him slip and stumble. To this cause we must likewise ascribe the frequent and sudden lameness horses are subject to in the legs, by twisting the ligaments of the joints, tendons, &c." He "does not affirm that caukers are always hurtful, and ought to be laid aside: on the contrary, he grants that they, or some such-like contrivance, are extremely necessary, and may be used with advantage upon flat shoes where the ground is slippery; but they should be made thinner and sharper than those commonly used, so as to sink into the ground, otherwise they will rather be hurtful than of any advantage."

He remarks that "the Chinese are said to account a small foot an ornament in their women; and for that purpose, when young, their feet are confined in small shoes. This no doubt produces the desired effect; but must necessarily be very prejudicial to them in walking, and apt to render them entirely lame. This practice, however, says he, very much resembles our manner of shoeing horses; for, if we looked upon it as an advantage to them to have long feet, with narrow low heels, and supposing we observed no inconvenience to attend it, or bad consequence to follow it, we could not possibly use a more effectual means to bring it about than by following the method already described." He thinks that "in shoeing a horse, therefore, we should in this, as in every other case, study to follow nature: and certainly that shoe which is made of such a form as to resemble, as near as possible, the natural tread and shape of the foot, must be preferable to any other. But it is extremely difficult, he says, to lay down fixed rules with respect to the proper method to be observed in treating the hoofs of different horses: it is equally difficult to lay down any certain rule for determining the precise form to be given their shoes. This will be obvious to every judicious practitioner, from the various constructions of their feet, from disease, and from other causes that may occur; so that a great deal must depend upon the discretion and judgment of the operator, in proportioning the shoe to the foot, by imitating the natural tread, to prevent the hoof from contracting a bad shape.

"In order, therefore, says he, to give some general idea of what may be thought most necessary in this matter, I shall endeavour to describe that form of shoe and method of treating the hoofs of horses, which, from experience, I have found most beneficial." And in this "it is to be remembered," says he, "that a horse's shoe ought by no means to rest upon the sole, otherwise it will occasion lameness; therefore it must rest entirely on the crust: and, in order that we may imitate the natural tread of the foot, the shoe must be made flat (if the height of the sole does not forbid it); it must be of an equal thickness all around the outside of the rim; and on that part of it which is to be placed immmediately next the foot, a narrow rim or margin is to be formed, not exceeding the breadth of the crust upon which it is to rest, with the nail-holes placed exactly in the middle, and from this narrow rim the shoe is to be made gradually thinner towards its inner edge" as seen at *fig.* 1 and 2 in the annexed plate.

And he adds, that "the breadth of the shoe is to be regulated by the size of the foot, and the work to which the horse is accustomed: but, in general, it should be made rather broad at the toe, and narrow towards the extremity of each heel, in order to let the frog rest with freedom upon the ground. The necessity of this has been already shewn. The shoe being thus formed and shaped like the foot, the surface of the crust is to be made smooth, and the shoe fixed on with eight or at most ten nails, the heads of which should be sunk into the holes, so as to be equal with the surface of the shoe. The sole, frog, and bars, as he has already observed, should never be pared, farther than taking off what is ragged from the frog, and any excrescences or inequalities from the sole. And Mr. Osmer has remarked, he says, that the shoe should be made so as to stand a little wider at the extremity of each heel than the foot itself: otherwise, as the foot grows in length, the heel of the shoe in a short time gets within the heel of the horse; which pressure often breaks the crust, and produces a temporary lameness, perhaps a corn." But "this method of shoeing horses he has, he says, followed long before Mr. Osmer's treatise on that subject was published; and for these several years

past he has endeavoured to introduce it into practice. But so much are farriers, grooms, &c. prejudiced in favour of the common method of shoeing and paring out the feet, that it is with difficulty they can even be prevailed upon to make a proper trial of it. They cannot be satisfied unless the frog be finely shaped, the sole pared, and the bars cut out, in order to make the heels appear wide. This practice gives them a show of wideness for the time; yet that, together with the concave form of the shoe, forwards the contraction of the heels, which, when confirmed, renders the animal lame for life."

He contends that "in this flat form of shoe, its thickest part is upon the outside of the rim, where it is most exposed to be worn; and being made gradually thinner towards its inner edge, it is therefore much lighter than the common concave shoe; yet it will last equally as long, and with more advantage to the hoof; and as the frog or heel is allowed to rest upon the ground, the foot enjoys the same points of support as in its natural state. It must therefore, he supposes, be much easier for the horse in his way of going, and be a means of making him surer-footed. It is likewise evident, that, from this shoe, the hoof cannot acquire any bad form; when, at the same time, it receives every advantage that possibly could be expected from shoeing. In this respect it may very properly be said, that we make the shoe to the foot, and not the foot to the shoe; as is but too much the case in the concave shoes, where the foot very much resembles that of a cat's fixed into a walnut-shell."

He adds that "it is to be observed, that the hoofs of young horses, before they are shod, for the most part are wide and open at the heels, and that the crust is sufficiently thick and strong to admit of the nails being fixed very near the extremities of each. But, as he has formerly remarked, from the constant use of concave shoes, the crust of this part of the foot grows thinner and weaker; and when the nails are fixed too far back, especially upon the inside, the horse becomes lame: to avoid this, they are placed more towards the fore-part of the hoof. This causes the heels of the horse to have the greater spring upon the heels of the shoe, which is so very detrimental as to occasion lameness; whereas, by using this flat form of shoe, all these inconveniences are avoided; and if the hoofs of young horses, from the first time that they were shod, were continued to be constantly treated according to the method here recommended, the heels would always retain their natural strength and shape. By following this flat method of shoeing, and manner of treating the hoofs, several horses now under his care, that were formerly tender-footed, and frequently lame, while shod with broad concave shoes, are now quite sound, and their hoofs in as good condition as when the first shoes were put upon them." He thinks that "if farriers considered attentively the design of shoeing horses, and would take pains to make themselves acquainted with the anatomical structure of the foot, they would then be convinced, that this method of treating the hoofs, and this form of shoe, is preferable to that which is so generally practised." But "it has been alledged, that in this form of shoe, horses do not go so well as in that commonly used. This objection will easily be set aside, by attending to the following particulars: There are but few farriers that can or will endeavour to make this sort of shoe as it ought to be. The iron, in forming it, does not so easily turn into the circular shape necessary as in the common shoe; and perhaps this is the principal reason why they object to it, especially where they work much by the piece. And as many horses that are commonly shod with concave shoes have their soles considerably higher than the crust, if the shoe is not properly formed, or if it is made too flat, it must unavoidably rest upon the sole, and occasion lameness."

It is further stated that "the practice of paring the sole and frog is also so prevalent, and thought so absolutely necessary, that it is indiscriminately practised, even to excess, on all kinds of feet: and while this method continues to be followed, it cannot be expected that horses can go upon hard ground (on this open shoe) with that freedom they would do if their soles and frogs were allowed to remain in their full natural strength. Experience teaches us, says he, that, in very thin-soled shoes, we feel an acute pain from every sharp-pointed stone we happen to tread upon. Horses are sensible of the same thing in their feet, when their soles, &c. are pared too thin. Hence they who are prejudiced against this method, without ever reflecting upon the thin state of the sole, &c. are apt to condemn it, and draw their conclusions more from outward appearances than from any reasoning or knowledge of the structure of the parts. From a due attention likewise to the structure of a horse's foot in a natural state, it will be obvious, that paring away the sole, frog, &c. must be hurtful, and in reality is destroying that substance provided by nature for the defence of the internal parts of the foot: from such practice it must be more liable to accidents from hard bodies, such as sharp stones, nails, glass, &c. From this consideration we shall likewise find, that a narrow piece of iron, adapted to the shape and size of the foot, is the only thing necessary to protect the crust from breaking or wearing away; the sole, &c. requiring no defence if never pared." But "there is one observation he would farther make; which is, that the shoe should be made of good iron, well worked, or what smiths call hammer-hardened, that is, beaten all over lightly with a hammer when almost cold."

"It is well known, he says, that heating of iron till it is red softens it greatly; and when the shoes thus softened are put upon horses' feet, they wear away like lead. But when the shoes are well hammered, the iron becomes more compact, firm, and hard; so that a well-hammered shoe, though made considerably lighter, yet will last as long as one that is made heavier; the advantage of which is obvious, as the horse will move his feet with more ac-

tivity, and be in less danger of cutting his legs. The common concave shoes are very faulty in this respect: for, in fitting or shaping them to the foot, they require to be frequently heated, in order to make them bend to the unequal surface which the hoof acquires from the constant use of these shoes: they thereby become soft; and to attempt to harden them by beating or hammering when they are shaped to the foot would undo the whole. But flat shoes, by making them, when heated, a little narrower than the foot, will, by means of hammering, become wider, and acquire a degree of elasticity and firmness which it is necessary they should have, but impossible to be given them by any other means whatever; so that any farrier, from practice, will soon be able to judge, from the quality of the iron, how much a shoe, in fitting it to the circumference of the hoof, will stretch by hammering when it is almost cold: this operation, in fitting flat shoes, will be the less difficult, especially when it is considered, that as there are no inequalities on the surface of the hoof (or at least ought not to be) which require to be bended thereto, shoes of this kind only require to be made smooth and flat; hence they will press equally upon the circumference or crust of the hoof, which is the natural tread of a horse." And a preference has lately been given by Mr. Moorcroft, to this kind of shoe, which he calls the "*seated shoe*," and which he has formed in a die, in the same manner as money is struck in coining. The figure of his shoe is seen in the plate. "The upper surface of this shoe, says he, consists of two parts: an outer part, which is a perfect plane near the rim, corresponding with the breadth of the crust, and called the *seat;* and an inner part, sloping from the seat, and distinguished by the name of the *bevel.*

"The seat is obviously intended to support the crust in its whole extent, the bevel to lie off the sole; and this part being more or less broad, according to the kind of work proposed to be done, will give the requisite strength to the shoe. As the whole of the crust bears on the seat, it is less liable to be broken than when only a small part of it rests on the shoe. In consequence, likewise, of the crust resting on the flat seat, the weight of the body has a tendency to spread the foot wider in every direction, rather than to contract it, as has been observed to happen with the common shoe: and it has in fact been found in various instances, that a foot contracted by the common shoe, and afterwards shod with the seated one, has become wider without the horse having been taken from his usual work; and again, that a foot being of a full size and proper form when first shod with the seated shoe, has retained the same size and form without the slightest alteration, as long as the seated shoe was used. By the slope or bevel in the shoe, a cavity is formed between it and the sole, sufficient to admit a picker, and to prevent pressure on this part, without the sole itself being hollowed, and consequently weakened.

"For if, says he, it be one of the functions of the horny sole to defend the sensible sole, of which, from its situation and nature, no one can doubt, it must be evident, that the more perfect it is left, the stronger it must necessarily be, and of course the more competent to perform its office. And that though he is not sanguine enough to suppose, that this shoe will prevent lameness in every case, he is nevertheless warranted by experience to assert, that it will diminish its frequency."

Some strong objections have however been made to this form of shoe by Mr. Coleman. If, says he, "it should be found, where the shoe is applied, that the sole very frequently receives pressure, then we shall demonstrate that the practice is incompatible with the principle. If it be good practice for the sole to receive pressure, then the principle must be erroneous that attempts to make the shoe rest totally on the crust: and if the principle be well founded for the crust only to support the shoe, then, if the sole be in contact with the shoe, the practice must be imperfect. Except a model be taken of every horse's foot, it is impossible for the resting place of the shoe precisely to fit the crust; for the crust not only varies exceedingly in different horses, but in the same hoof at different parts. The flat surface therefore, that is only broad enough for the toe, is frequently too broad for the quarters and heels. And in all the shoes he has ever seen of this description, the flat part of the shoe is made of the same breadth at the quarters as at the toe. It is farther to be observed, he says, that this surface very generally exceeds the crust at every part. In the same proportion as the seat of the shoe exceeds the breadth of crust, exactly so much of a flat surface is opposed to an equal quantity of sole. The principle of this shoe is therefore defeated by the practice; for, instead of the seat resting on the crust, it projects over the edge of the sole. It is therefore a fact, that while great pains have been taken to make a flat seat on the shoe, in order to support the crust only, and the web concave, in order to remove pressure from every part of the sole, that the seat has, nevertheless; very rarely fitted the crust: and consequently the soles of all flat feet, at their connection with the crust, must receive more or less of pressure from the seat of the shoe. Where the sole is concave, this shoe will only rest on the crust: but a shoe that is flat on its whole internal surface would answer the same purpose; for the concave part of the sole opposite to the concavity of the web of the shoe would receive no pressure even from a shoe wholly flat." He therefore recommends a shoe which has been found free from these and other objections, and which indeed bids fair to supersede the use of every other kind. But before this is noticed, it may be necessary to mention cursorily the shoes proposed by Mr. St. Bel, and Mr. Taplin; but in fact the changes they have introduced are rather novelties than improvements, as may be seen by the plate.

Mr. St. Bel has indeed committed a great error, that of promoting the arched form of the horse's foot, and thus raising the frog out of the way of pressure, a practice highly injurious to the animal.

It is observed in respect to Mr. St. Bel's mode of shoeing, by Mr. Coleman, that he "employed a shoe with a flat upper surface; but, from not attending to the very important operation of removing the sole under the heels of the shoe, to every kind of hoof, it frequently failed of success. But that the best form for the external surface of the shoe is *a regular concavity*; that is, the common shoe *reversed*. This shoe leaves, he says, the hoof of the same figure when shod, as before its application. And it is evident, that a concavity has more points of contact with pavement and other convex bodies than a flat or convex surface, and that the horse is consequently more secure on his legs. A shoe that is flat externally, may preserve the hoof equally well in health; but this form is not so well calculated to prevent the horse from slipping as a concavity."

In explaining the principles and practice of shoeing, he says, "there are two circumstances necessary to be attended to, viz. to cut the hoof and apply the shoe. Before the hoof is protected by iron, some parts require to be removed, and others preserved. This is even of more importance than the form of the shoe. But many have attended chiefly to the shoe, and not to its application, or to the hoof; and this error has produced more mischief, and more enemies to the Veterinary College than all the prejudices and calumnies of grooms and farriers. "The first thing, says he, to be attended to, is to take away a portion of the sole between the whole length of the bars and crust, with a drawing knife; for the heels of the sole cannot receive pressure without corns. To avoid this, the sole should be made concave, so as not to be in contact with the shoe. If there be any one part of the practice of shoeing more important than the rest, it is this removal of the sole, between the bars and crust. When this is done, the horse will always be free from corns, whatever may be the form of the shoe. "Besides this, the heels of the shoe should be made to rest on the junction of the bars with the crust: whereas, if the bars are removed, the shoe is supported by the crust only, and not by the solid broad basis of crust and bars united."

And he adds, that "it is necessary that the sole should be cut before any other part of the hoof be removed. If the heels have been first lowered by the butteris, then possibly there may not be sufficient sole left to enable a drawing knife to be applied, without reaching the sensible sole; whereas, by cutting the sole in the first instance, we can determine on the propriety of lowering the heels and shortening the toe, The sole can then descend, without the motion being obstructed by the shoe; and any foreign bodies that may have got into this cavity are always forced out when the sole descends, without producing any mischief. When the shoe is applied, the cavity between the sole and shoe should, he says, be sufficiently large, at every part, to admit a large horse picker, and particularly between the bars and crust. If the sole is naturally concave, a shoe with a flat surface applied to the crust will not touch any part of the sole; and if the sole be flat, or even convex in the middle, or towards the toe, the quarters and heels of the sole will generally admit of being made concave with a drawing knife, so as not to receive any pressure from a flat shoe. If a shoe with a flat upper surface does not leave ample space for a picker, between the sole and shoe, then it is requisite to make either the sole or the shoe concave. When the sole appears in flakes, and thick in substance, it will be better to make the whole of the sole concave by a drawing knife; and this operation should always be performed before the toe is shortened or the heels lowered. When we have made the sole hollow, then a shoe with a flat surface will rest only on the crust: but if the sole be flat, or convex, and thin towards the toe and middle of the hoof, so as to prevent the possibility of removing the sole at these parts, to form a concavity, then it is necessary to employ a shoe sufficiently concave to avoid pressure, and to admit a picker. In this case, however, the sole at the heels and quarters, even in convex feet, will generally allow of removal with a drawing knife, and then the quarters and heels of the shoe may be flat. It therefore follows, that, where the sole can be made concave, a shoe with a flat surface may with safety be applied; but where parts of the sole, from disease or bad shoeing, become flat, a shoe with a concave surface is required. As the hoof is always growing, and as the shoe preserves it from friction, the toe of the crust requires to be cut once in about twenty-eight days. The more horn we can remove from this part, the sooner it will be proper to apply a shoe thin at the heels, without mischief to the muscles and tendons, and the horse will be less liable to trip."

It is stated that "the bars and frog should never be removed. What is ragged and detached had better be cut off with a knife by the groom than left to the farrier, who will perhaps remove some of the sound parts. Where the frog is not large and projecting, the heels may be lowered by a rasp or the butteris, for in every case we are to endeavour to bring the frog in contact with the ground. The frog must have pressure or be diseased. Nevertheless, when the frog has been disused for a considerable period, and become soft, it must be accustomed to pressure by degrees. If the quarters are high, and much exceed the convexity of the frog, we should gradually lower the heels, and endeavour to bring the frog and heels of the shoe on the same parallel line. Where work is required of the horse, while the frog is soft and diseased, it may be gradually used to pressure, by lowering the hoof about the tenth of an inch, every time of shoeing, until the frog be hard, and equally prominent with the heels; or if the horse is not wanted, great advantage would be derived from his standing without shoes on a hard pavement." See *Frog*.

But, says he, as "the feet of horses are so variously deformed by bad management, it will be requisite in shoeing to attend to each particular kind of hoof. If any form of shoe be indiscriminately applied for all kinds of feet, it must frequently fail of success: but by proper attention to the different hoofs, we can generally improve the whole foot, so

as to employ the shoes recommended at the Veterinary College." And, "after the hoof has been properly prepared, then it is requisite to apply a shoe, and to vary its length, breadth, and thickness at the heel, surfaces, &c. according to the hoof. If the heels of the fore feet are two inches and a half or more in depth, the frog sound and prominent, and the ground dry, then only the toe of the hoof requires to be shortened, and afterwards protected by a short shoe, as seen in the plate, made of the usual thickness at the toe, but gradually thinner towards the heel. For a common sized saddle-horse, it may be about three-eighths of an inch thick at the toe, and one-eighth at the heel. The intention is, to bring the frog completely into contact with the ground, to expand the heels, prevent corns, thrushes, and canker. If applied in May or June when the ground is dry, it may be continued all the summer; and in warm climates, where this is the case, no other protection for the hoof is requisite." And he adds that, "so long as the wear of the hoof is not greater than the supply afforded by nature from the coronet, so long may the short shoes be worn; but in wet weather this is not the case: he has known some light horses, to wear them the whole year; but such instances are not common. Nevertheless, the short shoe can be employed on most horses with advantage in summer, when the heels are from two and a half to three inches in depth, and the frog equally prominent: but, unless the hoof has been properly preserved, the heels and frog are generally too low for the short shoe. The toe of the horse requires to be shortened as much as possible; but if the frog touches the ground, no part of the heels should be cut; and, by pursuing this practice, the heels will frequently grow sufficiently high to receive the short shoe." And after speaking of the application of the short shoe to running horses, he says, "during the wet months, we protect the whole crust by a long shoe; and if the heels of the hoof are low, we employ the same shoe in summer.

"In winter, when the heels are too high, it is better to lower them moderately with a rasp, than to wear them down with a short shoe, as the wet may cause more horn to be destroyed than is necessary to be removed; but it cannot be too often repeated, that the sole between the bars and crust should be taken out before the heels are cut. If the heels are first removed, then possibly the horn left will be insufficient to afford a proper degree of concavity between the bars and crust." Where very high heeled shoes have been worn, the frog would be liable to injury, as well as the muscles and tendons that bend the leg, from the sudden application of a shoe made thin at the heels. "Indeed, whether the shoe or hoof be the cause that elevates the frog, the same attention is required to bring it gradually into contact with the ground. We therefore thin the heels of the shoe by degrees, that the frog may become accustomed to hard pressure. The thickness of the last shoe at the heel will always furnish a proper criterion for that to be next applied. If only a small portion of the hoof can be taken from the toe, the heel of the new shoe should be about one-tenth of an inch thinner than the shoe removed; and the growth of the crust will generally be equal to this diminution of iron. By reducing the heels of the shoe in the same proportion as the hoof grows, a thin-heeled shoe may, in a few months, be employed; and yet the horn being preserved at the heels, and cut at the toe, every time of shoeing, the heels (shoe and hoof together) will be as high, and frequently higher, than when the former thick-heeled shoes were employed. The crust that descends at the heels we allow to remain; but subtract an equal quantity of iron from the heels of the shoe, and as much horn as possible from the toe of the hoof. This system should be continued till the heels of the shoe are about one third the thickness of the toe. In proportion as the crust from the coronet to the toe increases, and the heels decrease in depth, the back sinews and muscles will be put on the stretch. And the converse of this must be equally true, that as the heels are high, and the toe short, the muscles and sinews are relieved. It therefore follows, that every atom of horn or iron taken from the toe of the crust, or shoe, tends to relax the parts behind, and that the removal of horn or iron from the heels produces the opposite effect. If these simple facts are kept in view, there can, he thinks, be no difficulty in ascertaining the quantity of iron that may be removed with safety from the heels of any shoe without danger of mischief to the muscles and tendons."

In the shoeing of horses that are liable to *cut*, the following useful directions have been given by Mr. Moorcroft: He says, "to prevent a horse from striking the foot or shoe against the opposite leg, by which it is often bruised or wounded, is an important point; inasmuch as this accident occurs very frequently, and as it not only blemishes and disfigures the leg, but also endangers the safety of the rider. The parts struck in the hind leg, are the inside of the fetlock-joint, and the coronet; in the fore leg, the inside of the fetlock-joint, and immediately under the knee; which latter is called the *speedy-cut*, from its happening only when a horse goes fast. Young horses, says he, when first backed, generally cut their fore legs, although naturally they may be good goers. This arises from their placing the foot on the ground too much under the middle of the breast, in order the better to support the burthen to which they are unaccustomed; but by degrees they acquire the method of balancing the weight, with the foot in the same direction it would naturally have were they without it. It may therefore, he thinks, be laid down as a general rule, with such horses, that, till they regain their natural method of going, the edge of the inner quarter of the shoe should follow exactly the outline of the crust, but should not be set within the crust, nor should the crust itself be reduced in thickness; as both these practices tend to weaken the inner quarter, and to deform the hoof. And here it must be observed, that the outer edge of the shoe should, in all cases of sound

feet, follow exactly the outer edge of the crust, except just at the heel, where it should project a little beyond the line of the hoof."

It is added, that "horses with narrow chests, having their legs placed near together, are apt to cut when they begin to tire; and with these the practice just mentioned should always be employed. Horses that turn their toes much outwards are of all others most subject to cut." And in reply to the assertions of some, that this accident also happens to such horses as turn the toes much inwards, he denies having met with a single instance of the kind. "In horses of the first description," says he, "it has been long observed, that the inner quarters of the hoof were lower than the outer, and that the fetlock joints were nearer each other, than in horses whose feet pointed straight forwards. These two facts probably, says he, led to a conclusion, that if the inner quarters were raised to a level with the outer, and so much the more as they were made proportionably higher, that the fetlock joints would be thrown farther apart, so as to admit of the foot passing by the supporting leg without striking the joint. Accordingly, for the two last centuries at least, it has been usual to make the inner quarter of the shoe higher than the outer; and not only has this been the general practice, but it has been regularly recommended by almost every writer from that time to the present. And notwithstanding this method has very frequently failed of success, yet repeated disappointment appears never to have led to the circumstance of questioning the truth of the principle. Nay, indeed, the reliance placed upon it has been so strong, probably from the simplicity of the reasoning on which it was founded, that in the cases where it most particularly disappointed expectation, its failure was generally attributed to the practice not being carried sufficiently far; and accordingly the shoe has been still more raised on the inner quarter, and the edges of the crust and shoe have been filed away. When with these expedients likewise failed, the last resource has been, a circular piece of leather placed round the joint to receive the blow of the foot."

It is stated, that "about four years ago he applied a shoe, with the outer quarter thick and the inner one thin, in a case which had baffled many attempts on the old plan. On the first trial the horse ceased to cut, nor has he ever done it since; which can only be attributed to his having constantly worn the same kind of shoe. And other bad cases, which have occurred occasionally since that period, have been treated in the same way, and with the same success, although for a long time he was at a loss how to explain them. If the action of cutting principally depends, says he, on the faulty position of the fetlock joints, and of the feet with respect to each other, and it seems generally agreed that such is the fact, it should seem that a means which, by raising the outer quarters, must throw the fetlock joints still nearer to each other, would necessarily increase the defect in question; but as the reverse of this actually takes place, it might induce a suspicion, that there exists some other cause of cutting, which has been hitherto overlooked."

"For horses which cut their hind legs, the shoe, at the outer heel, should, he says, be from half an inch to an inch in thickness, according to the kind of horse, and to the degree in which he may cut. The web of the shoe should gradually become thinner till it reaches the toe, which should be of the ordinary thickness, and from which it should slope off, and end like a tip in the middle of the inner quarter. [For horses which cut only in a slight degree, a shoe of the same thickness throughout, but reaching on the inner quarter only as far as the middle of the foot, will in most instances be found sufficient.] This shoe, in point of effect, would be equally proper for the fore feet, were it not that in such horses as are used for the saddle, the fore feet being more charged with weight than the hind feet, are more particularly subject to be injured, and a horse thus shod on the fore feet might go unsafe: therefore, it is expedient to let the inner quarter of the shoe be thin, and reach to the heel; but the outer edge should be bevelled off, so as to slope inwards. The same kind of shoe is equally well calculated to prevent the speedy-cut; observing to bevel off, still more strongly, the part which strikes, and not to put in any nails thereabouts. And here it may be proper to remark, that in sound feet, the heel of the shoe should reach as far on the heel of the hoof as to admit of the angle formed by the crust and the bar resting fully upon it; but it should not be carried quite as far as the end of the heel of the hoof."

In order to ascertain what would happen to a horse shod with different kinds of shoes, he made the following trials:

Experiment I.—"A horse with a narrow chest, who had never cut, and having parallel shoes on his fore feet, was trotted at about the rate of eight miles an hour in a straight line, over ground sufficiently soft to retain slightly the impressions of the shoes, but not to admit the feet to sink into it.

"Two parallel lines were drawn along the track, including between them the prints of the shoes. By these it was found, that there was regularly a distance of nine inches and a half between the outer edge of the near fore shoe and that of the off fore shoe."

Experiment II.—"Shoes thick in their inner quarter, and like a tip, reaching only half way on the outer quarter, were then used; and it appeared, that the distance between the outer edges of the prints of the shoes, taken as before, was regularly reduced to eight inches and a half."

Experiment III.—"The same shoes were afterwards placed on the opposite feet, so that the thick heel was on the outer quarter; and the result, under circumstances exactly the same as in the foregoing experiments, was, that the distance between the outer edges of the prints of the shoes was regularly increased to eleven inches.

"To account for these results, it is necessary, he says, to attend closely to the different effects produced by the weight of the fore part of the body acting upon the two fore feet, when raised on the inner or outer quarters, during the opposite states of rest and action. And first, with regard to shoes raised

on the inner quarter: whilst a horse so shod is standing still, the fetlock joints are certainly thrown farther apart than when any other kind of shoe is used. Hence, it was concluded, that the limb which supported the body would have its fetlock joint thrown so much outwards, as to keep it completely out of the way of the foot in motion. But it appears, that the impressions made on the ground by such shoes are an inch nearer together than those made by parallel shoes, and two inches nearer together than those made by shoes raised on the outer quarter. And this may be thus explained: when the horse is at rest, the weight is supported equally by the two fore feet; but the instant one foot quits the ground, the weight is suddenly transferred to the other; and by the outer quarter being lower than the opposite one, the fore part of the horse has a tendency to fall over to the outside. To prevent this, the moving foot is suddenly brought close to the fetlock of the supporting foot, in order to relieve it by catching the weight, and the foot itself is placed on the ground, too much under the middle of the breast. The same circumstance occurs to both feet in their turn. And the horse, being thus in constant danger of falling to one side or to the other, is constrained to bring his feet near together to preserve his balance, and in doing this strikes the foot against the opposite fetlock.

"It frequently happens, that the more the toes are turned outwards the nearer the fetlock joints are brought together, and the more the horse is disposed to cut. However, this is true only to a certain extent; for if this faulty position of the lower part of the leg be carried artificially beyond a given point, instead of producing an increased degree of cutting, in most instances it remedies the defect altogether. The reason of this is just the reverse of what takes place when the inner quarter is raised; that is to say, when the weight of the fore part of the body rests only upon one leg, it bears too much upon the inner quarter, from its being lower than the outer quarter; and thus the horse has a tendency to fall over to the inside of the supporting leg.

"To prevent this, the moving foot is thrown farther from the supporting leg, in order to maintain the balance; and thus the foot misses the fetlock joint."

As in cases where the roads are covered with ice, it becomes necessary to have the heels of horse's shoes turned up, and frequently sharpened, in order to prevent them from slipping and falling: but this cannot be done without the frequent moving of the shoes, which breaks and destroys the crust of the hoof where the nails enter. To prevent this, it has been recommended to those who are willing to be at the expense, to have steel points screwed into the heels or quarters of each shoe, which might be taken out and put in occasionally. And the method of doing this properly, as laid down by Mr. Clark, is first to have the shoes fitted to the shape of the hoof, then to make a small round hole in the extremity of each heel, or in the quarters, about three eighths of an inch in diameter, or more, in proportion to the breadth and size of the shoe; in each of these holes a screw is to be made; the steel points are likewise to have a screw on them, exactly fitted to that in the shoes. Care must be taken that the screw on the points is no longer, when they are screwed into the shoe, than the thickness of the latter. The steel points are to be made sharp; they may either be made square, triangular, or chisel pointed, as may be most agreeable; the height of the point above the shoe should not exceed a quarter of an inch for a saddle horse; they may be made higher for a draught horse. The key or handle that is necessary to screw them in and out occasionally, is made in the shape of the capital letter T, and of a sufficient size and strength. At the bottom of the handle, a socket or cavity must be made, properly adapted to the shape of the steel point, and so deep as to receive the whole head of the point that is above the shoe. In order to prevent the screw from breaking at the neck, it will be necessary to make it of a gradual taper; the same is likewise to be observed of the female screw that receives it, that is, the hole must be wider on the upper part of the shoe than the under part: the sharp points may be tempered or hardened, in order to prevent them from growing too soon blunt: but when they become blunt, they may be sharpened as at first. These points should be unscrewed when the horse is put into the stable, as the stones will do them more injury in a few minutes than a day's riding on ice. A draught horse should have one on the point of each shoe, as that gives him a firmer footing in drawing on ice; but for a saddle horse, when points are put there, they are apt to make him trip and stumble. This may be seen in the plate at fig. 18. It is added that, "when the shoes are provided with these points, a horse will travel on ice with the greatest security and steadiness, much more so than on causeway or turnpike roads, as the weight of the horse presses them into the ice at every step."

In addition to the common shoe for horses that have sound feet, there are also others of various shapes, determined by the necessity of the case, as by the different derangements and diseases to which the horse's foot is liable. See *Shoe*.

In respect to the shoeing of other animals, Mr. Clark says, "The mule, being an animal uncommon in this country, the ass of no great value, and the ox not generally employed in labour, he shall dwell but little on the shoeing of these animals. The shoe for the fore feet of the mule is very similar to that which the farriers call the *bar shoe*. It is very wide and large, especially at the toe, where it sometimes projects four inches and upwards beyond the hoof. This excess is given it with a view to enlarge the basis of the foot, which is in general exceedingly narrow in this animal. The shoe for the hind feet is open at the heels, like the horse's shoe; but it is lengthened at the toe, like the preceding one."

It is added, that "the foot of the *ass*, having the same shape as that of the mule, requires the same kind of shoe, with this only difference, that the shoe for the fore foot is not closed at the heels, and that its edges do not project so much beyond the hoof. The same form of shoe is used for the hind feet of this animal."

SHOEING *of Oxen*, the business of fixing shoes upon animals of this kind. It is a practice which is yet far from being performed in a perfect manner. Mr. Clark says that, "in many parts of France, where the ox is used for draft, it is sometimes necessary to employ eight shoes, one under each nail; or four, one under each external nail; and sometimes only two, one under the external nail of each fore foot." In this country two pieces or shoes to each foot are generally made use of, being mostly fixed on, especially in the northern districts, with three or four large headed nails to each shoe. They are fitted on in a similar manner to those of the horse.

But from the shoes of these animals, being from the smallness of the pieces so liable to break, it has been suggested to have them shod with whole shoes in the manner of the horse; but how far this is a practice that will answer, must depend upon future trials. As there is much trouble in the shoeing these animals, from it being necessary to cast them each time, it has been found requisite to have recourse to contrivances for shoeing them standing. See *Ox-shoeing Machine*.

SHORT-JOINTED, in *Horsemanship*; the horse is said to be short-jointed where he has a short pastern. When this joint, or the pastern, is too short, the horse is subject to have his fore-legs, from the knee to the coronet, all in a straight line. Short-jointed horses are, in general, the strongest and most proper for labour.

SHOEMAKERS' *Chips*, the refuse cuttings pared off in making shoes, which when in sufficient quantity are found useful as a manure. See *Manure*.

SHOODS, a provincial term applied to oat hulls.

SHOOT, the young branch of any sort of plant which is afforded in one season. It also signifies a young animal of the cattle kind, in some districts.

SHOOTE, in *Farriery*, an affection of the bowel kind with which calves are often attacked a few days after calving. The usual symptoms are, first a colic that is more or less violent, and is frequently very severe and dangerous; especially when it is contagious. This colic is terminated, and the calf relieved by a discharge taking place from the bowels, though this sometimes proves fatal before the shoote appears. Secondly, a loathing and refusing of food, even previous to the discharge; which decreases and increases according to the duration and violence of the disorder. Where the disease prevails, the best medicine which can be administered, is that of eggs and flour properly blended with oil, melted butter and aniseed, linseed or similar mucilaginous vegetable matters; and milk simply mulled with eggs may be often given with much advantage.

SHOTS, a term provincially applied to young store-swine.

SHOVEL, a well known implement, consisting of a long handle, and a broad blade, with raised edges.

SHOVELING, a term used in Ireland to signify the throwing the mould of the furrows, in cleaning them out, over the ridges.

SHOULDER, in *Farriery*, the joint in the fore quarters that joins the end of the shoulder-blade with the extremity of the fore-thigh in animals; also the part of the fore-hand that lies between the withers, the fore-thigh, the counter and the ribs.

It has been observed by Gibson, in noticing the faults and defects of a horse's shoulders, that they "should not be too much loaded; for a horse that has heavy shoulders can never move well. On the other hand, one that has very thin shoulders, with a narrow chest or bosom, though he may move briskly while he keeps sound, yet such horses are generally weak; and the most easily lamed in their shoulders of all others. A narrow-chested horse turns his elbows inwards towards his brisket, and his toes outwards; crosses his legs in travelling, and sometimes cuts himself; and this sort of horses, by their unsteadiness, are as apt to trip and stumble, as the horses that are thick shouldered, though they do not so easily come down: in the main, they are of less value: for if they happen to get lame, they are fit for nothing, being weak and slender; whereas thick-shouldered horses are generally strong; and if any accident happens that renders them unfit for other uses, they will serve for a waggon or team: but a heavy-shouldered horse, at best, is neither fit for the saddle or for a coach, nor indeed for any thing that requires expedition."

There are several diseases of this part, as mentioned below, and to understand which, the above writer says, it will be necessary to observe, that the blade-bone of the shoulder is fixed to the body, not by articulation or jointing, but by apposition; being laid to the ribs, and fastened by the muscles, which lie under and above it: so that when a horse happens to receive a blow or strain in the shoulder, the tendons of these muscles are apt to be stretched and relaxed.

It is well known that a slip, false step, or any undue position of a horse's legs, will strain and weaken the shoulder, by stretching those ligaments; and that sometimes the shoulder is affected by a hurt or bruise on the withers; the reason of which may be easily enough conceived, by any one who will examine into the structure of those parts: but when the accident proves not so violent as to cause inflammation and swelling, it is not so easily discerned, whether the lameness be in the shoulder, in the foot, or any other joint. But the infirmities of the shoulders may be distinguished from those of the feet, by having a horse put to exercise: for if the lameness be in the feet, he will halt most when he is ridden: but if it be in the shoulder, the warmer he grows the less he will halt; and, if the wrench be violent, he will be apt to cast his legs outwards, forming a circle as he goes. But if none of these signs are perceivable, the surest way is to turn him short on the lame side, for that tries the muscles the most of any thing; so that if the hurt be in the shoulder, he will set his foot on the ground hardily, and endeavour to favour his shoulder.

In attempting the cure, a distinction should be made between an old injury and one that is newly received: as in a fresh strain the first intention is to apply such things as are proper to allay the heat and inflammation, and prevent a too great flux of blood to the part; whereas in an old complaint a very different course should be observed. See *Lameness* and *Strain*.

According to some, strains in the shoulders of horses are much less frequent than in the hinder limbs,

and that there is much deception in them, all lame horses appearing affected in the shoulders, however sound those parts may be, which is the occasion of the perpetual blunders of grooms and farriers, whose sole rule of judgment is from appearances and custom. The only sign to be depended upon is supposed to be the motion of the fore-arm, or a tenderness and tumour in the parts.

SHOULDER-*Drain*, a sort of under drain constructed with a shoulder. See *Drain*.

SHOULDER-*Pegged*, in *Farriery*, a term applied to horses when they are gourdy, stiff, and almost without motion in the fore legs.

SHOULDER-*Splait*, in *Farriery*, a term applied to a horse when he has given his shoulder such a violent shock, as to almost disjoint it from the body.

SHOULDER-*Pight*, in *Farriery*, a malady, produced by the displacing of the point of the shoulder by some great fall, rack, or strain, which may be known by one shoulder-point sticking out farther than its fellow, and also by the halting of the horse.

For the cure, some advise to swim the horse up and down in deep water several times, which will cause the parts to go back into their right place again.

SHOULDER-*Pinching*, in *Farriery*, an accident caused in horses by labouring or straining when too young, or by being over-loaded.

SHOULDER-*Torn*, in *Farriery*, an accident caused from sliding or separating the fore legs too greatly, by which the shoulder is parted from the breast, and leaves a sort of open rift, not in the skin but the flesh, under it, which renders the horse so lame, that he is not able to go; and which is known by his trailing his legs after him in going.

SHOULDER *Wrench*, in *Farriery*, an accident that befalls horses several ways, sometimes by turning and stopping too suddenly upon some uneven ground; sometimes by running too hastily out at a door: at other times by slipping or sliding either in the stable or abroad; and from several other similar causes.

The remedies in these cases must be applied according to the nature of the accident, and the cause which has produced it. See *Lameness* and *Strain*.

SHOWEL, a term applied to a blind for a cow's eyes.

SHROUD, a term signifying shelter or harbour.

SCHUK, a term applied to a husk or shell.

SHUCK, provincially a stouk, or twelve sheaves of corn set up together in the harvest field.

SHUD, a word provincially used to signify shed.

SHUG, a term used to imply the shaking of any thing, as hay, &c.

SHUGGINGS, a word signifying that which is shed or scattered, as grain at harvest, &c.

SHY, a provincial term signifying high mettled, or head strong, in the manner of wild colts, &c.

SIBERIAN *Barley*. See *Barley*.

SICKNESS *in Horses*. See *Horse*.

SICKLE, a toothed hook, with which corn is reaped.

SIDDOW, a term provincially applied to peas that boil soft.

SIEVE, hair, lawn, or basket work, strained on a hoop, for separating the flour from the bran, the dust from corn, &c.

SIG, a provincial term applied to urine, or chamber-lie.

SIGNS *of Disease in Horses*, in *Farriery*, the appearances which show them to be out of order.

The first sign of a horse's indisposition, is, his loathing his food; especially when he has a wild and haggard look, as the eye of an horse is, as it were, a glass, through which may be discerned the inward disposition of his body; it should also be observed whether his ears be cold, his mouth hot or clammy, the hair of his flanks rough and staring, and paler than usual about the ends; his dung hard or black, or greenish, and his urine clear like water. In this case his eyes are also subject to weep, his head is heavy and hanging down; he is apt to stumble as he walks; he is slow and dull, though he was vigorous before; he never minds other horses; contrary to his former custom, he rises and lies down often in the stable, looking towards his flanks, which are doubled and folded in; his heart beats quick; and he is also indifferent and unconcerned at what is done to him.

These and many other signs are met with in horses which are not in a state of perfect health, and should be immediately attended to; and suitable remedies be applied.

SIKE, a term provincially applied to a little rill, a water-furrow, and a gutter.

SILE, provincially the name of a milk strainer.

SILICEOUS, having the nature of silex, or a sort of sandy gravel.

SILICEOUS *Earth*, such as is constituted of these materials.

SILICEOUS *Marl*, that which is of a sandy nature. See *Marl*.

SILK, a well known material from which different fine fabricks are made.

SILK *Worm*, the name of the insect which elaborates and prepares the above material, and which is often kept for the purpose.

SILLS, a term signifying the shafts of a cart, &c.

SILVER-*Fir*, a tree of the pine kind. See *Pine*.

SILVER-*Weed*, a term applied to wild tansey; a plant which grows naturally upon cold stiff land in most parts, and is a sure mark of the sterility of the soil. Its stalks spread upon the ground, and send out roots from their joints; by which means, and by the frequent shedding of its seeds, as it flowers during the whole summer, it soon over-runs, and fills the land to a great distance. Its leaves are composed of several lobes or wings, which are generally placed along the mid-rib, and terminated by an odd one: they are jagged at their edges, and are of a silvery colour, especially on their under side. It has been noticed by Ray, that the root is somewhat of the parsnip kind, and that hogs are very fond of it.

SIMPSON, a provincial term sometimes applied to groundsel, a troublesome weed in some soils.

SIND, provincially to rinse or wash out, as a milking pail.

SINEW-*Shrunk*, in *Farriery*, is said of a horse that is over-ridden, and so worn down with fatigue, that he becomes gaunt bellied, as it is called, through a contraction of the two sinews that are under his belly.

SINEW-*Sprung*, in *Farriery*, a violent attaint, or

over-reach, in which a horse strikes the toe of his hinder foot against the sinew of the fore-leg. See *Attaint*.

SIT-FAST, in *Farriery*, is a part of the skin of a horse which is turned horny, and which if it cannot be dissolved and softened by rubbing with mercurial ointment, must be cut out, and afterwards healed as a fresh wound. It generally proceeds from a warble. See *Warble*.

SIZE *of Farms*. See *Farm*.

SIZZING, a term provincially applied to yeast or barm.

SKEEL, provincially a large milking pail, having two handles, formed by two opposite staves, which rise above the rest. It also signifies a broad flat creaming or milk dish.

SKEGS, a sort of oat, sometimes cultivated as a crop in Nottinghamshire: the *avena stipiformis* of Linnæus. It is pannicled, the calyxes two flowered, awns twice as long as the seed, culm branchy, and stipeform.

They are a crop mostly cultivated, according to the report of the above district, on the worst land, sometimes on a lea, sometimes after turnips, often taken as a last crop. On bad land they may produce about four quarters per acre, which are generally about two-thirds of the price of oats. But they answer to sow on good land, producing fourteen and fifteen quarters per acre. The kernel is reckoned remarkably sweet and good food for horses. They are sometimes threshed, sometimes cut in the straw. And they are chiefly grown about Carberton, and will grow where nothing else will.

In regard to seed per acre, "eight strikes are said to be sown, and yield a crop double that of other oats, in quantity; but not more than equal in weight. They will grow in the poorest land, and are reckoned very sweet food. They are seldom brought to market; but esteemed by farmers for their own use, and are often given in the straw."

It is stated by Mr. Neville in the same report, in a letter to Sir R. Sutton, that "skegs are remarkably good for horses, in the straw, or threshed, and in the straw remarkably so for cows. Straw beasts are also very fond of the straw. He can get taking up weak land from the swarth, from four to six quarters an acre. On the same land he should not have been able to get, perhaps, above three sacks of black, red Friesland, or what is called short small, or any other kind of corn. If land is in the state in which all our bad land will be, more or less, after the seeds are quite run out, and as is frequently the case, when you cannot conveniently put it again into tillage so soon as you could wish, from either the too great quantity you may have to improve, or other circumstances—if in this state, he says, it were to be taken up with turnips, the most eligible way, it would be often impossible to provide manure *upon* the *farm* for any quantity of land sufficient for the purpose; which makes skegs a very desirable crop, and which, if for that reason alone, he finds a great acquisition, and feels a pleasure in having been the first to introduce them into this country."

How far this crop may be capable of being grown in other districts as the food of live stock in the green state, must depend upon the trial.

SKEP, a coarse round farm basket. It is also provincially used to signify a bee hive.

SKEYL, provincially to lean on one side or throw up as in unloading a cart.

SKEYL-*Beast*, provincially the partition of cattle stalls.

SKEYLD, provincially party coloured, as geese, ducks, &c. or shelled.

SKID, a term applied to the chain by which the wheel of a waggon is fastened, so as to prevent its turning round, upon descending a steep hill. See *Drag*.

SKILLING, a term signifying an isle, or bay of a barn; also a slight addition to a cottage.

SKIM-*Coulter*, a sort of coulter invented by Mr. Ducket, for paring off the surface of coarse grass or other lands, and placing it in the bottom of the furrow, so as to be fully covered and secured. It has been used in different districts with the greatest advantage and success. It is stated in the Agricultural Report of Hertfordshire, that Mr. Biggs, near St. Albans, finds it of excellent effect in clover lays, and also wherever any rubbish is on the land that wants burying, as well as in breaking up old saintfoin lays. And it may be beneficially employed on many other occasions.

SKIM-*Coulter Plough*. See *Plough*.

SKIN, the hide of an animal.

SKIRTING, a mode of performing the business of sod burning. See *Sod-burning*.

SKITTISH, a term applied to such animals as are frisky and shy.

SKOVES, provincially reaps, shoves, grips, or bundles of grain: also unbound sheaves.

SKREED, provincially a border or narrow slip of land.

SKUFE, provincially a precipice.

SLAB, the out-side plank of a piece of timber when sawn into boards.

SLACK, provincially a valley or small shallow dale or dip.

SLADE, a term provincially signifying a sledge. See *Sledge*.

SLADE-*Down*, a provincial term signifying to draw back part of the mould into the interfurrow with the plough dragging or *slading* upon its side.

SLAG, a term applied to copper dross.

SLAKE, a term signifying the saturating of quick lime with moisture, as water, &c.

SLAM, the refuse of alum works which is used as a manure with sea weed, and lime in Yorkshire.

SLAPDASH, provincially rough cast, or the liquid external coating of buildings.

SLASHER, a term applied to a plasher of hedges.

SLATAXE, provincially a mattock with a short ax end.

SLATE, a well known neat, convenient, and durable material, for the covering of the roofs of buildings. There are great varieties of this substance, and it likewise differs very greatly in its qualities and colours. In some places it is found in thick lamina or flakes, while in others it is thin and light. The colours are white, brown, and blue.

It is so durable in some cases, as to have been known to continue sound and good for centuries. However,

unless it should be brought from a quarry of well reputed goodness, it is necessary to try its properties, which may be done by striking the slate sharply against a large stone, and if it produce a complete sound it is a mark of goodness; but if in hewing, it does not shatter before the edge of the *sect*, or instrument commonly used for that purpose, the criterion is decisive. "The goodness of slate may be farther estimated by its colour: the deep black blue is apt to imbibe moisture, but the lighter blue is always the least penetrable: the touch also may be in some degree a guide, for a good firm stone feels somewhat hard and rough, whereas an open slate feels very smooth and as it were greasy." And "another method of trying the goodness of slate, is to place the slate stone lengthwise, and perpendicular in a tub of water, about half a foot deep, care being taken that the upper or unimmersed part of the slate be not accidentally wetted by the hand, or otherwise; let it remain in this state 24 hours; if good and firm stone, it will not draw water more than half an inch above the surface of the water, and that perhaps at the edges only, those parts having been a little loosened in the hewing; but a spongy, defective stone will draw water to the very top." There is still another mode, held to be infallible. First, weigh two or three of the most suspected slates, noting the weight, then immerge them in a vessel of water 12 hours; take them out, and wipe them as clean as possible with a linen cloth, and if they weigh more than at first, it denotes that quality of slate, which imbibes water; a drachm is allowable in a dozen pounds, and no more.

In the laying of this material, a bushel and a half of lime and three bushels of fresh water sand will be sufficient for a square of work, but if it be pin plastered, it will take above as much more: but good slate well laid and plastered to the pin will lie an hundred years, and on good timber a much longer time. It has been common to lay the slates dry, or on moss only. When they are to be plastered to the pin, then about the first quantity of lime and sand will be sufficient for the purpose.

SLECK, a provincial term applied to the small of pit coal. Also to the black matter of smutty grain.

SLED, provincially a sledge.

SLEDGE, an implement employed for conveying various articles upon. It is made of two strong pieces of wood framed together.

SLEEAN, provincially the smut in corn.

SLEEPING-*Evil*, in *Farriery*, a sort of lethargy.

SLIDE-*Butt*, provincially a dung sledge.

SLIME, a material left by the tides and other waters in different places, which is an useful manure. See *Ooze*.

SLIPPING, a term used by farriers to denote abortion in animals. Thus, mares are said to slip their colts; and cows, their calves.

It has been stated that cows in calf, by smelling to any flesh, particularly in a putrescent state, occasions such a nausea as to stimulate the womb to action, and to eject the fœtus: this is well known in the north of Scotland, where it is particularly guarded against. It is observed by Mr. Ross, in the twenty-fifth volume of the Annals of Agriculture, that through the inattention of a game keeper there was always horse flesh lying about his yards, and he had many cows which slipped calves. It is supposed in the Essex Report that bleeding when one-third or half gone, is a preventive. When it happens, the abortion should be immediately buried, and the cow kept as widely apart as possible from the herd, and not receive the bull that goes with them. It is considered as certainly infectious.

SLIT, a crack or cleft in the breast of fat cattle.

SLIT-*Planting*, a mode of planting trees in small openings without the whole of the ground being dug out. See *Planting*.

SLOBBERER, a term implying a slovenly farmer.

SLOB-*Furrowing*, a particular method of ploughing land.

SLOT, a term used to signify any broad, flat, wooden bar.

SLOUGH, a deep rut or hole in a road or carriage way.

SLUDGE, a term applied to mud or mire.

SLUG, a destructive animal of the snail kind. It is highly mischievous in the field, as well as the garden, by eating off the young stems of tender plants. The white and brown leathery kind, often even destroy the strong stems of young cabbage, and other similar plants. The destruction of them has been suggested to be effected by the use of tar water, sprinkled over the ground; and also by having recourse to lime in the preparation of the land for such crops. They conceal themselves in the holes and crevices, only making their appearance early in mornings and late in the evenings. See *Grub*.

The white slug or snail is likewise very destructive to young turnip crops by rising out of the holes of the soils, on wet and dewy mornings and evenings Rolling with a heavy implement before the sun rises, has been advised as a means of destroying them.

SLUICE, a strong frame of wood which is of great convenience in many cases, and to which, in order to its perfection, a good and experienced workman is required. It ought to be strongly framed in deep waters, particularly where a great height is necessary, so as to stand firm and immoveable against the rushing of heavy bodies, for a small strain makes it leaky, and a small thing will occasion this, unless sufficiently guarded by proper abutments. Larch, green elm, or willow, are the best timber to be always in water, but heart of oak to stand above, in wet and dry. They should be formed in different ways for different purposes.

The importance of sluices is extremely evident, as when a pressing necessity demands the discharge of a great quantity of water, either the expensive mode of engines must be recurred to, the bank be cut, or a sluice drawn. If the bank be cut, the passage is interrupted, and there remain the trouble and charge of removing the earth, and re-embanking; but a sluice vents the superfluous water without the least inconvenience or charge.

Their utility in many cases of drainage and embankment, as well as irrigation, is also very great.

SLUSS, a word applied to mud or mire; it is sometimes written slush.

SMART-*Weed*, a term applied to the biting or pale-flowered persicaria or arsmart, which is a troublesome weed.

SMOOT, a term signifying a hair muce, or a small gap or hole in the bottom of a hedge.

SMUT, a disease in corn, and which, according to M. Duhamel, exhibits the following marks or appearances:

"1. This distemper destroys entirely the germ and substance of the grain.

"2. It affects not only the ear, but also, in some degree, the whole plant, when it has made a great progress.

"3. It very seldom happens, but that when one stalk is smutty, all the ears of the other stalks from the same root are so too.

"4. So early as in March or April, upon opening carefully the hood or blades which cover the ear, and examining the young ear, then not above the sixth part of an inch in length, and almost close to the roots, he found this embryo already black, and attacked with this distemper. Perhaps it may not always seize the plants so early.

"5. When the distempered ear comes out of its covering formed by the blades, it looks lank and meagre: the common, and immediate coverings of the grains arein this case so very slight and thin, that the black powder is seen through them: and from this time nothing is found in lieu of grain, but a black powder which has a fetid smell, and no consistency. As this powder, of which the constituent particles have but very little cohesion, and of which the coverings are destroyed, is easily blown off by wind, or washed away by rain, the husbandman, in housing these plants, houses only skeletons of the ears. If any impression of this powder remains, it is easily taken off by sifting; but he has not experienced it to be contagious, like that of burnt grain." And "Mr. Tillet, he says, has observed that these corrupted ears are often found to be vitiated even in the hood, though this last, looks as green and perfect as if nothing ailed the corn within. The upper part of the stalk of a smutty plant is not, commonly, quite straight, from within about half an inch below the ear. If such a stalk is squeezed there, it scarcely yields at all to the pressure. If it be cut asunder at about a sixth part, or a quarter of an inch below the ear, it will be found to be almost entirely filled with pith, in such manner that only a very small opening can be perceived in the heart of the stalk, instead of the large pipe that is in healthy stems. He concludes from hence, that the circulation of the juices is obstructed in the upper part of the stalks of smutty plants. Bearded wheat is apt to be smutty, as well as that which is not bearded; but neither Mr. Tillet nor he ever met with a smutty ear of rye."

In respect to the causes of smut, it is observed that "the smuttiness of corn cannot be owing to a want of fecundation, as many have hitherto mistakenly imagined; since it affects and destroys the organs of both sexes, long before the time of that fecundation.

"It cannot be imputed to the settling of wet upon the ears, or to fogs, or to a violent impression of the sun; since we have seen the ears smutty long before they ceased to be covered with the blades, which continue green till the distemper has made great progress.

"The same observations refute absolutely the opinion of those who suppose the cause of the smut to be in the grains after they are formed, and before they are past their milky state.

"The smut of corn has been also ascribed to the moisture of the earth; but we do not see more smutty plants in the lowest, and consequently wettest parts of a field, than in the highest and most dry. Besides, why should there be a single smutty plant in the midst of numbers of sound ones? However, as it appears that corn is more frequently attacked with this distemper in wet years than when the seasons are dry, too much moisture may perhaps, without being the immediate cause of the smut, favour its progress more than drought would do.

"Some naturalists have ascribed this distemper to insects. If he is not authorised absolutely to deny this, he can at least assert that, after having been of this opinion for some time, all his endeavours to establish it by facts have proved ineffectual. Some observers have indeed shewn him different insects in smutty grains; but as he found the very same kinds likewise in sound ears, he believes, with M. Tillet, that they are not in any manner the cause of this distemper. We know that the corn-caterpillar devours the mealy substance of the grain: but it does not occasion smut. Numbers of flies lay their eggs upon these seeds; and the worms and maggots which proceed from them, eat the seeds; but this does not occasion any thing like smut. The Reverend Dr. Hales, to satisfy himself whether the smut of corn might not proceed from the seeds being bruised by the flail, took a number of grains of different sizes, and bruised them with a hammer. They grew well, and bore ears which were not smutty. Thus his own experience convinced him that he had conceived a wrong idea of the cause of this distemper.

"Several cultivators have thought that pigeons' dung and that of sheep render corn smutty: but this is a groundless notion. We have large pigeon houses, the dung of which is strewed upon our wheat lands: the same is done with the dung of our sheep, and we even fold our flocks upon those lands: yet we do not find that these fields are more affected with smut than others. This allegation is therefore absolutely destitute of proof." It is added, that "Wolfius was of opinion, that the smut of corn proceeded from a monstrosity of the embryo: but that M. Aimen has refuted that supposition, by showing that the male flowers of certain kinds of plants are attacked with this distemper: now the flowers have not any embryo."

And this last philosopher has judiciously observed

that the smut of corn cannot derive its origin from a defect in the sap; as all the parts of the plant, except the ear, look healthy, and there are plants whose roots are perennial, which appear vigorous, though their seeds are smutty every year. He is of opinion, that whatever weakens the plant is apt to bring on the smut, and instances as a proof of this, that it is a frequent custom in his country, to cut rye as soon as it spindles, for food for their cattle; and that this rye generally produces other ears, which seldom contain any but distempered grain: to which he adds, that seed-corn which had been pricked or run through with a needle; or which is not thoroughly ripe, and that which produces lateral or second ears, is subject to the smut. And he afterwards from other trials seems disposed to ascribe this disease to mouldiness.

In the Memoirs of the Bath Agricultural Society, it is said however to be a disease that only occurs when the weather is wet, during the period of the flowering of the plant, in which the *anthers* may burst and the *farina* be washed away. It is supposed not to be produced by any infectious material, or the *ova* of insects that may adhere to the grain, as smutty ears and sound ones are found proceeding from the same root; and, in some instances, both smutty and sound grains to be contained in the same ear; some of the corns having even one end smutty and the other sound, consequently to arise from the want of due impregnation, from the farina fecundans faulty or imperfect, and that putrefaction takes place on the death of the corn. And this supposition is supported by the experiments of the Italian philosopher Spallanzani, who found that the seed is produced in the plants long anterior to impregnation, which cannot be performed until the flower is open, and the dust of the anther fully in a state of maturity. And Dr. Darwin, on these principles, conceives that for want of impregnation, or the vivifying principle, the wheat corn may putrify, as is the case with addle eggs of oviparous animals.

But the enquiries of other writers seem to lead to the opinion that the affection is produced by the attacks of an insect, and that, though certainly infectious, it may be prevented or cured by the use of different kinds of pickles. See *Pickle*.

A variety of facts and reflections have been offered on this subject by Mr. R. Somerville, in the second volume of Communications to the Board of Agriculture. He begins by remarking that, "some years ago, he collected a quantity of smutted ears from one field of wheat, in which they were very numerous, and a number of healthy well-filled ears from another field, in which there was no smut. The grains were rubbed out of both, intimately mixed, and kept in a box for two months, at the end of which they were rubbed between the hands in such a manner as to break the whole of the smut ball. The parcel was then divided into two equal parts, one of which was three or four times washed with pure water, and well rubbed between the hands at each washing, and afterwards sown in a drill in his garden; the other half was sown in another drill without any washing or preparation whatever; the soil and every other circumstance was equal. Both parcels vegetated at the same time, and for about two months thereafter there was no visible difference in their appearance; about that period he, however, observed that many of the plants in the drill, that had been sown without being washed, were of a darker colour than the others; these, when narrowly examined, were of a dirty green. The plants in the drill that had been washed were all of one colour, and seemingly healthy; as the season advanced, the difference in colour became more striking, and continued to increase till the grain was fairly out of the blade; about this time many of the dirty green ears began to exhibit symptoms of decay. As soon as the ear was fairly shot out, the whole of those in the unwashed drill, that had the dirty green appearance above described, were found to contain nothing but smut; and these smutted ears were in the proportion of more than six to one of the healthy ones; while, on the contrary, the drill in which the washed grains had been sown, and which consisted of several hundred grains, had hardly a smutted or unhealthy ear in it. The same experiment was repeated the following season, and with nearly the same result. Satisfied with knowing that complete washing would be found a remedy for the disease, he made no farther enquiry upon the subject till last autumn, when he was employed in making observations upon the blight, in the course of which he met with a good deal of smut in many fields; and being at the time possessed of some excellent glasses, he carefully examined some of the smutted plants. This at first was done more as a matter of amusement, than from any expectation of discovering any thing that might contribute to throw light upon the subject. Upon a near inspection with the glass, he found that the dirty green colour of the blades of the smutted ears was owing to a number of spots infinitely small, and bearing a near resemblance to those upon blighted ears: his observations were continued throughout the whole period of the ripening, in the course of which he made no additional discovery, except observing, that the leaves and stalks of the smutted ears decayed sooner than such as were healthy.

"About the end of autumn, however, having one day brought home some smutted ears of rather an unusual appearance, he examined them very narrowly, and observed that the balls were perforated in many places with small round holes, a thing he had not before observed in any that he had met with: this he ascribed to vermin; and upon sticking one of the grains upon a pin, and placing it under the glass in a very bright sun, he could distinctly observe several small transparent specks upon the beard, or downy part of it. He examined several more, and met with exactly the same appearance; but upon being called hastily away upon business, he was under the necessity of leaving them upon the table, without being able to ascertain whether the objects he had seen were eggs or insects. In the evening, when he

came home, he resumed the investigation by *candle-light*; in the course of which, as he was under the necessity of holding them very near the candle, the heat soon relieved him from his embarrassment, by putting them in motion, and he then discovered that the specks above mentioned were real insects, resembling wood-lice in shape. Next day he repeated the same trials by sun-light with new smut balls and discovered the same appearances, but without being able to make any of the insects stir. Disappointed and vexed at not being able to see them in motion with sun-light, and recollecting the heat of the candle, he threw the concentrated rays of the sun upon them with a burning glass, which completely answered his purpose of putting them in motion, and shewing them in every different point of view. To describe minutely an insect so small as not to be distinguishable by the naked eye, would, says he, be no easy matter; it is sufficient to say, that its general appearance is very similar to the wood-louse, though infinitely smaller.

"As soon as he was clearly ascertained of the existence of this insect, his mind was, he says, perfectly at ease with regard to the cause of the distemper; but though he could very readily conceive that vermin, in the early stages of the growth of a plant, might so injure the stamina as to render it unfit to produce any thing but smut, he could not so well understand how it was possible for the mere touch of the black earth contained in the smut-balls to produce the same effect."

It is well known, he says, that in the animal body certain infections are communicated merely by the contact of the sound and unsound parts; but that in every instance where this happens, the injury can be distinctly traced to an absorption of the virulent matter, by the vessels of the healthy subject.

"We are now, says he, so well acquainted with vegetation, as to know that plants have a circulating system as well as animals; and that while they are in a growing state, poison as well as nourishment may enter their vessels, and do infinite mischief. If this reasoning is sanctioned by experience, and there can be no doubt of it, and if there is the slightest analogy between animal and vegetable life, it will at once appear, that no bad effect could possibly arise from smutted and healthy ears coming in contact, either in the stack or the barn, as at that time they are in a state of rest, and no circulation going on. It may be argued in answer to this, that while the plants are green, the shaking of the wind may bring the smutted and the healthy ears into contact; and that the acrimony of the smut may corrode and destroy the healthy wheat, so as to produce the disease. This idea he knows is entertained by many very good farmers: it is, however, clearly disproved by the experiment above recited, by which it appears that a simple washing in water, provided it is properly performed, is a very effectual cure for the distemper: common sense will inform, that had the stamina, or germ of the grains so washed, been injured by any thing of a corrosive nature, even in the slightest degree, no ablution whatever could possibly have repaired the mischief.

"The same reasoning, says he, applies with equal justice to the other causes assigned, with the single exception of insects; for if either the grain was naturally weak, or had been sprung in harvest, or was deficient in its male organs, as is ridiculously supposed, nothing but the highest degree of weakness and credulity could make any person believe, that either the washing with water, or indeed any other preparation, could cure such defects."

"It is my opinion, says he, that the smut is occasioned by the small insect above described, as seen by the glass in the downy part of the grain; and that when the balls are either broken in the operation of thrashing, or come in contact with clean healthy grains, the insects leave the smutted grains, and adhering to such as are healthy, are sown with them, and wound the tender stem in such a manner as to render the plant incapable of producing any thing but smut. It is not an easy matter to account for the manner in which this takes place; but a little attention to the circumstances he is now to mention will perhaps throw some light upon it. It is known that plants of very opposite natures and qualities will grow and produce abundantly upon the same soil, where the nourishment is seemingly the same. This effect is also known to be owing to the structure of their vessels, by the action of which the juices that circulate through them are differently prepared in every different plant. From this striking difference, owing confessedly to organisation, is it not, says he, presumable that the smut in wheat is produced by the insects wounding the vessels of the plant in such a manner as to render them incapable of taking up any other principle from the soil, but the smut contained in the balls, which upon examination seems to have no quality different from the finest vegetable earth? This opinion, he thinks is strongly supported from the circumstance of certain pickles being found a cure for the malady. The effect of these pickles is, however, completely misunderstood; for in place of supposing, as is erroneously done, that they operate by strengthening the grain, and thereby removing that debility which has been long considered as the cause of smut, their benefit depends upon the powers they possess of destroying the insects above described: but to shew the absurdity of the commonly received opinion in a more striking point of view, it is only necessary, he adds, to state, that many of these preparations, which are supposed to be so friendly to vegetation, are in fact highly inimical to it, unless they are used with the utmost caution; even stale urine, which has long been considered as a safe and innocent remedy, is, under certain circumstances, highly pernicious. After he had discovered the insect, he made trial of all the substances commonly used, and found all of them, when properly applied, destructive to it. Is it not therefore, continues he, more agreeable to plain common sense to suppose, that the virtue of these preparations consists more in the power they have of destroying vermin, than in any strengthening quality they possess?"

But whether this vegetable disease may be produced by insects, or be the effect of some other cause, to many of which it has been ascribed by different philosophical inquirers; the most general practice of farmers has been that of preparing their seed by the means of some sort of washing or brining.

The following tabular view of the results of trials made with different steeps in order to ascertain their utility in this intention, as well as in promoting the growth of the grain, is given by Mr. Bevan in the ninth volume of the Agricultural Magazine. It contains 12 samples of smutty wheat, and the same number of sound good wheat, steeped in 12 different solutions of the most common acids and alkalies, and salts, most readily procured. The wheat was sown at Leighton, Bedfordshire, on a sandy soil. The solutions were all made cold, and the samples continued twenty-four hours in steep. The column marked A are the results from the good wheat, and those marked B are from the smutty samples. It may be observed that neither of the samples steeped in the solutions of nitric acid came up, excepting a single corn in the good sample, and which produced above 1200 corns.

Substances used.	Specific gravity of the solution.	Number of smutty ears in three sheaves.		Bushels of good wheat per acre.		Cwts. of straw per acre.	
		A.	B.	A.	B.	A.	B.
1. Solution of potash - -	1,357	1	81	21-6	13-6	36-6	29-1
2. ——— of muriat of potash	1,097	3	218	20-2	10-1	36-0	21-1
3. ——— of nitrat of potash -	1,080	7	115	23-8	14-3	36-9	31-9
4. ——— of soda - -	1,056	9	159	20-2	11-7	35-6	26-7
5. ——— of muriat of soda	1,089	—	290	24-0	14-5	41-5	33-3
6. ——— of sulphat of soda	1,047	12	241	21-6	12-3	38-5	27-8
7. ——— of muriat of ammonia	1,026	1	150	19-8	17-6	35-4	30-2
8. ——— of common soot -	1,025	—	123	20-8	11-4	34-8	25-3
9. ——— of lime saturated	1,003	—	2	21-9	12-4	38-7	25-9
10. ——— of nitric acid	1,016	—	—	—	—	—	—
11. ——— of muriatic acid -	1,011	—	136	20-7	16-1	35-7	34-1
12. ——— of sulphuric acid	1,050	—	—	20-4	17-8	35-4	37-1
13. Dry in its natural state - -	———	6	323	20-3	14-7	35-7	31-0
14. Washed in common water -	———	None sown.	107	—	18-3	—	35-8

"M. de Lignerolle says, that the surest means of avoiding smut, and that which he has long practised with success on upwards of three hundred acres of land, is to change the seed every year, to be very careful that the seed corn be well dried and thoroughly ripe, and that it be not smutty nor have any smutty powder sticking to it. He then pours boiling water on quick lime, in a large tub; and after the ebullition is over, as much cold water as there was hot, and stirs it all strongly together, in order to dissolve and thoroughly mix the lime. The quantity of wheat intended to be sowed is sprinkled with this lye, and then well stirred with a shovel, and laid in as high a heap as possible. It is best, he supposes, to keep the grain for a week after this preparation, turning it every day; for otherwise it would heat so as to destroy the germ. By these means he has not had any smut, when the fields around him have been infected with that distemper."

And Mr Donat, near Rochelle, has used the following with success:

"Take quick-lime and pigeons' dung, of each twenty-five pounds, forty pounds of wood ashes, and twenty-five pounds of sea-salt, or salt petre. Put all these into a tub large enough to hold half a hogshead of common water, which should be added to them. Stir them all well with a stick, till the lime is quite dissolved. This lye will keep some time without spoiling. It must be stirred just before the corn is steeped in it. The grain is then put into a basket, and plunged in the lye, where it remains till it has thoroughly imbibed it; after which it is taken out, and laid in a heap till it is quite drained of all its moisture: or, which is a still better way, take a mashing-tub, fill it with grain to within four inches of the brim, and then pour in the lye well stirred beforehand. When the tub is full, let the lye run out at the bottom into some other vessel in order to use it again for more corn. Let the grain be then taken out and laid in a heap to drain; and continue in this manner to steep all the seed-corn. The wheat thus prepared may be sowed the next day, and must not be kept above five or six days, for fear of its heating. This quantity of lye will serve to prepare more than twenty bushels of wheat." And "Mr. Tull has observed, that bringing and changing the seed are the general remedies for smut."

And a very intelligent writer in the eleventh volume of the Agricultural Magazine says that "he can truly state, that in the course of long and extensive practice, he has never discovered the produce of any good and properly prepared seed wheat, smutted, while that of his unprepared escaped. On the contrary, whenever he has sown any in the latter state, he has always observed much smut in the crops raised from it; and refers his readers to the follow-

ing account of an accurate comparative experiment.

"On the fifteenth of March last, he sowed two contiguous ridges, (in the middle of a very large field) equal in soil, condition, and exposure, with wheat of the same variety, raised on the same kind of soil, in precisely the same mode of management, and thoroughly *mixed*. The seed contained a very small quantity of smut, perhaps one black ball to a quart; but the other grains were not at all discoloured. The ridges were set out in an east and west direction, each 80 yards long and 9 broad. On the west half of the northern ridge, he sowed the seed without any preparation whatever; and on the east, after being well washed in clean river water. On the west half of the other ridge the wheat was sown after having been wet with old chamber-lye; and on the east half, after being prepared (provincially, pickled) in the usual manner, with old chamber-lye and lime in fine powder. All the land was ploughed and sown (broad-cast) on the same day, without any variation of weather, and equally well harrowed. We had a calm, dry, and tolerably warm blooming season. Some time after the ears were out, he examined the crop very minutely. That after the unprepared seed, the washed seed, and the wheat wet with chamber-lye, contained a great, and that from the seed which received the chamber-lye and lime, a very small, quantity of smut. The straw of this appeared as good as that of the sound wheat. Upon every piece of ground he found ears partly smutted and partly sound. In part of these ears he found some rows of grain containing sound wheat near the middle of the row, and smut both above it and below it. With a view of finding the proportion (at harvest) with some degree of precision, he took four sheaves from the middle of the crop raised from the pickled seed, mixt them thoroughly, reduced them to an equal size, viz. to the circumference of 24 inches, and then carefully pickt out and counted the number of smutted ears they contained. He pursued precisely the same mode with the crops upon the other pieces of ground, and the results were as under:

The 4 sheaves after the pickled seed contained -	165	smutted	ears.
The 4 do. from the seed which was washed in clean water.	1212	do.	do.
The 4 do. from the seed wet with chamber-lye -	723	do.	do.
The 4 do. from the seed which received no washing or preparation -	1270	do.	do.

He thinks it is stated in some of our agricultural publications, that one of the strong acids much diluted with water, has been successfully used in preparing seed wheat, with a view of preventing smut; a disease which has been improperly confounded with blight or mildew. The latter remedy he never tried, he has, however, on several occasions, used sea water (so strongly impregnated with salt, that an egg would swim on it) and lime; and also the drainings of fold-yards and lime, and is of opinion that these mixtures are not nearly so efficacious as the latter article, and strong chamber-lye. The best mode of preparation is, he thinks, to immerse the wheat in the chamber-lye, stirring it well (about 5 to 10 minutes) and skimming off the light grains, &c. The chamber-lye should be let out by a tap, and the wheat spread on a floor, and so well mixed with the lime that every grain may receive a part of it. If this mode be carefully practised with seed free from smut, he can, from experience, assure the husbandman that he will never suffer, in any considerable degree, from that disease. As the lime and chamber-lye will soon destroy the vegetative principle of the grain if it be suffered to remain in a heap, or in bags, it should be committed to the ground within 6 or 8 hours after it has been thus prepared. He has sometimes known it considerably injured after being kept 24 hours thinly spread out upon a well aired floor.

"When the seed is in a very moist state it will not pass regularly through the drill machine, and therefore it is necessary to have it drier in the drill than the broad-cast husbandry.

"When the wheat used in the above experiment was prepared, a proper vessel was not at hand, and therefore the chamber-lye was sprinkled upon it. This, however, is not a good method, for we lose the chamber-lye, and the advantage of skimming off the light grains, black balls, &c. and notwithstanding frequent turnings, it sometimes happens that *all* the grains do not receive a sufficient quantity of the liquid."

On the supposition of this diseased state of grain being produced by an insect, the following method of kiln-drying, has been proposed in the third volume of the Farmer's Magazine.

"Let the wheat be laid upon the kiln, about three or four inches thick, the kiln to be heated middlingly strong with blind coal: the wheat to continue on the kiln for 24 hours, but turned frequently. After taking it off the kiln, it must be allowed 24 hours to cool, during which time, it must be frequently turned then put it through the fanners, once or twice. After the wheat has lain a few hours on the kiln and the fire begins to have effect, a great number of very small worms formerly undiscovered by the eye, appear on the top of the grain, and are soon destroyed by the heat. These come from blacked wheat or other corns that could not be suspected to be indifferent; or may lie in, or on good wheat, which worms continuing (when not thus killed), might consume the corn after it is thrown into the earth, thereby checking the growth entirely, or preventing it from having the strength it otherwise would have, to bring forth a strong productive stalk. It is added that the first farmer in Clackmannanshire, who tried the kiln-drying of wheat, instead of pickling it, learned it about 25 years ago (and he has continued the practice ever

since) from an Irishman, who had been appointed by the Board of Trustees to stamp the linens, &c. manufactured in the village of Alva, who asserted, that it was practised in his part of Ireland: but, at this distance of time, the farmer has forgot what part of Ireland: the man said he came from." See *Pickle* and *Steeping*.

The following opinion has however been offered on this vegetable affection by sir John Call, who supposes, that "the smut is occasioned by certain animalcula deposited in the husks of the ear, when the wheat is in blossom, which are fed and brought to perfection by devouring the milky juice; and observes that were the disease radical in the original grain of the seed-wheat, or infectious from the juice arising through the pores and tubes of the stalk, there could not be in the same ear, grains, some decayed and others quite perfect." But "to bring the matter to the test of experiment, he collected a quantity of smutted ears of wheat, in some of which were two or more grains apparently perfect; all which he caused to be rubbed out with the hand in a bag, smut and altogether the fresh grains found in the bags were then sown in a particular ridge amongst other wheat, in a field under tillage. Their growth from the first was similar to the rest of the wheat, and from a certificate of respectable farmers it appears their produce was as free from smut, as that of the field in general." And "hence the conclusion is drawn, that washing or pickling wheat, as a remedy against the smut, is unnecessary and useless; and that as blights and other diseases of plants are more prevalent from circumstances in some seasons than in others, so the smut is an accident of a like nature, which mankind can neither foresee nor prevent." The general experience of farmers is however in opposition to this supposition.

With the view of cleaning smutty grain various methods have been proposed, as by agitating it with different substances, as sand, and lime made from stone, or white or gray chalk, which, when used, should be finely sifted, and then well blended with the wheat in proportion to the state of the smut, as from one to two bushels for a load of five quarters, which should then be passed through a machine one or more times according to the purpose, for which wheat is intended.

SMOTHER-*Fly*, a provincial term applied to the bean aphis.

SNAFFLE, in *Horsemanship*, a well known kind of bridle. It has a very slender bit-mouth without any branches. They are in very general use. See *Bridle*.

The common snaffle, or small watering bit, is only a scatch-mouth, with two very little straight branches, and a curb mounted with a headstall, and two long reins.

SNAIL, an animal which is injurious to different crops, and of which there are various families, some with shells and others without them. These conceal themselves in holes beneath the soil, from which they occasionally in the evenings and mornings ascend to the destruction of various crops.

Snail-*Cod*, a name given by Mr. Worlidge to a species of manure found at the bottom of deep rivers. It is a kind of mud or sludge, very soft, full of wrinkles, and intermixed with many little shells and snails, to which it is thought to owe a great part of its richness. It is sometimes called *Snag Greet*.

Snail-*Horned*, a term applied to the horns of such cattle as have them short and down-hanging, with blunt points, and somewhat bent in the common form of the snail.

SNAKE, a well known troublesome sort of animal, which should be destroyed as soon as possible.

SNATHE, a term applied to the handle of a scythe.

SNECK, provincially the latch of a door or gate.

SNORT, in *Horsemanship*, a kind of harsh sound that a mettlesome horse sends through his nostrils, as if he had a mind to expel something from his nose that hindered his taking breath. It is, in fact, a sort of sneezing.

SNOW, the congealed particles of water which are precipitated from the atmosphere, in a white flaky state. It is supposed by Doctor Darwin, that it may "be true, that snows of long duration in our winters may be less injurious to vegetation, than great rains and shorter frosts. First, Because great rains carry down many thousand pounds worth of the best manure into the sea; whereas snow dissolves gradually, the upper surface, as it thaws, sliding over the under part, which remains frozen, and thence carries away less from the land into the rivers; whence a snow flood may be distinguished from a rain flood by the transparency of the water. Secondly, Snow protects vegetables from the severity of the frost; since it is generally in a state of thaw, where it is in contact with the earth; as the earth's heat is 48 degrees, and that of thawing snow is 32°. The plants between them are generally kept in a degree of heat about 40, by which many of them are preserved. On this account some plants from Siberia were said to perish by the frosts at Upsal; because the snows did not commence at the same time as in the colder climate, from which they were brought." And thus, "says he, the *lichen rangiferinus*, coral-moss, vegetates beneath the snow in Siberia, where the degree of heat is always about 40; that is, in the middle between the freezing point and the common heat of the earth. And as this vegetable is for many months of the winter the sole food of the rein-deer, who digs furrows in the snow to find it; and as the milk and flesh of this animal is almost the only sustenance, which can be procured by the natives during the long winters of those higher latitudes, this moss may be said to support some millions of mankind."

And it is added, that "snow protects vegetables, that are covered by it, from cold, both because it is a bad conductor of heat itself, and contains much air in its pores. When living animals are buried in snow, as sheep, or hares, the water, which their warmth produces, becomes absorbed into the surrounding snow by capillary attraction, and the creatures are not moistened by its dropping on them;

but the cavity enlarges, as the snow dissolves, affording them both a dry and a warm habitation. If this was generally known, many cold and weary travellers in snowy nights might be saved by covering themselves with snow instead of endeavouring to proceed. It should be added, he says, that Hassenfratz has endeavoured to shew by ingenious chemical experiments, that rain water and snow contain both of them a redundancy of oxygen, compared with river water, which they may have acquired in their descent through the atmosphere; and that as oxygen is shown by the experiments of Ingenhouz, and Senebier, to promote the growth of seeds, and of plants, he concludes that rain water and snow, promote vegetation in a much greater degree, than river water and ice, which seems to accord with the popular observations on this subject."

Snow-*Plough*, a contrivance made use of in Sweden, and other northern countries, for the purpose of clearing roads from snow; and which might probably be employed here with advantage, in the same intention. It consists of a shaft to which the horses are yoked, usually two abreast, and one before. The sides are constructed of three or four deals well jointed and nailed together, having more or less height, according as the snow is more or less deep, as from three to four feet. The length is usually about fifteen feet, and two iron bars are nailed to the bottom, to make it slide with greater facility. It has also a box for the purpose of being loaded, to keep it down. It may have any breadth from fifteen to twenty feet according as the snow may want clearing. There is a representation of it in the first volume of Communications to the Board of Agriculture.

SOAP, a compound of oil, tallow, and other substances, with lime and pot-ash. Most sorts of soapy mixtures are found to have much effect in promoting vegetation.

Soap-*Ashes*, the refuse of soap boilers, sometimes termed soapers' ashes. See *Ashes*.

SOCIETIES, *Friendly*, such as are established for the purpose of relieving the labouring classes during the period of sickness, or when incapable of working.

Many societies of this nature have been formed in different parts of the kingdom within these few years, with much success. And it has been remarked by Mr. Curwen, that to encourage the people to provide the means of support for themselves, in cases of sickness and misfortune, is highly desirable, both as to the effect it produces in making them more respectable members of the community, and in exempting parishes from the most enormous weight of poor rates.

It has been suggested by Mr. Donaldson, after observing that such establishments would certainly be attended with very beneficial consequences, that it might be highly proper to frame a law, whereby labourers of all descriptions should be *compelled* to assign a portion of the fruits of their labour, during the time of their health and strength, for the establishing a *fund* for their relief when overtaken by misfortunes. The forming of provident societies or clubs, by which, during the time the members are in health and the vigour of life, they may, by small constant weekly payments, make a suitable provision, from the produce of their own industry, against the period when sickness, misfortune, old age, or infirmity may reach them, is, says he, a measure which, the more it is known, the more it will meet with the approbation of the public.

And though, by some, such "societies may be thought, says he, very remotely, if at all, connected with the subject of agriculture; to the more intelligent, the best means of providing for the industrious peasantry, whose 'rough laborious hand,' allows the wealthy to live in indolence and ease, will always be an interesting subject. The more so it must prove, as the suggesting proper measures for that effect, if attended to, will infallibly remove, in a great degree, the load of poor's rates, which hangs like a mill-stone about the neck of the English farmer; a load which, if effectual measures be not in a short time adopted to remove, must necessarily be attended with consequences of the most alarming nature, as its weight is increasing with such rapidity, that in a few years it must become altogether insupportable."

It has been well remarked by Dr. Anderson, that "friendly societies, voluntarily entered into by the industrious poor, have relieved many a worthy character in the times of their sickness, infirmities, misfortunes, and old age, in a more ample and comfortable manner than they would have been provided for by the parish levies. Why, he asks, may not all the poorer sort in their youth be compelled to provide, out of their industry, for their old age and infirmities? Why may not the poor of every parish be by law created friendly societies? Suppose the master of every servant and labourer was obliged to retain, out of the wages of each, three-pence a week, and pay the same in the respective names of such servants and labourers into the parish stock. When a servant or labourer removes from one parish to another, he might be entitled to a certificate from the parish he leaves, where he has drawn no pay of the amount of the sum total he has contributed; and when he has gained a settlement in another parish, that parish might be entitled to draw on the first for the money the pauper has paid; so that every man may draw his fortune after him, which may prevent many a litigation respecting the settlement of the poor, and be a great spur to industry."

And, in the Rural Economy of the West of England, it has been stated by Mr. Marshall, that "several of these valuable institutions have existed in Devonshire for about thirty years; and that their good effects are so evident, that the encouragement of them ought to become a national object of the first magnitude; not more with a view to lessen the present heavy burdens of the poor's rates, than to instil into the lower classes of society a principle of frugality, and a sense of social duties, which these meetings, under suitable regulations, cannot fail of producing."

The following is the plan laid down by Mr. Pew,

who has paid much attention to the subject, and who observes, "that if the collection of a small but voluntary tax upon the sober and industrious citizen, for his own use when in distress, be in some degree beneficial, he conceives that the collection of a still smaller, though compulsitory, tax upon all ranks of men, the idle, the improvident, and the irresolute, as well as the industrious citizen, for the same purpose, would be a measure as much more beneficial as it is more extensive."

"Clause I. That a proper officer be appointed for such an extent of district as he may be supposed conveniently to superintend, to take a list of the names and places of abode of all males above the age of seventeen years, in the same manner as the list is made out for the militia.

"II. That every such male pay two-pence per week, and every such female three farthings or one penny per week, into the hands of the above officer, for the purposes hereafter to be specified.

"III. The above officer shall be empowered to furnish employment for all such as are willing to work, and who cannot find it for themselves. Whether this officer should be chosen annually in rotation, after the manner of an overseer, or whether he should be a permanent officer upon an adequate salary, will be a matter of future consideration; but if the latter, he should be paid by the community, and not out of the fund.

"IV. All the poor being thus sure of employment, the master or mistress for whom they work should be justified in retaining these sums respectively out of their wages; and whether they do so or not, they should (in default of the individual) be answerable to the officer for its payment. All masters and mistresses of families should in like manner be answerable for their servants; and all keepers of lodgings, &c. for their inmates.

"V. These sums should be carried weekly to the general treasurer of the division, who should give sufficient security for the same.

"VI. Out of this fund every male who is really incapable of labour, should (by virtue of a certificate from the above officer) have a right to demand from the treasurer five shillings per week for the first six months, should his illness last so long, and four shillings per week after that period, until he again become capable of labour.

"Every female should have a right to demand two shillings and sixpence per week for the first six months, and afterwards two shillings per week, until she be again able to work: she should also be entitled to four weeks full pay at every lying-in. Every male above the age of sixty-five years, whether capable of labour or not, should be entitled to four shillings per week during life. Every female, after the same age, two shillings.

"VII. Any person having three children under nine years of age, should be entitled to one shilling and six-pence per week, until the eldest should have attained the age of nine years; and if he has more than three under that age, he should be entitled to one shilling and six-pence per week for each above that number; and if any one or more of his children should happen to be idiotic, insane, or otherwise so far disabled, either in body or mind, as to be utterly incapable of labour, each of them should still be considered as under the age of nine years, and paid for accordingly.

"If a mother should be left a widow with three children under nine years of age, she should be entitled to receive five shillings; if with two children, three shillings; and if with one child, one shilling and six-pence per week; if with more than three under that age, one shilling per week for each above that number; it being admitted that all her time is taken up by three, and allowance made for it, but that she is capable of looking after, and taking care of, a greater number. The wives of men serving in the militia, and in the army or navy, should, during the absence of their husbands, be considered and provided for in all respects as widows.

"If a child should be left an orphan under nine years of age, two shillings per week should be allowed from the fund for its maintenance; if more than one of the same family, one shilling and six-pence per week for each above that number. As there is probably no less friendship amongst the lower than amongst the higher orders of society, it would generally happen that some friend or relation of the deceased would gladly take charge of the children, provided they could do so without essential loss to themselves. This regulation would effectually prevent that loss; and to compensate in some degree for the want of parental affection, six-pence per week more is allowed for the maintenance of an orphan, or a family of orphans, than for a child, or a family of children, who still retain their mother. If, however, any beings should be so uncommonly unfortunate as not to be thus adopted, the officer above-mentioned should be obliged to provide a receptacle for them, which he will always be able to do for the sum or sums above-mentioned.

"VIII. All children above nine years of age, if in health, should, if they have no parents, or their parents are not able to provide for them, be put out after the manner of parish apprentices.

"IX. All persons neglecting or refusing to pay their contribution, should be committed to hard labour in the house of correction for the space of ——.

"X. If the fund should at any time fall short of the necessary demands upon it, the deficiency should be made up by a parish rate, collected in the same manner as at present; but without any sense of obligation on the part of the multitude, (for there would be no poor,) who should, in all cases, receive their relief in the nature of a demand.

"XI. If the fund (as most probably would happen) should increase beyond the necessary demands upon it, the surplus should on no occasion be diverted to any other purpose than the benefit of the subscribers; but when the price of grain exceeded that which brings it easily within the reach of the multitude (suppose 6s. or 6s. 6d. the Winchester

bushel,) every person who had three children or more under nine years of age, should have a right to demand such a sum as, in proportion to the number of his family, would reduce the various necessary articles of life (taking wheat as the standard) to a moderate price; and, indeed, he thinks, in all cases, when the price of grain exceeds that proportion at which the *industrious labourer* can afford to come to market, *sound policy*, as well as *common humanity*, requires that all large families should be entitled to receive such a sum as above specified, although it should be necessary to collect a rate for the purpose.

"He need not perhaps add, he says, that every officer intrusted with money should give ample security for his integrity, and the faithful discharge of his duty; that due checks should be established to prevent embezzlement; and that all accounts should be made up and balanced so frequently as to prevent the probability of mistakes.

"And still more effectually to secure the complete execution of the plan, it would perhaps be necessary to appoint a general inspector of the funds, who, with the assistance of a few subordinate officers, would probably be able to superintend the whole kingdom."

It is supposed by Mr. Donaldson, that if this plan was "carried into execution by the legislature, it must in its consequences promote most essentially the well-being of the great body of the people, as well as the interests of those concerned in the commerce, manufactures, and agriculture of the country." But though the establishment of friendly or provident societies has, in numerous instances, been found productive of the most salutary effects; and would, if well supported and countenanced in every part of the kingdom by the contributions of the rich proprietors, render compulsitory acts of parliament unnecessary; yet as such mode, however desirable, could probably never be generally adopted, it would certainly be the most effectual method to have an act of parliament for the purpose framed on the above principles: without this, or some similar regulation, such societies will probably never, he says, become sufficiently general to fully answer the intention."

The great beneficial effects that have resulted from these societies, in those instances in which they have been established in parishes, have been shown in various statements of them, and should promote their adoption in others, which may easily be done by the principal proprietors in such places taking the lead in forwarding such institutions.

SOCK, provincially the share of a plough, or part that opens the land. They are of different kinds, as sharp pointed and feathered.

Sock, the drainage of a farm yard.

Sock-*Pit*, the receptacle of the same.

SODA, a term applied to the common mineral alkali.

SODBURNING, the practice of paring off the sward or mossy surface of land. It is observed by Mr. Marshall, in the Rural Economy of West Devonshire, that the most noticeable particular of management, in the soil process of that district, is that of "*burning beat*," as it is provincially termed; answering to the paring and burning, or more technically, sodburning, of other districts. And that this operation in agriculture has been practised, in this western part of the island, from time beyond which memory or tradition reaches. It has, he says, probably been imported from the opposite shore of the continent. And in an old tract, which he saw some years ago, in the British Museum, this operation is termed *Devonshiring*, and it is to this day called *Denshiring*, in different districts of the kingdom.

He further states that "there are at present three distinct methods of separating the sward or sod, provincially the "*spine*," from the soil. The one is performed with a "*Beating-Axe*"—namely, a large adze—some five or six inches wide, and ten or twelve inches long; crooked, and somewhat hollow or *dishing*." With this, which was probably the original instrument employed in the operation, large chips, shavings, or sods, are struck off. It is still used in rough uneven grounds, especially where furze or the stubs of brushwood abound. In using it, the workman appears to the eye of a stranger, at some distance, to be *beating* the surface as with a beetle, rather than to be chipping off the sward with an edged tool. This operation is termed "*hand-beating*." And the next instrument in use, is, he says, the *spade*, resembling the paring spade, or breast plough of other districts; with however, in some instances at least, a notable addition: namely, a mould-board, fixed in such a manner as to turn the sod or turf as a plough turns the furrow-slice: thus becoming literally a *breast plough*; a name which has probably been given to the implement in this state, and continued to be applied to the spade or share after the mould-board was laid aside."

He adds, that "in working this tool, the labourer proceeds without stopping to divide the sods into short lengths; this part being done by women and children, who follow to break the turfs into lengths, and set the pieces on edge to dry. The *price* for "*spading*" is about three halfpence a square perch, of 18 feet, or 16 or 17*s.* a statute acre. Formerly, it is probable, this instrument was much used, but at present it appears to be chiefly in the hands of small farmers."

He states that "the instrument at present used, for separating the spine or grassy turf from the soil, by farmers in general, is the common *team-plough* with some little alteration in the size and form of the share, according to the fancy or judgment of the farmer or his ploughman, there being two different ways of performing the operation. The one is termed "*velling*," the other "*skirting*," or "*skir-winking*."

He observes "that for *velling*, the share is made wide, with the angle or outer point of the wing or fin, turned upward to separate the turf entirely from the soil. But that for *skirting*, the common is used, but made, perhaps, somewhat wider than when it is used in the ordinary operation of plough-

ing. And that in this mode of using the plough, little more than half the sward is pared off, turning the part raised upon a line of unmoved turf; as in the operation of ribbing, rice balking, raftering, or half ploughing. The paring of turf in this case is from one to two inches thick on the coulter margin, decreasing in thickness to a thin feather edge, by which it adheres to the unmoved sward. And after having lain some time in this state to rot, or grow tender, it is pulled to pieces with rough *harrows* drawn across the lines of turf; and having lain in this rough state, until it be sufficiently dry, it is bruised with a *roller*, and immediately harrowed with light harrows, walking the horses one way, and trotting them another, to shake the earth out more effectually from among the roots of the grass; going over the ground again, and perhaps again, according to the season, and the judgment of the manager; until most of the earth be disengaged. The "*beat*," or fragments of turf being sufficiently dry, it is gathered into heaps of five or six bushels each; either with the "*drudge*" first into rows, and then drawing it along the rows, into heaps; or is pulled together with long-toothed hand rakes, adapted to the purpose. The former is more expeditious and requires fewer hands; the latter gathers the beat cleaner,—freer from earth, which is liable to be drawn together by the drudge. The "*beat burrows*," or heaps, being rounded, and shook up light and hollow, a wisp of rough straw, a large handful, is thrust, double, into the windward side of each heap: and a number of heaps being thus primed, a match or flambeau is formed, with "reed," or straight unthrashed straw; one end of which being lighted, it is applied in succession, to the loose ragged ends of the wisp of straw; which readily communicate the fire to the heaps. The centre of the heap being consumed, the out skirts are thrown lightly into the dimples or hollows, and the heaps rounded up, as at first; continuing to right up the burrows until the whole of the beat be consumed or *changed*, by the action of the fire. And the produce of the first skirting being burnt and spread over the surface, the operation is sometimes repeated, by running the plough across the lines of the first skirting; thus paring off the principal part of the spine; again dragging, rolling, harrowing, collecting, and burning, as in the former operation." This is a process of very great importance in the system of Devonshire husbandry, and from which vast advantages and improvements have been effected.

SOFT *Chalk*, a sort of fossil marle, which readily moulders down and becomes blended with the mould of the soil, on which account it forms an excellent manure free from the objection made to that of the hard kind, which requires to be reduced into lime. This sort of substance is often met with at some depth at the bottoms of chalk hills, where search should be constantly made for it as it may become of great value as manure.

SOFT *Meadow Grass*, a common grass in most meadows, but which is of no great value for the purposes of the farmer. There is also a creeping soft grass often met with, which is said to be useful on dry sandy soils. See *Holcus*.

SOIL, a general name applied to all sorts of land.

The fine powdery materials which have been gradually formed by time from the various earthy and other bodies in nature, being grounded down, blended and incorporated with each other in different states and proportions, constitute the earthy layers usually denominated soils, which are destined to promote the growth and support of various vegetable crops: while the more solid and less reduced substances, which have been excluded from the influence of the atmosphere, and other natural causes, form the under stratum, which is commonly known by the title of subsoil. On this account it is evident that there must be a great diversity in the soils of different districts, as in some there is an abundance of some kinds of materials, while others are deficient, and in others there is a plentiful supply of these, while the former sorts enter in very deficient proportions or quantities. The more compact and hard substances of nature, from their reduction being effected in a more slow and gradual manner, are in common found more sparingly in the principles of soils, than those of the more soft and easily reducible kinds.

In the natural state of soils, the clayey, loamy, and vegetable materials are generally found to enter in a pretty large proportion, and to constitute very essential differences according to the quantities in which they are predominant.

The earthy vegetable matter is in many cases a principal material in soils, constituting a sort of superficial layer or bed in which the crops grow and are supported; but which differs greatly, according to the quantity, and the state of reduction or decay, to which it has advanced, as well as many other circumstances. See *Vegetable Earth*.

Substances of the calcareous, siliceous, and sandy kinds are abundantly prevalent in some tracts of country, while in others they are met with only in a very sparing manner, and thus of course afford much variety in the nature and properties of the soils.

It has been well observed by professor Davy in an excellent paper on the Analysis of Soils, that "the substances which are found in soils, are certain mixtures or combinations of some of the primitive earths, animal and vegetable matter in a decomposing state, certain saline compounds, and the oxide of iron. These bodies always retain water, and exist in very different proportions in different lands, and the end of analytical experiments in the detection of their quantities and mode of union."

But, "the *earths* found in common soils are principally silex, or the earths of flints, alumina, or the pure matter of clay, lime, or calcareous earth, and magnesia. That *silex* or the earth of flints, when perfectly pure, appears in the form of a white powder, which is incombustible, infusible, insoluble in water, and not acted upon by common acids; it is the substance which constitutes the principal part of rock crystal; it composes a considerable part of

hard gravelly soils, of hard sandy soils, and of hard stony lands.

"Alumine, or pure clay, in its perfect state is white like silex; it adheres strongly to the tongue, is incombustible, insoluble in water, but soluble in acids, and in fixed alkaline menstrua. It abounds most in clayey soils and clayey loams; but even in the smallest particles of these soils, it is usually united to silex and oxide of iron.

"Lime is the substance well known in its pure state under the name of quick lime. It always exists in soils in combination, and that principally with fixed air or carbonic acid, when it is called carbonate of lime; a substance which in the most compact form constitutes marble, and in its looser form chalk. Lime, when combined with sulphuric acid (oil of vitriol), produces sulphate of lime (gypsum), and with phosporic acid, phosphate of lime. The carbonate of lime, mixed with other substances, composes chalky soils and marles, and it is found in soft sandy soils.

"Magnesia, when pure, appears as white, and in a lighter powder, than any of the other earths; it is soluble in acid, but not in alkaline menstrua; it is rarely found in soils; when it does exist, it is either in combination with carbonic acid, or with silex and alumine.

"Animal decomposing matter exists in very different states, according as the substances from which it is produced are different; it contains much carbonaceous substance, and may be principally resolved by heat into this substance, volatile alkali, inflammable aeriform products, and carbonic acid; it is principally found in lands that have been lately manured.

"Vegetable decomposing matter is likewise very various in kind, it contains usually more carbonaceous substance than animal matter, and differs from it in the results of its decomposition principally in not producing volatile alkali; it forms a great proportion of all peats; it abounds in rich mould, and is found in larger or smaller quantities in all lands.

"The saline compounds found in soils are very few, and in quantities so small, that they are rarely to be discovered. They are principally muriate of soda (common salt), sulphate of magnesia (Epsom salt), and muriate and sulphate of potash, nitrate of lime, and the mild alkalies.

"The *oxide of iron*, is the same with the rust produced by exposing iron to the air and water; it is found in all soils, but is more abundant in yellow and red clays, and in yellow and red siliceous sands."

It has been stated by a late practical writer, that "there are probably few, if any, substances in nature, which after they have been sufficiently acted upon, and reduced by the influence of the atmosphere and other agents, but which are capable of affording support to some kind of vegetable or other, though there is considerable difference in this respect among different earthy matters, some being able to sustain a great number of different plants in a vigorous state of growth, almost immediately after they become mixed with the soil, while others require to be applied and united for a length of time before they afford sustenance to any kind of vegetable whatever, and even then only yield a scanty supply of nourishment, and that for the support of a few particular sorts of plants. Where the former sorts of materials are abundant, the soils are generally fertile and productive; but where the latter prevail, they are mostly sterile and unfriendly to vegetation." But that soils, "besides possessing the proper earthy matters, must be embued with other principles, such as the aqueous and carbonaceous, and have such a consistence and texture, as will properly support the plants, as well as such proportions of the several materials as will admit of their being retained, and applied in such quantities as are suitable for the purposes of vegetation, according to the differences of climate in respect to moisture, and the varieties of situation in regard to the lands, in order to be rich, fruitful, and productive," in the different kinds of vegetable crops.

And it has been still further stated, that the bodies or materials, "so far as they are yet known, that have a tendency to lessen the fertility of soils, are the oxids or calces of particular metals, some coaly and pyritical matters, acids, and certain heathy vegetable substances. But some of these substances, though unfriendly to the growth of vegetables when in these circumstances, on being blended and united with other materials that enter into the composition of soils, operate upon them in such a manner as to render them more fertile than they would have been without them. Mixtures and impregnations of this nature are constantly taking place in soils, which cannot be easily comprehended or ascertained, but which produce great and important effects and changes in them. From this cause, soils, which are apparently similar in every respect, on being brought into cultivation, frequently turn out to be essentially different." And "it is well known to most persons conversant with practical agriculture, that soils in which calcareous matter is predominant, even when they are grown so poor and exhausted as to be almost incapable of producing any of the other crops commonly cultivated on them, will bear large and repeated crops of one sort of vegetable, that of sainfoin; and that other soils which are capable of affording the common crops in an abundant manner, cannot be made to produce this. In the same way, such calcareous soils as have been cultivated for a great length of time, and are consequently much impregnated with manure, afford plentiful crops of barley; while oat crops, if attempted to be raised upon them in such a situation, are weak, puny, and relatively extremely small. And, on the contrary, some primitive soils, not originally containing any calcareous materials, and which, not having been cultivated, cannot be impregnated with manures on first being broken up, often yield astonishing crops of oats, while barley can scarcely be raised at all upon them."

These and many other similar facts noticed by cultivators of the soil, sufficiently show the effects which even trifling mixtures of certain matters have in altering their qualities, and rendering them more or

less fertile, as well as more or less proper for the growth of particular sorts of crops without there being any external appearance of such alteration.

But further, soils are found to differ also greatly from their depths, and the nature of the sub-soils on which they rest. "It is stated as a fact well known by practical farmers, and which the experience of every day confirms, that even the soils that are constituted of the most suitable substances for the purposes of vegetation, when only a few inches in depth, and deposited upon beds of cold wet clay, rock, or chalk, are by no means so fruitful and productive as those which are thicker, though of inferior quality, but resting on a bottom which is more dry and gravelly. The difference of weight and tenacity in the under strata of soils, likewise introduces great variety in regard to their powers and capabilities of rearing vegetable productions" in the way of crops.

In respect to the constitution or composition of fertile soils, the first essential requisite, according to Mr. Kirwan, is, "that it contain a sufficient quantity of the three or four simple earths above mentioned, and of the soluble carbonaceous principle." And that "the other requisites are, that the proportion of each, and general texture of the soil, be such as to enable it to admit and retain as much water as is necessary to vegetation, and no more." And further, that it has been "seen that the retentive powers of moisture are very different in the simple earths; the proportions in which the fertility of a soil requires them to be mixed, must be different in climates and countries that differ considerably in moisture; in the *drier*, they must be such as are most retentive; in the *moister*, such as suffer it to pass or evaporate more easily. The same remark also extends to situation. Lands on a plain should be so constituted as to be less retentive of water than those situated on a declivity; as is very evident." Consequently "lands that have a retentive or impermeable subsoil, should be differently constituted from those that have one less retentive or more permeable." And "the time of the year in which rain most abundantly falls may also be worthy of notice" in this business.

In the analysis of a fertile soil made by Mr. Giobert in the vicinity of Turin, where it rains yearly above 40 inches on the square foot, "he found 1lb. of it to contain from 20 to 30 grains of extractive matter which flamed and burned, and therefore was a coal soluble in water; 26lb. of it contained 1808 grains of water. The simple earths were in the following proportion per cwt.

Silex, from	77 to 79
Argill	9 - 14
Calx	5 - 12

Hence the pound should contain,

	grs.
Carbonic matter	25
Water	70
Silex, from	4362 to 4475
Argill	509 - 793
Calx	283 - 679"

And that it also contained "a great deal of air (about 19 grains) of which one third was fixed, and the remainder heavy inflammable air; but no volatile alkali."

But in a less fertile soil, the proportions were found to be of

Silex, from	48 to 80
Argill	7 - 22
Calx	6 - 11

Hence the troy pound contained of

		grs.
Silex, from	2716 to	4528
Argill	396	1245
Calx	389	622

Allowing 100 grains for moisture, as either the calx or argill exceeds the proportions in more fertile lands.

And in barren soils he found

The proportions of Silex, from	42 to 88
Argill	— 20 — 30
Calx	— 4 — 20

Hence the troy pound contained, allowing for water 120 grains,

Silex, from	2368 to	4963
Argill	1128	162
Calx	225	620

He has not given the specific gravity of these soils but it probably is either much above, or much below that of the former, as they are either too close or too open. Mr. Fabroni found, that of barren sandy land 2. 21.—It was found by Mr. Bergman, that a fertile soil situated on a plain, where the yearly fall of rain amounts to 15 Swedish, (that is 23,9 English) inches, contained four parts clay, three of siliceous sand, and two of calcareous earth, and one of magnesia, (in all ten parts) but the last not being of absolute necessity may be annexed to the calcareous.

The composition of the clay he does not expressly mention, but we may suppose it such as most frequently occurs, containing 66 per cwt. of fine siliceous sand, and 34 of mere argill, consequently 0,40 if it contain nearly 0,14 of mere argill, and 0,26 of fine siliceous sand.

The siliceous sand mentioned by him is what is called gravel, (consisting of stone from the size of a pea or less to that of a nut); and thus he himself explains it. This amounted to 30 per cwt.

The proportions may be stated thus:

Coarse Silex	30	
Finer	26	
	—56	parts.
Argill	14	
Calx	30	
	100	

The use of gravel is to keep the soil open and loose: a circumstance which is absolutely necessary. The specific gravity is not given, but should not much exceed, it is supposed, 1,600. Muschenbrook found that of garden mould 1,630. Bergman was not acquainted with the carbonic matter.

The proportion in a troy pound, supposing the quantity of water and coal not to exceed 100 grains, stands thus, omitting fractions:

Gravel	- -	1698
Fine sand	- -	1471
		—3169
Argill	- -	792
Calx	- -	1698

"Here we see, he says, the quantity of calx much greater than in the soil of Turin, where the fall of rain is greater; for in the drier climates there is a necessity to retain the rain, and the argill if increased would retain it too long and too much; and, besides, enters very sparingly into the constitution of plants."

And in the less extensive trials of M. Tillet at Paris, made by filling pots twelve inches in diameter at the top, ten at the bottom, and seven or eight deep, with mixtures of different earths, but so porous as to absorb moisture, and perforated in the bottom, by plunging them up to the surface in the earth of a garden, in each some grains of wheat were sowed, and then abandoned to nature. "The first mixture he found fertile, consisted of three-eighths of the potters clay of Gentilly=0,375, three-eighths of the parings of lime-stone, and two-eighths of river sand=0,25. In this, the corn grew very well for three years; that is, as long as the experiment lasted. But as potters clay is not pure argill, and as M. Tillet does not mention the proportion the mere argillaceous part bore to the siliceous, Mr. Kerwan supplies the defect, by supposing this clay to contain near one half its weight of pure argill, as it is clay of this sort that potters generally chuse; and that of Gentilly is esteemed one of the best. Both the clay and lime-stone were pulverized, that they might more exactly incorporate when mixed. Then the centesimal proportions will stand thus:

Coarse silex	- -	25
Finer	- -	21
		—46
Argill	- -	16,5
Calx	- - -	37,5
		100

The quantities in the troy pound, supposing the water, &c. to amount to 100 grains, are:

Coarse sand	- -	1415
Finer	- -	1188
		—2603
Argill	- -	934
Calx	- -	2122
		5659

"The second contained two-eighths of potters clay, three-eighths parings of lime-stone, and three-eighths coarse sand. The centesimal proportions are:

Coarse sand	-	37,5
Finer	- -	14
		—51,5
Argill	- -	11
Calx	- - -	37,5
		100

"In the troy pound, supposing the quantity of water to amount to 100 grains, the quantities of the three earths will be:

Coarse silex	-	2122
Finer	- -	792
		—2914
Argill	- -	622
Calx	- - -	2122
		5658

"Hence it is seen that in the drier countries, where the fall of rain is but 20 inches, the soil, to be fertile, must be closer, and the quantity of calcareous earth much increased, and that of the siliceous much diminished. Thus, in the climate of Turin, where the fall of rain exceeds 40 inches, the proportion of silecious earth is from 77 to 80 per cwt. and that of calcareous, from 9 to 14, to suffer this excess of rain more easily to evaporate. In the climate of Upsal, where the fall of rain is 24 inches, the proportion of silex is only 56 per cwt. but that of calx is 30; and in the climate of Paris, which is still drier, the proportion of silex is only from 46 to 51, and that of calx 37,5 per cwt. and hence we may perceive the necessity of attending to the average quantity of rain to judge of the proper constitution of fertile lands on fixed principles. The quantity of rain differs much in different parts of the same kingdom; but in general in Ireland, Mr. Kerwan believes it to be between 24 and 28 inches on an average.

"In the two last mixtures the proportions vary considerably: the first may serve, he says, as a model for the heavier soils, and the second for the lighter. In these and the following experiments, the carbonic principle seems to have been extracted from the surrounding garden-mould with which the pots communicated, by means of their perforation at bottom."

In regard to barren mixtures, it is remarked, that, "*first*, Mr. Tillet, in his sixth and eighth experiments, mixed three-eighths of potters clay with three-eighths of parings of lime-stone and two-eighths of fine sand; the only difference between this mixture and that of the first experiment was, that in the first experiment coarse sand was used, and in this fine, yet the former was fruitful in the highest degree; but in this the grain prospered indeed the first year, but sickened in the second, and failed in the third: the proportions have been already stated.

Here we have, it is supposed, a clear proof of the necessity of an open texture in soils, without which the best proportions are useless." And it is further stated, that, "*second*, in his thirteenth experiment he employed a mixture of two-eighths potters clay, four-eighths coarse sand, and two-eighths marl. The corn grew well the first year, poorly the second, and decayed the third. The composition of the marl is not mentioned; but supposing it to contain 70 per cwt. of calx, and 30 of clay, of which the one-half is argill, it would form one of the richest sorts of marls. The centesimal proportions of this mixture should be:

Silex	-	50 + 14 = 64
Argill	-	11 + 8 = 19
Calx	-	17
		100

And in the troy pound, supposing the water, &c. to amount to 100 grains, the quantities will be:

Silex	-	3622
Argill	-	1075
Calx	-	962
		5659"

It is added, that "the sterility of this mixture seems to proceed from a defect of calcareous earth. If we suppose the marl poorer in that earth, the defect will be still greater. The retentive powers of the different earths with respect to water, being expressed by the quantities which each can retain without suffering any to drop, as above noticed, and the quantities retained by the mixed mass of these earths being proportional to the respective quantities of each, it should seem that in fertile soils, where the fall of rain is from 20 to 30 inches, this power should not exceed 70, nor fall short of 50 per cent. It were, Mr. Kerwan says, of great consequence to settle this point with precision; but to do this would require more numerous experiments."

But in order to explain his meaning he shall give one example.

In respect to the retentive power of the fertile soils, mentioned by Mr. Bergman, it is stated, that "this soil contains, as has been already seen:

Silex	-	56
Argill	-	14
Calx	-	30

Now the retentive power of 100 parts,

Silex	= 35
Argill	= 250
Calx	= 50

Consequently the retentive power of:

56 parts	Silex	=	13
14	- Argill	=	35
30	- Calx	=	15
			—63

It is added, that "the constitution of the Irish fertile soils has not been ascertained, nor has the average annual quantity of rain been determined: but he should suppose its best soil to approach to the nature of that of Upsal, the fall of rain being probably between 24 and 28 inches. In 1792, which was reckoned remarkably wet, it was 30½ inches in Dublin."

It is farther observed by Mr. Kerwan, that "before he quits the experiments of M. Tillet, it will be proper to mention a few made by him, which seem to invalidate the necessity of the presence of the three simple earths in fertile soils.

"1mo. In his 26th experiment, he tells us, he says, he employed only pure sand, such as is used for making glass, yet corn grew well in it the first year, indifferently the second, and nearly failed in the third. Mr. Hassenfraz having repeated the experiment in pots unperforated, did not find it to succeed even the first year; therefore, says Mr. Kerwan, the success of M. Tillet was owing to the perforation at the bottom of his pot, through which water impregnated with the different earths, and coal must have passed. In fact, M. Tillet's conclusion is contradicted by universal experience.

"2°. In his 28th experiment, in which powdered limestone only was employed, the corn sown prospered exceedingly during the three years. To the cause mentioned, in treating of the 26th, he must add, that the limestone he used was that of St. Leu, which contains clay, and consequently silex and argill; it is so porous as to admit from 3-19ths to 1-5th of its weight in water, as Mr. Brisson has shewn; and thus is easily decomposed. The coarse powder to which it was reduced answered the same purpose as coarse silex; and the finer might nourish the plants.

"3°. In his 30th experiment he employed mere potters clay; the grain grew tolerably well the first year, but perished the second; on the third it flourished most. It is hard to draw any specific conclusion from this experiment, for it is plain that if the texture were not much looser than that of clay, the corn could not grow at all, as was the case in his 6th and 8th experiments, and as Mr. Hassenfraz, who repeated this experiment, observed. Rain-water might however supply a small quantity of calx sufficient for a small produce of corn."

Professor Davy, in speaking of the improvement of soils, as connected with the principle of their composition, remarks in the above paper that "when a barren soil is examined with a view to its improvement, it ought in all cases, if possible, to be compared with an extremely fertile soil in the same neighbourhood, and in a similar situation: the difference given by their analyses would indicate the

methods of cultivation; and thus the plan of improvement would be founded upon accurate scientific principles." And that, "if the fertile soil contained a large quantity of sand, in proportion to the barren soil, the process of amelioration would depend simply upon a supply of this substance; and the method would be equally simple with regard to soils deficient in clay or calcareous matter." But that "in the application of clay, sand, loam, marle, or chalk to lands, there are no particular chemical principles to be observed; but when quick lime is used, great care must be taken that it is not obtained from the magnesian limestone; for in this case, as has been shewn by Mr. Tennant, it is exceedingly injurious to land. The magnesian limestone may be distinguished from the common limestone by its greater hardness, and by the length of time that it requires for its solution in acids, and it may be analyzed by the process for carbonate of lime and magnesia."

"When the analytical comparison indicates an excess of vegetable matter, as the cause of sterility, it may be destroyed by much pulverization and exposure to air, by paring and burning, or the agency of lately made quick lime. And the defect of animal and vegetable matter must be supplied by animal or vegetable manure."

It is further stated that sterile soils in different climates and situations must differ in composition. "The general indications of fertility and barrenness, as found by chemical experiments, must necessarily differ in different climates, and under different circumstances. The power of soils to absorb moisture, a principle essential to their productiveness, ought to be much greater in warm and dry countries, than in cold and moist ones; and the quantity of fine aluminous earth they contain larger. Soils likewise that are situated on declivities, ought to be more absorbent than those in the same climate on plains or in valleys. The productiveness of soils must likewise be influenced by the nature of the subsoil, or the earthy or stony strata on which they rest; and this circumstance ought to be particularly attended to, in considering their chemical nature, and the system of improvement. Thus a sandy soil may sometimes owe its fertility to the power of the subsoil to retain water; and an absorbent clayey soil may occasionally be prevented from being barren, in a moist climate, by the influence of a substratum of sand or gravel."

That in regard to the chemical composition of fertile corn soils in this climate, "those soils that are most productive of corn, contain always certain proportions of aluminous and calcareous earth in a finely divided state, and a certain quantity of vegetable or animal matter.

"The quantity of calcareous earth is however very various, and in some cases exceedingly small. A very fertile corn soil from Ormiston in East Lothian afforded the writer in an hundred parts, only eleven parts of mild calcareous earth; it contained twenty-five parts of siliceous sand; the finely divided clay amounted to forty-five parts. It lost nine in decomposed animal and vegetable matter, and four in water, and afforded indications of a small quantity of phosphate of lime.

"This soil was of a very fine texture, and contained very few stones or vegetable fibres. It is not unlikely that its fertility was in some measure connected with the phosphate; for this substance is found in wheat, oats, and barley, and may be a part of their food. A soil from the low lands of Somersetshire, celebrated for producing excellent crops of wheat and beans without manure, he found to consist of one-ninth of sand, chiefly siliceous, and eight-ninths of calcareous marle tinged with iron, and containing about five parts in the hundred of vegetable matter. He could not detect in it any phosphate or sulphate of lime, so that its fertility must have depended principally upon its power of attracting principles of vegetable nourishment from water and the atmosphere." And Mr. Tillet, as has been seen above, "found that a soil composed of three-eighths of clay, two-eighths of river sand, and three eighths of the parings of limestone, was very proper for wheat."

With respect to the composition of soils proper for bulbous roots and for trees, it is observed that, "in general, bulbous roots require a soil much more sandy, and less absorbent than the grasses. A very good potatoe soil, from Varsel in Cornwall, afforded him seven-eighths of siliceous sand; and its absorbent power was so small, that one hundred parts lost only two by drying at 400 Fahrenheit.

"Plants and trees, the roots of which are fibrous and hard, and capable of penetrating deep into the earth, will vegetate to advantage in almost all common soils, which are moderately dry, and which do not contain a very great excess of vegetable matter.

"He found the soil taken from a field at Sheffield-place in Sussex, remarkable for producing flourishing oaks, to consist of six parts of sand, and one part of clay and finely divided matter. And one hundred parts of the entire soil submitted to analysis, produced

	Parts.
Water	3
Silex	54
Alumine	28
Carbonate of lime	3
Oxide of iron	5
Decomposing vegetable matter	4
Loss	3"

On the advantages of improvements made by changing the composition of the earthy parts of soils, it is observed that, "from the great difference of the causes that influence the productiveness of lands, it is obvious that, in the present state of science, no certain system can be devised from their improvement, independent of experiment: but there are few cases in which the labour of analytic trials will not be amply repaid by the certainty with which they denote the best methods of amelioration; and this will particularly happen, when the defect of composition is found in the proportions of the primitive earths.

"In supplying animal or vegetable manure, a tem-

porary food only is provided for plants, which is in all cases exhausted by means of a certain number of crops; but when a soil is rendered of the best possible constitution and texture, with regard to its earthy parts, its fertility may be considered as permanently established. It becomes capable of attracting a very large portion of vegetable nourishment from the atmosphere, and of producing its crops with comparatively little labour and expense."

The great difficulty, or almost impossibility, of affording any directions or marks for ascertaining the properties and qualities of lands that can be fully depended on, must be obvious from the great diversity that takes place in the nature and composition of soils; but notwithstanding various modes and processes have been proposed at different times, that by means of chemical analysis is, without doubt, the most correct and satisfactory; but it is attended with considerable expense, and requires a pretty intimate acquaintance with the science, which is not often met with in the common farmer. It can therefore be only well executed by those who have studied the subject. Where this method is had recourse to, the following rules and directions, laid down by professor Davy in the paper before alluded to, may be found useful.

"1. *Instruments required for the analysis of soils.* The really important instruments required for the analysis of soils are, he says, few, and but little expensive. They are a balance capable of containing a quarter of a pound of common soil, and capable of turning when loaded, with a grain; a series of weights from a quarter of a pound troy to a grain; a wire sieve, sufficiently coarse to admit a pepper corn through its apertures; an Argand lamp and stand; some glass bottles; Hessian crucibles; porcelain, or queen's ware evaporating basons; a Wedgewood pestle and mortar; some filters made of half a sheet of blotting paper, folded so as to contain a pint of liquid, and greased at the edges; a bone knife, and an apparatus for collecting and measuring aeriform fluids.

"The chemical substances or reagents required for separating the constituent parts of the soil, are muriatic acid (spirit of salt), sulphuric acid, pure volatile alkali dissolved in water, solution of prussiate of potash, soap lye, solution of carbonate of ammoniac, of muriate of ammonia, solution of neutral carbonate of potash, and nitrate of ammoniac. An account of the nature of these bodies and their effects, may be found in Dr. Thomson's System of Chemistry, and Henry's Epitome; and the reagents are sold together with the instruments mentioned above, by Mr. Knight, Foster Lane, Cheapside, arranged in an appropriate chest.

"2. *Mode of collecting soils for analysis.* In cases when the general nature of the soil of a field is to be ascertained, specimens of it should be taken from different places, two or three inches below the surface, and examined as to the similarity of their properties. It sometimes happens, that upon plains the whole of the upper stratum of the land is of the same kind, and in this case, one analysis will be sufficient; but in valies, and near the beds of rivers, there are very great differences, and it now and then occurs that one part of a field is calcareous, and another part siliceous; and in this case, and in analogous cases, the portions different from each other should be separately submitted to experiment.

"Soils when collected, if they cannot be immediately examined, should be preserved in phials quite filled with them, and closed with ground glass stoppers.

"The quantity of soil most convenient for a perfect analysis, is from two to four hundred grains. It should be collected in dry weather, and exposed to the atmosphere till it becomes dry to the touch.

"The specific gravity of a soil, or the relation of its weight to that of water, may be ascertained by introducing into a phial, which will contain a known quantity of water, equal volumes of water and of soil, and this may be easily done by pouring in water till it is half full, and then adding the soil till the fluid rises to the mouth; the difference between the weight of the soil and that of the water, will give the result. Thus if the bottle contains four hundred grains of water, and gains two hundred grains when half filled with water and half with soil, the specific gravity of the soil will be 2, that is, it will be twice as heavy as water, and if it gained one hundred and sixty-five grains, its specific gravity would be 1825, water being 1000.

"It is of importance, that the specific gravity of a soil should be known, as it affords an indication of the quantity of animal and vegetable matter it contains; these substances being always most abundant in the lighter soils.

"The other physical properties of soils should likewise be examined before the analysis is made, as they denote, to a certain extent, their composition, and serve as guides in directing the experiments. Thus siliceous soils are generally rough to the touch, and scratch glass when rubbed upon it; aluminous soils adhere strongly to the tongue, and emit a strong earthy smell when breathed on; and calcareous soils are soft, and much less adhesive than aluminous soils.

"3. *Mode of ascertaining the quantity of water of absorption in soils.* Soils, though as dry as they can be made by continued exposure to air, in all cases still contain a considerable quantity of water, which adheres with great obstinacy to the earths and animal and vegetable matter, and can only be driven off from them by a considerable degree of heat. The first process of analysis is, to free the given weight of soil from as much of this water as possible, without in other respects, affecting its composition; and this may be done by heating it for ten or twelve minutes over an Argand's lamp, in a bason of porcelain, to a temperature equal to 300 Fahrenheit. In several experiments, in which this process has been carried on by distillation, he has found the water that came over pure, and no sensible quantity of other volatile pmatter was produced. And in case a thermometer

is not used, the proper degree may be easily ascertained, by keeping a piece of wood in contact with the bottom of the dish; as long as the colour of the wood remains unaltered, the heat is not too high; but when the wood begins to be charred, the process must be stopped. A small quantity of water will perhaps remain in the soil even after this operation, but it always affords useful comparative results; and if a higher temperature were employed, the vegetable or animal matter would undergo decomposition, and in consequence the experiment be wholly unsatisfactory.

"The loss of weight in the process should be carefully noted, and when in four hundred grains of soil it reaches as high as 50, the soil may be considered as in the greatest degree absorbent, and retentive of water, and will generally be found to contain a large proportion of aluminous earth. When the loss is only from 20 to 10, the land may be considered as only slightly absorbent and retentive, and the siliceous earth as most abundant.

"4. *The separation of stones, gravel, and vegetable fibres from soils.* None of the loose stones, gravel, or large vegetable fibres should be divided from the pure soil till after the water is drawn off; for these bodies are themselves often highly absorbent and retentive, and in consequence influence the fertility of the land. The next process, however, after that of heating, should be their separation, which may be easily accomplished by the sieve, after the soil has been gently bruised in a mortar. The weights of the vegetable fibres of wood, and of the gravel and stones should be separately noted down, and the nature of the last ascertained; if calcareous, they will effervesce with acids; if siliceous, they will be sufficiently hard to scratch glass; and if of the common aluminous class of stones, they will be soft, easily scratched with a knife, and incapable of effervescing with acids.

"5. *Separation of the sand and clay, or loam, from each other.* The greater number of soils, besides gravel and stones, contain larger or smaller proportions of sand of different degrees of fineness; and it is a necessary operation, the next in the process of analysis, to detach them from the parts in a state of more minute division, such as clay, loam, marle, and vegetable and animal matter. This may be effected in a way sufficiently accurate, by agitation of the soil in water. In this case, the coarse sand will generally separate in a minute, and the finer in two or three minutes, whilst the minutely divided earthy, animal, or vegetable matter will remain in a state of mechanical suspension for a much longer time; so that by pouring the water from the bottom of the vessel, after one, two, or three minutes, the sand will be principally separated from the other substances, which, with the water containing them, must be poured into a filter, and after the water has passed through, collected, dried and weighed. The sand must likewise be weighed, and their respective quantities noted down. The water of lixiviation must be preserved, as it will be found to contain the saline matter, and the soluble animal vegetable matters, if any exist in the soil.

"6. *Examination of the sand.* By the process of washing and filtration, the soil is separated into two portions, the most important of which is generally the finely divided matter. A minute analysis of the sand is seldom or never necessary, and its nature may be detected in the same manner as that of the stones or gravel. It is always either siliceous sand, or calcareous sand, or a mixture of both. If it consists wholly of carbonate of lime, it will be rapidly soluble in muriatic acid, with effervescence; but if it consist partly of this substance, and partly of siliceous matter, the respective quantities may be ascertained by weighing the residuum after the action of the acid, which must be applied till the mixture has acquired a sour taste, and has ceased to effervesce. This residuum is the siliceous part: it must be washed, dried, and heated strongly in a crucible; the difference between the weight of it and the weight of the whole, indicates the proportion of calcareous sand.

"7. *Examination of the finely divided matter of soils, and mode of detecting mild lime and magnesia.* The finely divided matter of the soil is usually very compound in its nature; it sometimes contains all the four primitive earths of soils, as well as animal and vegetable matter; and to ascertain the proportions of these with tolerable accuracy is the most difficult part of the subject.

"The first process to be performed, in this part of the analysis, is the exposure of the fine matter of the soil to the action of the muriatic acid. This substance should be poured upon the earthy matter in an evaporating bason, in a quantity equal to twice the weight of the earthy matter; but diluted with double its volume of water. The mixture should be often stirred, and suffered to remain for an hour or an hour and a half before it is examined.

"If any carbonate of lime or of magnesia exist in the soil, they will have been dissolved in this time by the acid, which sometimes takes up likewise a little oxide of iron; but very seldom any alumine.

"The fluid should be passed through a filter; the solid matter collected, washed with rain water, dried at a moderate heat, and weighed. Its loss will denote the quantity of solid matter taken up. The washings must be added to the solution, which if not sour to the taste, must be made so by the addition of fresh acid, when a little solution of common prussiate of potash must be mixed with the whole. If a blue precipitate occurs, it denotes the presence of oxide of iron, and the solution of the prussiate must be dropped in till no farther effect is produced. To ascertain the quantity, it must be collected in the same manner as other solid precipitates, and heated red; the result is oxide of iron.

"Into the fluid freed from oxide of iron, a solution of neutralized carbonate of potash must be poured till all effervescence ceases in it, and till its

taste and smell indicate a considerable excess of alkaline salt.

"The precipitate that falls down is carbonate of lime; it must be collected on the filter, and dried at a heat below that of redness.

"The remaining fluid must be boiled for a quarter of an hour, when the magnesia, if any exist, will be precipitated from it, combined with carbonic acid, and its quantity is to be ascertained in the same manner as that of the carbonate of lime.

"If any minute proportion of alumine should, from peculiar circumstances, be dissolved by the acid, it will be found in the precipitate with the carbonate of lime, and it may be separated from it by boiling for a few minutes with soap lye, sufficient to cover the solid matter. This substance dissolves alumine, without acting upon carbonate of lime.

"Should the finely divided soil be sufficiently calcareous to effervesce very strongly with acids, a very simple method may be adopted for ascertaining the quantity of carbonate of lime, and one sufficiently accurate in all common cases.

"Carbonate of lime, in all it states, contains a determinate proportion of carbonic acid, i. e. about 45 per cent. so that when the quantity of this elastic fluid, given out by any soil during the solution of its calcareous matter in an acid, is known, either in weight or measure, the quantity of carbonate of lime may be easily discovered.

"When the process by diminution of weight is employed, two parts of the acid and one part of the matter of the soil must be weighed in two separate bottles, and very slowly mixed together till the effervescence ceases; the difference between their weight before and after the experiment, denotes the quantity of carbonic acid lost; for every four grains and a half of which, ten grains of carbonate of lime must be estimated.

"The best method of collecting the carbonic acid, so as to discover its volume, is by the pneumatic apparatus, the construction and application of which is described below. The estimation is, for every ounce measure of carbonic acid, two grains of carbonate of lime.

"8. *Mode of ascertaining the quantity of insoluble finely divided animal and vegetable matter.* After the fine matter of the soil has been acted upon by muriatic acid, the next process is to ascertain the quantity of finely divided insoluble animal and vegetable matter that it contains.

"This may be done with sufficient precision, by heating it to strong ignition in a crucible over a common fire till no blackness remains in the mass. It should be often stirred with a metallic wire, so as to expose new surfaces continually to the air; the loss of weight that it undergoes denotes the quantity of the substance that it contains destructible by fire and air.

"It is not possible to ascertain whether this substance is wholly animal or vegetable matter, or a mixture of both. When the smell emitted during the incineration is similar to that of burnt feathers, it is a certain indication of some animal matter; and a copious blue flame at the time of ignition, almost always denotes a considerable proportion of vegetable matter. In cases when the experiment is needed to be very quickly performed, the destruction of the decomposible substances may be assisted by the agency of nitrate of ammoniac, which at the time of ignition may be thrown gradually upon the heated mass in a quantity of twenty grains for every hundred of residual soil. It affords the principle necessary to the combustion of the animal and vegetable matter, which it causes to be converted into elastic fluids; and it is itself at the same time decomposed and lost."

"9. *Mode of separating aluminous and siliceous matter and oxide of iron.* The substances remaining after the decomposition of the vegetable and animal matter, are generally minute particles of earthy matter, containing usually alumine and silex with combined oxide of iron.

"To separate these from each other, the solid matter should be boiled for two or three hours with sulphuric acid, diluted with four times its weight of water; the quantity of the acid should be regulated by the quantity of solid residuum to be acted on, allowing for every hundred grains two drachms, or one hundred and twenty grains of acid.

"The substance remaining after the action of the acid, may be considered as siliceous; and it must be separated, and its weight ascertained, after washing and drying in the usual manner.

"The alumine and the oxide of iron, if they exist, are both dissolved by the sulphuric acid, they may be separated by carbonate of ammoniac; added to excess it throws down the alumine, and leaves the oxide of iron in solution, and this substance may be separated from the liquid by boiling.

"Should any magnesia and lime have escaped solution in the muriatic acid, they will be found in the sulphuric acid; this, however, is scarcely ever the case; but the process for detecting them and ascertaining their quantities, is the same in both instances.

"The method of analysis by sulphuric acid, is sufficiently precise for all usual experiments; but if very great accuracy be an object, dry carbonate of potash must be employed as the agent, and the residuum of the incineration must be heated red for half an hour, with four times its weight of this substance, in a crucible of silver, or of well baked porcelain. The mass obtained must be dissolved in muriatic acid, and the solution evaporated till it is nearly solid; distilled water must then be added, by which the oxide of iron and all the earths, except silex, will be dissolved in combination as smuriates. The silex, after the usual process of lixiviation, must be heated red; the other substances may be separated in the same manner as from the muriatic and sulphuric solutions.

"This process is the one usually employed by chemical philosophers for the analysis of stones

"10. *Mode of discovering soluble animal and vegetable matter, and saline matter.* "If any

saline matter, or soluble vegetable or animal matter, if suspected in the soil, it will be found in the water of lixiviation used for separating the sand.

"This water must be evaporated to dryness in an appropriate dish, at a heat below its boiling point.

"If the solid matter obtained is of a brown colour and inflammable, it may be considered as partly vegetable extract. If its smell, when exposed to heat, be strong and fetid, it contains animal mucilaginous or gelatinous substance; if it be white and transparent, it may be considered as principally saline matter. Nitrate of potash (nitre) or nitrate of lime, is indicated in this saline matter, by its scintillating with burning coal. Sulphate of magnesia may be detected by its bitter taste; and sulphate of potash produces no alteration in solution of carbonate of ammoniac, but precipitates solution of muriate of barytes.

"11. *Mode of detecting Sulphate of Lime (Gypsum) and Phosphate of Lime in Soils.* Should sulphate or phosphate of lime be suspected in the entire soil, the detection of them requires a particular process upon it. A given weight of it, for instance four hundred grains, must be heated red for half an hour in a crucible, mixed with one-third of powdered charcoal. The mixture must be boiled for a quarter of an hour, in a half pint of water, and the fluid collected through the filter, and exposed for some days to the atmosphere in an open vessel. If any soluble quantity of sulphate of lime (gypsum) existed in the soil, a white precipitate will gradually form in the fluid, and the weight of it will indicate the proportion.

"Phosphate of lime, if any exist, may be separated from the soil after the process for gypsum. Muriatic acid must be digested upon the soil, in quantity more than sufficient to saturate the soluble earths; the solution must be evaporated, and water poured upon the solid matter. This fluid will dissolve the compounds of earths with the muriatic acid, and leave the phosphate of lime untouched.

"It would not, the writer says, fall within the limits assigned to this paper, to detail any processes for the detection of substances which may be accidentally mixed with the matters of soils. Manganese is now and then found in them, and compounds of the barytic earth; but these bodies appear to bear little relation to fertility or barrenness, and the search for them would make the analysis much more complicated without rendering it more useful.

"12. *Statement of Results and Products.* When the examination of a soil is compleated, the products should be classed, and their quantities added together, and if they nearly equal the original quantity of soil, the analysis may be considered as accurate. It must, however, be noticed, that when phosphate or sulphate of lime are discovered by the independent process just stated, a correction must be made for the general process, by subtracting a sum equal to their weight from the quantity of carbonate of lime, obtained by precipitation from the muriatic acid.

"In arranging the products, the form should be in the order of the experiments by which they were obtained.

"Thus 400 grains of a good siliceous sandy soil may be supposed to contain

		Grains.
Of water of absorption		18
Of loose stones and gravel principally siliceous		42
Of undecompounded vegetable fibres		10
Of fine silicious sand		200
Of minutely divided matter separated by filtration and consisting of		
Carbonate of lime	25	
Carbonate of magnesia	4	
Matter destructible by heat, principally vegetable	10	
Silex	40	
Alumine	32	
Oxide of iron	4	
Soluble matter, principally sulphate of potash and vegetable extract	5	
Gypsum	3	
Phosphate of lime	2	
		125
Amount of all the products		395
Loss		5

"In this instance the loss is supposed small; but in general, in actual experiments, it will be found much greater in consequence of the difficulty of collecting the whole quantities of the different precipitates; and when it is within thirty for four hundred grains, there is no reason to suspect any want of due precision in the processes.

13. *This general method of analysis may in many cases be much simplified.* When the experimenter is become acquainted with the use of the different instruments, the properties of the reagents, and the relation between the external and chemical qualities of soils, he will seldom find it necessary to perform in any one case, all the processes that have been described. When his soil, for instance, contains no notable proportion of calcareous matter, the action of the muriatic acid 7, may be omitted. In examining peat soils, he will principally have to attend to the operation by fire and air 8, and in the analysis of chalks and loams he will often be able to omit the experiment by sulphuric acid 9.

"In the trials that are made by persons unacquainted with chemistry, they must not expect much precision of result. Many difficulties will be met with; but in over-coming them, the most useful kind of practical knowledge will be obtained, and nothing is so instructive in experimental science as the detection of mistakes. The correct analyst ought to be well grounded in chemical information; but perhaps there is no better mode of gaining it than that of attempting original investigations. In pursuing his experiments, he will be continually obliged to learn from books the history of the substances he is employing or acting upon, and his theoretical ideas will be more valuable in being connected with practi-

cal operations, and acquired for the purpose of discovery.

"*Description of the apparatus for the analysis of soils.* A. *Fig.* 1. *Pl.* XXXI. is a Retort.

B. B. Funnels for the purpose of filtering.

E. Argand's lamp.

F. G. H. K. *fig.*2, the different parts of the apparatus required for measuring the quantity of elastic fluid given out during the action of an acid on calcareous soils. F. represents the bottle for containing the soil. K. the bottle containing the acid, furnished with a stop-cock. G. the tube connected with a flaccid bladder. I. the graduated measure. H. the bottle for containing the bladder. When this instrument is used, a given quantity of soil is introduced into F; K is filled with muriatic acid, diluted with an equal quantity of water; and the stop-cock being closed is connected with the upper orifice of F, which is ground to receive it. The tube G is introduced into the lower orifice of F, and the bladder connected with it placed in its flaccid state into H, which is filled with water. The graduated measure is placed under the tube of H. When the stop-cock of K. is turned, the acid flows into F, and acts upon the soil; the elastic fluid generated passes through G into the bladder, and displaces a quantity of water in H equal to it in bulk, and this water flows through the tube into the graduated measure; the water in which gives by its volume the indication of the proportion of carbonic acid disengaged from the soil; for every ounce measure of which two grains of carbonate of lime may be estimated.

L. Represents the stand for the lamp.

M, N, O, P, Q, R, S. *fig.* 1, represent the bottles containing the different reagents."

Another method of deciding in regard to the nature, properties, and qualities of soils, but which is far inferior to that of chemical analysis, though most frequently had recourse to in the purchasing of land, is that of attending to the growth and colour of the vegetables which grow upon or cover it; but it requires a sound judgment, much experience, and a correct eye in the execution. Hence when plants that are the natural production of good soils, or such as are of particular kinds, are found in healthy and flourishing states of growth in other situations, the soils may be supposed to be of this or that sort, according to the difference of circumstances in which they are met with. Thus, the dock, the thistle, the rush, and the nettle, may show different descriptions of soils; the first affording the mark of an inferior soil of the stiff kind, the second that of a good one, the third that of the wet cold clayey kind, and the last that of the dry loamy description. It has likewise been remarked by the author of Phytologia, that the fox glove, *digitalis*, and the sand wort, *arin aria*, are generally found on sandy soils; while the *veronica beca bunga*, and cresses of some kinds, belong to moist situations, and others to mountainous ones. The fern is likewise mostly found on good soils: and he suggests that a particular catalogue of such plants as grow spontaneously in different situations, might be advantageous in showing the fertility and nature of the soils, as those of the flowering kind, by the periods of their opening in different climates, may teach the temperature of the season. The healthy appearance and growth of different sorts of trees of the timber kinds, as well as of hedges, may likewise afford useful information in this respect in many cases.

It is customary also, for farmers to have recourse to other marks in forming their judgments of soils, such as their appearances or colours, and their adhesion, tenacity or looseness, and friability.

Thus the hazel brown shows a valuable sort of loamy soil, and the reddish sandy mould, a good one of the lighter kind. The wetness of lands should likewise be well considered, so far as it is connected with the nature of the soil. From the full consideration of all these different circumstances, with a competent experience, a tolerably correct decision may in general be formed in respect to the nature of land. See *Farm*.

It is obvious from what has been advanced, that soils must be of very different kinds, according to the nature of the principal material or matters of which they are composed. This has indeed led to an almost endless division of them by the farmer, and which he has denominated by a great variety of local terms little known or understood except in the particular district in which they have originated. But they may be sufficiently distinguished for all the practical purposes of the farmer, under the following heads:

Division of Soils.

Clayey,	*Gravelly*,	*Boggy* and
Loamy,	*Sandy*,	*Heathy* or
Chalky,	*Peaty* or *mossy*,	*Moory*.

However, these several divisions must evidently be capable of being subdivided under various other heads according to the differences in the constituent ingredients.

Clayey Soils. As clay is seldom found in any thing near a state of purity in soils, it is plain that there must be much difference in the soils in which it is the chief constituent principle, according to the proportion and nature of the admixture that has taken place. These soils are mostly found to contain an intermixure of different earthy materials, with various animal, vegetable, and mineral substances, and often blended with considerable quantities of siliceous and sandy matters. It has been observed in a late practical work, on the authority of Dr. Anderson, that it is upon this account that "the clayey soils of some districts are so abundantly fruitful and productive, while those of others are insuperably sterile and refractory. Farmers, or those engaged in cultivating land, for the most part being only acquainted or conversant with earth or mould, as it offers itself to their attention in the gross or whole, have not, he thinks, been led to remark the astonishing diversity that takes place in respect to the properties of clays and other bodies that are united with them as primitive and constituent parts of soils, in their original and native states; but having found that they all

agreed in possessing the property of imbibing and retaining moisture, and thereby becoming soft and ductile, have, probably too hastily, concluded them to have in some measure a similarity in their other qualities. In this way erroneous notions have frequently, he supposes, been engendered respecting soils in which these substances abound. For it is well ascertained from the use of clays in states of greater purity, that there are essential differences in their qualities. There are some sorts, as that which is denominated fullers-earth, and several of the soft boles that have the cohesive property in but a very slight degree; while others, such as those which are termed *tills*, are so extremely tenacious and viscid, as to be capable of being drawn out into threads: and there are still others, which from their softness and property of imbibing water readily, are capable of being cut with great facility by any sharp instrument; while some other sorts are so firm, hard, and compact, as scarcely to admit of being softened by means of water. The clays which are employed for making the finest porcelain, and those used in the composition of the more coarse wares, are only to be met with in particular situations and districts. This fully shows that much diversity must exist in the nature of soils of this description, and which are perhaps far from being yet fully understood.

But, besides soils of this sort differing in these respects, they have an equal diversity in their appearances or colours, and their textures; being found in the state of nature of very different colours, as red, white, blue, and yellow, and of very different degrees of compactness or density, in some cases readily admitting the intermixture of other matters to improve them; while in others they are highly refractory in this respect, being with very great difficulty made to unite with them.

It is plain that in the first of these varieties of clayey soils, the proportion of siliceous or sandy material must be considerably larger than in the latter, in relation to that of the clayey part. But notwithstanding the above, all these descriptions of soils are found to possess some degree or other of the stiff or heavy quality, according to which, with proper attention to their other circumstances, their cultivation and improvement must be conducted.

But the following chemical analysis of different sorts of clays, as executed by the late ingenious Mr. Somerville, and detailed in his valuable Survey of East Lothian, may place the nature of such soils in a more clear point of view.

Common loamy Clay. Experiment 1.—"Half a pound of clay of a quality approaching to loam, but possessing considerably more cohesion, yielded, upon distillation, one ounce and a quarter of an alkaline liquor, which effervesced with acids, and turned syrup of violets green."

Experiment 2.—"The same clay burnt, afterwards pounded, and washed with boiling water, yielded an alkaline solution possessing the same properties."

Experiment 3.—"The same soil, mixed with quick lime, was boiled for a considerable time in water, and the liquor strained and saturated with vitriolic acid. It was then set to cool, and, when cold, filtered a second time, when it yielded a quantity of oily matter, in the proportion of nearly one half more than was obtained from the richest loam."

Experiment 4.—"The same soil boiled in water, without any addition, and the liquor strained and saturated with vitriolic acid, yielded gypsum in small quantities."

Experiment 5.—"The magnet applied to this clay, discovered iron, but in small quantity."

Strong Clay. Experiment 6.—"Half a pound of clay, taken from the surface of a field, of a very strong texture, yielded, upon distillation, one ounce of an alkaline liquor, possessing the same properties as in the foregoing operations."

Experiment 7.—"The same soil burnt, and afterwards well pulverized, and washed with boiling water, afforded an alkaline liquor possessing the same properties as in the foregoing experiment."

Experiment 8.—"The same quantity was mixed with potash and lime, and boiled for a considerable time in water: the liquor, when strained, was saturated with vitriolic acid, and afforded an oily matter, but in greater quantity than in Experiment 3."

Experiment 9.—"The same soil, boiled, and treated with vitriolic acid, yielded gypsum."

Experiment 10.—"The same soil, burnt and examined with the magnet, discovered iron, in greater proportion than was met with in Experiment 5."

Clay taken from the top of Limestone. Experiment 11.—"Half a pound of clay, taken from a stratum of limestone, where the rock was within a foot of the surface, yielded, upon distillation, about one ounce and a half of a liquor that effervesced with acids, and seemed to possess all the properties of an alkali.

Experiment 12.—"The same quantity burnt, and afterwards broke small, and boiled, yielded a liquor possessing the same properties"

Experiment 13.—"The same clay, treated with lime and potash, and afterwards saturated with vitriolic acid, afforded an oily matter, but in smaller quantity than was obtained in Experiments 3 or 8."

Experiment 14.—"The same clay, boiled in water for two hours, and saturated with vitriolic acid, let fall a considerable quantity of gypsum."

Experiment 15.—"The same clay burnt, and examined with the magnet, discovered no iron."

It is observed that "similar trials were made upon loam and gravel situated above limestone, with nearly the same result."

The clay termed Till. "In East Lothian, it is stated, the name of till is given to such of the thin clays as are blue, yellow, and red coloured, and, at the same time, barren."

Experiment 16.—"Half a pound of blue till yielded, upon distillation, only an insipid water."

Experiment 17.—"The same quantity burnt, and boiled in water, afforded a liquor, which did not effervesce with acids, but turned the syrup of violets, green."

Experiment 18.—"The same quantity, mixed with lime and potash, and boiled in water, when strained, yielded a greasy matter, in a proportion nearly equal to the strongest clay."

Experiment 19.—"Some of this till, boiled in wa-

ter without any addition, and afterwards saturated with vitriolic acid, discovered no gypsum."

Experiment 20.—"A quantity of this till, properly burnt and pulverized, when examined by the magnet, discovered iron in very great quantity."

It is added that "similar trials were made upon different tills, all of which discovered nearly the same principles, and all went to prove, that it contained iron in a much greater proportion than any other soil."

The intelligent writer concludes, that these "experiments seem to prove, that the principal constituent parts of fertile clays are, alkaline salts, calcareous earth, and oil, together with a very small proportion of iron. In the strongest and most retentive clays the proportion of oil is greater, and that of alkaline salt and calcareous earth less, than in such as approach nearer to the nature of loam, except in the experiments, when the clay was taken from the top of a lime-rock, in which it was found to contain less oil than any of the others, and more calcareous earth than either loam, or any of the other clays; it differs further in containing no iron."

And it is supposed that "tills contain the same principles as other clays, with the exception of calcareous earth, of which they appear to be entirely destitute, in place of which, they contain a very great proportion of iron, which seems to be the principal cause of their barrenness, and, according as they contain more or less of it, they are more or less sterile."

But, in whatever manner these soils may be constituted, they invariably require greater power, labour and attention to bring them into a condition proper for the purposes of the farmer, than those of most other sorts.

They are in fact naturally sterile, from their adhering together in masses; unless where the summer is so divided between rain and sun-shine, that they are kept in a medium between drought and wetness, a circumstance that rarely happens in this uncertain climate. Where the seasons are wet, the plants growing on such soils are inundated; the closeness of the clay not admitting the water to soak into the ground; and in a dry season, the ground becomes so solid that the roots of plants cannot penetrate or spread themselves in it. A tolerably accurate idea of the fertility or barrenness of clay soils may be obtained by regarding the appearance of the different plants as they vegetate; if they appear lively and vigorous, a favourable opinion may be drawn; the reverse of course follows, if they appear languid, unhealthy and stinted in their growth.

The clayey soils are thought to contain more of the food of plants, than almost any other, as without much alteration, such lands will produce good crops of grass, provided care be taken not to feed them too closely, nor to admit cattle into them in the spring. In order however to bring them into tillage it is necessary that such soils should be altered by the admixture of such substances as tend to open the soil and to break the cohesion of its particles, and which supply vegetable matter in many cases. When once these objects are accomplished, the land will become highly valuable, retaining manure excellently, and never returning to its former state of barrenness.

These kinds of soils are capable of much improvement by the judicious application of manures of suitable kinds and a proper course of tillage husbandry.

In regard to the former, limestone, gravel and marl are the most useful articles in the view of altering the texture, and the best season for laying them on is in the beginning of the year, as it is only during winter, while the surface is frozen, that teams can stir upon them. Where those fossil substances cannot be procured, and the vegetable principle is deficient, a mixture of dung and sand, especially that from the sea shores, will contribute greatly to fertilize the ground. But the application of lime alone has, in many instances, been attended with great advantage, though some farmers disapprove of it on account of its being apt to cake, and not mixing intimately with the soil. But a variety of other substances may likewise be employed in cases where a deficiency of those fossils exists, such as composts of chalk and dung, tanners bark, and other materials that promote a strong fermentation. And it has been found by experience, that chalk and these together not only enrich the soil, but also make it produce earlier crops than it did before. The chalk indeed thus laid upon the land at length subsides, settles as deep as the plough goes, and is then of no further value in opening the land; but it may be recovered, and brought up again to the surface, by ploughing somewhat deeper than ordinary; after which it will produce its former good effects. Gravel from neighbouring soils may also be carted upon clayey soils to which may be added sea or pit coal ashes, dust from saw pits, chips, and rubbish from the back yards of houses, straw, and stubble, rotten wood, clay, peat ashes, and perhaps *gypsum*, or plaster of Paris in some cases. This last substance as well as those of lime and other calcareous matters may also be found useful in such soils of this sort as have a sour tendency, by neutralizing and correcting such acidity, by which they may be rendered more proper for the growth of crops of both the grain and grass kind.

It is observed in the third volume of the Farmer's Magazine, that "the thinner kinds of these lands are almost universally poor: the colder and unkindly bottoms such soils are found upon, must naturally render them so. And that such land is badly adapted to bear much fatigue of the plough, either in winter or summer: that being the case, neither autumn nor late spring ploughing can be depended on, by the farmers; the land being so delicate of itself, it cannot resist the alternate frost and rain in winter, and if it happen to be a wet season before seed time, the prospect of a crop must be very unpromising; and by the latter, if drought come on, it cannot fail in penetrating to the bottom of the furrow; in which case the grain cast upon it must remain destitute of nourishment; therefore the most proper season for ploughing such land is February, and the beginning of March, when the weather is dry."

And further that "the stronger sorts baffle the

operation of the plough more than any other it encounters.

The only friend that cooperates with it in subduing such soils is strong liming; without doubt, winter frost is also of much benefit, on which account, the farmer is often induced to plough such land early: but it ought to be remembered that, although salutary effects may be produced by early ploughing, when there happens to be much frost, yet very pernicious effects must follow when the winter turns out to be very wet; for it is generally understood that clay soils, for the most part, lie upon a retentive bottom of the same nature, therefore all the water that falls upon it must easily penetrate to the bottom through the seams between the furrows; and as the subsoil or bottom of the furrow will be left with a small bank on the land side of the coulter cut together with the under arase of the back part of the furrow resting upon it, the water must be prevented from running to the drain furrow, which will prove very pernicious and hurtful to the soil, being too cold at the bottom in its best state. It may perhaps be said that the same danger will be incurred, at whatever period the ploughing is performed, but there is a material difference between water stagnating in the bottom of the furrows for four or five months, and when it only does so for as many weeks: therefore wherever autumn, or early winter ploughing is practised on such soils, that of summer fallow will also, he thinks, be often necessary."

The most proper sorts of crops in the first sort "are peas, and oats; and where composts can be had and applied to the sward, summer fallow will be beneficial; followed by wheat and artificial grasses.

"And in the latter, cabbages, wheat, beans, peas, and grass seeds for both hay and pasture." See *Clayey Land.*

Loamy Soils. Loam, in its natural state, is a sort of earth material, more compact than chalk, but less cohesive than clay. In these soils there is likewise much variety, some being stiff and compact, while others are more open, loose and porous; hence we have *heavy*, *stiff* and *light* loams. The materials of which these soils are chiefly composed, are those of the clayey, chalky, sandy and gravelly kinds; on which account writers on husbandry have denominated them *clayey loams*, *chalky loams*, *sandy loams*, and *gravelly loams:* and sometimes, where a small portion of the oxide or calx of iron is found mixed with the loamy material, they are termed *tilly loams.*

The first, according to Kerwan, "denotes a compound soil, moderately cohesive, in which the argillaceous ingredient predominates. Its coherence is then greater than that of any other loam, but less than that of pure clay. The other ingredient is a coarse sand, with or without a small mixture of the calcareous ingredient. It is this which farmers generally call strong, stiff, cold, and heavy loam, in proportion as the clay abounds in it."

And the second "indicates a loam formed of clay, coarse sand, and chalk; in which, however, the calcareous ingredient or chalk much predominates. It is less cohesive than clayey loams."

The third "denotes a loam in which sand predominates: it is less coherent than either the above-mentioned. Sand, partly coarse and partly fine, forms from 80 to 90 per cent. of this compound."

The fourth "differs from the above only in containing a larger mixture of coarse sand, or pebbles. This and the two last are generally called by farmers light or hungry soils; particularly when they have but little depth."

The fifth "is generally of a dark brown, or reddish colour, and much harder than any of the preceding: it consists of clay and calces of iron, more or less intimately mixed. It may be distinguished not only by its colour, but also by its superior weight; it sometimes effervesces with acids, and sometimes not; when it does, much of the irony part may be separated, by pouring it, when well dried, into spirit of salt; from which the iron may afterwards be separated by alkalies or chalk." And "akin to this are certain vitriolic soils, which when steeped in water, impart to it the power of reddening syrup of violets. These are generally of a blue colour, but redden when heated."

It has been remarked by a late writer, that in proportion as the clayey principle disappears, they recede from soils of that kind, and that of course the nearer the quality of the clayey matter comes to that of the others, the stronger and heavier the loamy soils must be.

"The differences in the lightness and friability of the soils of this class, in a great measure, says he, depend on the relative proportions of the other ingredients. Where the calcareous ingredient greatly exceeds those of the sandy or gravelly kinds, they are neither so light nor so pulverizable as where they are nearly equal, or where the sandy or gravelly matters considerably predominate over it. In the latter case indeed, such soils are formed as have been denominated by practical farmers light and hungry, especially where the earthy bed or stratum thus produced, is but of little depth, and rests on a gravelly or flinty bottom or subsoil."

And it is added that "the variety in the colours of soils of the loamy kind, seems, in some instances, to be produced by the union or mixture of metallic substances in greater or less proportions, and in more close or more lax states of combination with them; in others, by the prevalence of acid impregnations. The colour in the first case is for the most part reddish, approaching to brown; in the latter it is commonly blueish, changing by heat to a slight red. But these are not, he supposes, the only causes that influence the colour of these soils; they are much altered in their appearances, as well as other qualities, by the different proportions of vegetable or animal matter which they contain, and the different states of decomposition and decay to which they have been carried by length of time, cultivation, and other means. In situations, says he, where this sort of soil has been but little disturbed, and consequently little changed by the artificial additions of either animal or vegetable substances, and those which it naturally contained not having advanced to the stage of perfect solution and decay, it is generally found of a light brown or hazel colour; but where much cul-

ture has been employed for a length of time, and large applications of animal and vegetable matters frequently made, the natural and artificial materials of these kinds, having proceeded more nearly to the state of perfect dissolution and destruction, it has an appearance that approaches to that of black. And it is added that from these various circumstances the properties of the soils are likewise considerably altered and affected."

Such soils of this kind as are met with in extensive tracts on the borders of the sea, and of large rivers communicating with it, are generally rich and fertile, being mostly composed of "a fine sort of sand, calcareous matter in a high state of tenuity from the attrition or rubbing down of different kinds of shells and other marine productions, and a rich matter proceeding from the dissolution of various luxuriant sea plants, and innumerable sorts of animal *exuviæ*." These alluvial materials being all gradually deposited and incorporated with the natural loamy earth of the situations in which they are found.

The chemical analysis of this sort of soil, as given in the work already mentioned, by Mr. Somerville, show their properties in a more clear manner.

Black rich loam. Experiment 1. "—Half a pound of black rich loam, yielded upon distillation one ounce and six drams of an alkaline liquor, which effervesced with acids, and turned the syrup of violets green.

Experiment 2. "The same quantity burnt and washed with boiling water, afforded an acid liquor possessing the same qualities as the former."

Experiment 3.—"The same quantity, with a little quick lime added, was boiled for a considerable time in water, and the liquor saturated with vitriolic acid. The produce of this operation had a greasy appearance, resembling that which results from the decomposition of soap ley with acids."

Experiment 4.—"The same quantity, boiled without lime, and the liquor filtered through brown paper, upon being saturated with vitriolic acid, yielded a small quantity of earth resembling gypsum, scarcely soluble in water."

Hazel-coloured loam. Experiment 5.—"Half a pound of this loam yielded, upon distillation, about two ounces and a quarter of an alkaline liquor, which effervesced with acids, and turned syrup of violets green."

Experiment 6.—"The same quantity, burnt, and washed with boiling water, afforded an alkaline solution possessing the same properties as the former."

Experiment 7.—"The same quantity, with a little quick lime added, was boiled in water; and the liquor saturated with vitriolic acid, yielded a greasy solution, but in less quantity than from the black loam.

Experiment 8.—"The same quantity, but without any lime, was likewise boiled, and filtered through brown paper; the liquor, when saturated with vitriolic acid, yielded a kind of gypsum similar to what was obtained from the black loam, but in greater quantity."

Light loam bordering upon gravel. Experiment 9.—"Half a pound of light loam yielded upon distillation, about two ounces and a half of an alkaline liquor, possessing the same properties as that obtained from the high coloured and black loams.

Experiment 10.—"The same quantity of this loam burnt, and washed with boiling water, likewise afforded an alkaline liquor."

Experiment 11.—"The same quantity, boiled with quick lime, and treated with vitriolic acid, as in the former experiments, afforded an oily matter, but in smaller quantity than in either of these."

Experiment 12.—"Some of the same soil, but without any lime, was boiled in water, filtered through paper, and saturated with vitriolic acid; the produce was gypsum as in the two former experiments, but in much greater quantity."

Experiment 13.—"A part of this soil was burnt, and tried with the magnet, but very little iron was discovered either in it, or any of the other loams."

"From the above experiments it would appear, that the principal constituent parts of the different kinds of loam, upon which they were tried, are, vegetable and calcareous earths, oil, alkaline salts, and an inconsiderable quantity of iron. The deep black loams seem to contain considerably more oil than any of the other two, but less alkali and calcareous earth; which, in some measure, accounts for the inactive nature of some soils of that description, which, by no means, yield crops equal to what might be expected from their appearance. The hazel-coloured loam contains less oil than the black, but a greater proportion of alkaline salts and calcareous earth; owing to which, all the loams of that description in East Lothian are more active, and produce better crops than the former. The light loams, from the circumstance of their containing less oily and more alkaline and calcareous matter, are the most active, and are commonly termed *sharp* lands," by the farmers in that district.

These soils being, in general, less tenacious or more friable and mellow than clays, are capable of being more easily improved with less expense and labour of team, and also at any season of the year. The manure proper for such soils varies according to their relative degree of fertility, and the greater or less proportion of acidity and of argillaceous and calcareous matter they contain. Those loams which are contiguous to the banks of rivers, or the sea coasts, are generally admitted to be so fertile, as to require little additional aid from manure; but for the more heavy and adhesive kinds, a compost of lime and dung, or lime in combination with pulverized or ground bones and blood, or other animal recrements, and such terrene substances as contain large quantities of sand, may be beneficially applied in such quantities as the tenacity or poverty of the land may require. Where the argillaceous principle abounds, lime alone may be spread on the soil, in order to counteract the acidity prevalent in such soils; in the contrary case, or where there is an abundance of sand, gravelly, or chalky particles duly mixed with the loams, well rotted dung, vegetable manures of different kinds, and the mud or deposition procured

from stagnant waters, may be spread to the greatest advantage; and in case the loam be too friable or light, a quantity of clayey loam may be carted on the land, sufficient to impart a proper degree of cohesion or tenacity.

Soils of this nature are capable of affording almost all sorts of crops, both those of the grain and root kind, as well as those of the pulse, hemp, and flax sort, as may be seen under these different kinds of crops.

Chalky-Soils. These are soils which are found to occupy very extensive tracts, in many of the southern districts of the kingdom, as well as in some of the more northern; and like those which have been already noticed, differ very materially both from the diversity of the calcareous material which they contain, its proportion, and the other matters that are intermixed and blended with it, as well as the thickness of the earthy bed, on which it rests, and the nature of the inferior stratum on which the whole is deposited.

It has been stated by an useful practical writer, that matter of the calcareous kind is "contained in many different stony substances, besides that of chalk, as marble, lime-stone, coral, and shells of different kinds; and in states of union with other materials, such as sand, the different simple earthy bodies, in different proportions, and in some instances with iron and magnesia. Its capability or powers of imbibing and retaining moisture is considerable, though not so great as that of clay. It burns to lime by proper degrees of heat, and absorbs carbonic acid gas or fixed air in different proportions from the atmosphere, and returns again to the state of chalk or effete calcareous matter. It is found of very different degrees of hardness and friability, as well as of different states of fineness or pulverization, in different soils of the class to which it belongs. It varies also greatly in its effects in respect to vegetation; from the different matters that may happen to be combined with it in its primitive or original state." And it is further stated that it has long been known to the practical farmer "that some sorts of lime may be employed in large proportions; while others cannot be used, except in very small quantities, without doing very considerable injury to the soil with which they are incorporated." But that "the long unexplored cause of this diversity of effect in different limes, seems lately to have been placed in a more clear and satisfactory point of view, by the experimental attempts of an ingenious philosopher, Mr. Tennant, who has found by repeated experiments, that that sort of lime which is the most friendly to vegetation consists entirely of calcareous earth, and quickly absorbs a large portion of carbonic acid gas or fixed air from the atmosphere; while that which is injurious and unfriendly to the growth of plants contains only three parts of pure calcareous earth, the other two consisting of magnesia, and that it absorbs comparatively but an extremely small portion of carbonic acid gas or fixed air from the surrounding atmosphere." It was also found that "this kind of mixture of calcareous matter was very slow in acquiring the power of supporting vegetation, even after it had been converted into lime, and remained for a considerable length of time in the state of mortar." And that the lime-stone in which there is a mixture of magnesia, is much harder, and dissolves considerably more slowly in acids than that which is purely calcareous." It is likewise supposed that the crystallized structure commonly observed in the magnesian lime-stone indicates that it has not been formed by the accidental conjunction of the two earths, but constituted by their chemical union. The difficulty with which it is dissolved by means of acids, may also, it is conceived, in some measure, depend on the attraction of its different component particles to each other." It is a sort of lime stone which is found to extend itself over very large districts, in the midland parts of the island, as well as in the more northern counties, as is obvious from the practical distinctions of *mild* and *hot* limes, which are in common use, as noticed by Docto Fenwick, in his excellent Essay on Calcareous Manures.

It has been suggested that these "interesting facts not only shew that whatever sameness there may be in the nature of calcareous matter when in its pure and unadulterated state, that as met with in soils, and different substances of the calcareous kinds, it has considerable diversity, and when in union with magnesia it is in a high degree prejudicial to the growth of vegetables." Later trials have however rendered this last supposition doubtful, and till further experiments have more completely cleared up the matter, the farmer should proceed with caution in the use of such materials.

It has been found that matter of the calcareous kind, "whether in the effete or state of carbonate, or in the more active one of causticity, as quick-lime, seems ultimately to promote the resolution and destruction of all vegetable and animal substances;" But that in the latter state, "it acts with much greater violence on these materials, destroying their organization, and dissipating their principles more quickly, as well as robbing them more completely of the carbonic acid gas or fixed air, which is so essential; while in the former it operates with great mildness, and only aids the resolution of those substances by gently promoting the process of putrefaction" or decay.

It is obvious that in them the proportions of clayey, loamy, and gravelly ingredients, in combination with the calcareous matters of these soils, are materially different in different districts; where the clayey and loamy are comparatively in large quantities, the heavier kinds of chalky soils are met with; but where the sandy or gravelly are prevalent, the lighter ones. Material differences also arise from the earthy matter with which the calcareous substance is blended in the state of soil, as where the quantity of this is small, and not reduced into any perfect state of mould, the soil is poor and thin; but where the thickness of this superficial bed or layer is considerable, and the animal, vegetable, or other substances of which it is constituted has proceeded to a more complete stage of decomposition, the soils are more rich and heavy. Where the state of the subsoil is of a compact nature, and much blended with siliceous or flinty matter, or has a mortary hardness, it is less favour-

able than where it is of a more open, brittle, or mellow powdery nature.

From the calcareous material being abundant in these cases, the principal intention is the changing of their textures, and the supplying of vegetable matter to them.

It is found that in the thinner or lighter calcareous soils, clay, or clayey marl, and the vegetable recrements deposited and obtained in wet or swampy situations, may be beneficially applied. In those of a contrary or heavier nature, the spreading of sandy and clayey loams, as circumstances may require, will be attended with advantage, as altering their textures; and to these may be added composts of various vegetable and animal substances, farm-yard manure and ashes; besides which great attention is requisite in breaking up these soils at the proper season, as if this operation be deferred till a dry season, they become so *bound* or hard, that it will be impossible to work them, until they are softened by rain, without very great expense both of teams and of labour in other ways. Near London, the use of soot and malt-dust have also been found highly beneficial in many cases.

Gravelly Soils. In the gravelly materials which constitute soils of this description, there is much difference in the size of the stony particles, from that of the smallest pea, to that of the egg of a pullet. But when they become of still larger dimensions, they are denominated stony or rocky soils, according as they are in detached or connected masses. But the gravelly beds of whatever kind consist in general of siliceous or flinty, or those of the calcareous or chalky kinds, while the rocky and stoney substances are of several different qualities. Various other matters are mixed with these, so as to constitute soils of this kind, which have much diversity in different respects. These are principally matters of the loamy or earthy kind, arising from the putrefaction and decay of different animal and vegetable materials. It is remarked that the "gravelly mixture is sometimes found to approach nearly to the surface, while at others it recedes considerably from it." In Middlesex, Mr. Middleton found that, "when the stratum is very near to the top, a full crop of yellow blossomed broom covers the ground; if in a state of grass, and when ploughed an equally full crop of sorrel. This was seen in the old inclosures. In some instances springs arise immediately underneath; in others they are at a great depth. The bottom or sub-soil is likewise various; in some cases it is stony and rocky, in others it is clayey, or a rocky gravel, and sometimes sand, &c." And it is added, that "the open porous nature of gravelly soils disposes them to admit moisture very readily, as well as to part with it with equal facility; from the latter of which circumstances they are subject to burn, as it is termed, in dry seasons, which is not the case in the heavier or more retentive sort of soils."

The differences of these soils must be remedied according to their nature by the use of different sorts of matters of the marl kind. In cases "where the gravel is of the calcareous kind, clay, or clayey loam, may be most properly employed. And a mixture of the carbonate of lime, or lime in its effete state, and clay, may be found beneficial; also chalk, as being of the same nature, may be made use of in the same way. For these kinds of gravel, which from their contiguity to springs are apt to lie wet in the winter, there is no manure more properly adapted than chalk; which, although it does not abound with vegetable matters in any large proportion, like yard dung, and some other dressings, is, however, an excellent preparative for them, and will, in some measure, supply the place of such substances." It is found from its absorbent nature, to have "a good effect not only in counteracting the superabundant moisture of such soils, but in lessening their heat; by which means the disposition to burn in the summer, so inimical to the growth of various crops, and to which all gravels are in some degree liable, is prevented; and in this last view chalk, though particularly adapted to those of the wet and springy kind, may be applied with success, on gravels of almost every denomination" with the prospect of advantage.

Where there exists any deficiency in the vegetable and animal earthy materials, it may be properly supplied by dung of the farm-yard kind in its more reduced state, and various other animal excrementitious matters, which may probably be employed with the greatest benefit in the form of composts, with good loamy mould, ashes, the mucilaginous and clayey depositions of rivers and ponds, and other substances of a similar kind. Several of these materials, and some others of the animal class, are, however, often used separately to the surface of soils of this sort, with the most evident advantage.

Much benefit may be derived to such lands by a proper alternation of green vegetable and other crops that are usually grown upon them, as by such means the moisture is more preserved and the soils more guarded against injury.

In the Agricultural Survey of Hertfordshire Mr. Young speaks of a poor sort of gravelly soil, "the characteristics of which are wetness, or spewiness, as the farmer terms it, from many springs; most of which are sulphury, and extremely unfriendly to vegetation, abounding more or less with smooth blue pebbles; which, at various depths, are conglomerated by sulphury clay into plumb-pudding stones, in some places so near the surface, as to impede the plough; if set but for an inch or two at a greater depth than the old scratchings of bad ploughmen: it is stiff without a matrix for the roots of plants; and sharp and burning even in the immediate vicinity of springs; it has much sticky clay in the composition, but of a most sterile nature. He hollow-drained many acres; but as he was obliged to employ the pick-axe, the expense was too great; and he found that the ploughing it into high ridges was considerably the best way of draining it. When it has been drained, manures have then a great effect for a time; but such was the voracity of the soil, that the benefit of manuring was soon lost; even when it had been laid down for pasture some years, as a preparation for corn; the best improve-

ment that can, he supposes, be made on it, when cultivated for such a purpose."

It is suggested by Mr. Walker, "that this soil is best adapted to wood; for he was surprized to see the hedges thriving with great luxuriance on land not worth cultivation."

Sandy-Soils. These are a description of soils which seem to have been formed gradually by the reduction of different sorts of hard bodies in nature, particularly those of the calcareous, siliceous, and stony sorts, the particles being brought into different states of fineness, being in some cases extremely minute. They vary equally in their colours in different instances, being sometimes perfectly white, brownish, yellow, and red. The differences in the quantities in which other sorts of matter enter into their compositions afford considerable variety in their weights, tenacity, and different other properties.

In some districts soils of this sort exist of different kinds, from the lightest species of loam to the naked sand composed entirely of small flints, and in all of them there is a mixture of earth; according to the proportion of which they are more or less favourable to vegetation.

It has been remarked by the late Mr. Somerville, that in East Lothian, the whole of the sandy soil is evidently superinduced, the bottom upon which it is laid being uniformly of the same quality with the circumjacent grounds. The origin of this sand, which is accumulated upon several parts of the coast, is owing to two causes: the first, and that which no doubt has produced the greatest part of it, has been the washing away of many points of land by the sea, by which the coast, formerly very much indented, is now rendered pretty uniform, and brought nearer to a regular figure; the second cause of its formation has arisen from the wasting of the soil in the interior during heavy falls of rain, by which great quantities have been brought from the higher grounds, and either deposited in places where the current has been less rapid, or carried along with the stream to the sea; the last however is a rare occurrence, unless in situations where the land declines very rapidly towards the shore; in that county however it is evident that the whole of the land upon the coast has arisen from the wasting and washing away of different points of land, while that in the interior has been produced by the washing of the rivers.

It is remarked by a writer mentioned above, that in cases "where the proportions of clayey, loamy, or other earthy substances with which they are mixed, approach nearly to that of the sand, the heavier sorts of sandy soils are formed;" but that "where these enter only in very small quantities, the light sandy soils are formed; and where they are hardly met with at all, the soil is a loose blowing sand, most commonly of a white or brownish appearance." And it is added that "the portions of vegetable matters that are intermixed with different soils of the sandy kind are not less various than those of the clayey and loamy, from which considerable differences of quality are produced. These differences in their textures and compositions, also introduce others which respect their powers of admitting and retaining heat and moisture. The openness and want of adherence in such soils, while they allow of the admission of heat and water more readily, permit them to be carried off with greater ease and expedition, they are therefore less permanently benefited by their influence than many of the closer and more adhesive soils."

As these soils are chiefly deficient in the calcareous, clayey, loamy, and vegetable materials, the aim of the farmer must be the augmentation of their cohesive property, and the supplying the calcareous and decayed animal and vegetable materials.

They cannot of course be cultivated with advantage, without the aid of other fossil manures to counteract their poverty and prevent the continual evaporation of moisture. For this purpose clay and loam may be beneficially spread on sandy soils, which may likewise be improved by the use of composts of animal and vegetable manure; though where these cannot be obtained, good mould or earth may be employed with advantage, as also may peaty earth, either alone or in combination with other matters. It has been observed by Dr. Fordyce, that a less quantity of clay is required in the improvement of light sandy soils than of sand in the clayey ones; but whether this be a practical rule or not, the thinner and poorer sorts of sandy soils mostly stand in need of a large quantity of clayey matter. And when the calcareous property prevails, clayey marles and clayey loams are most proper; but in cases of its being deficient, calcareous marle and loams may be used with more advantage. This has been sufficiently proved by their application in different districts. A degree of tenacity or firmness may also be imparted to sandy soils by the treading of sheep, folded upon them, while they receive much benefit from the dung and urine deposited by those animals.

These different materials are proper for being laid on either alone, or in the state of composts, but marles and clayey substances are mostly applied in the states in which they are found in nature; but the farm-yard dung, and peaty substances, in mixture with other matters.

It has been stated by the author of Practical Agriculture, that "the light, open, and porous texture of sandy soils, renders them much more easily cultivated and kept in order than those of the strong and close kinds;" and that "consequently the farms where they prevail are generally large;" but that "when properly prepared they are better adapted for the growth of many sorts of crops, such as those of the bulbous and tap-rooted sorts." And "they have also another advantage, he says, which is that of pushing forward the crops with more expedition. Whatever inconveniencies attend them, are mostly such as proceed from the want of a sufficient degree of cohesion among their constituent particles and solidity of texture. On these accounts they often counteract the best and most judicious management. The roots of the crops are liable to become naked and exposed, from storms and various other causes;

and if grain, to fall down and be lodged so early in the season as to render them of little value."

It has been remarked by the writer of the East Lothian Report on Agriculture, that "within these few years considerable tracts of this soil formerly of little value, have been brought under the plough and made to produce excellent crops of turnips, clover, barley, rye, &c. as may be seen in different parts of the Survey; but the most valuable improvement upon this description of soil has been made by laying it into grass, and treating it with top dressings of different kinds of soils, which when liberally applied have, in not a few instances, changed the appearance, and so much altered its nature, as to render it capable of bearing a succession of valuable crops of grain."

Peaty or Mossy Soils. These soils are more common in the northern districts and in Ireland, than in the southern parts of the kingdom, though in these latter they occur in a small extent.

These, as in other sorts of soil, vary from the nature and proportions of the ingredients of which they are composed. It has been observed that "where the vegetable or peaty material predominates but little over the other substances with which it is mixed and incorporated, the lighter sorts of peaty, or mossy soils, are formed; but where the other matters bear only a slight proportion to it, the deep and heavy peaty or mossy soils present themselves. In different districts the peaty matter is found of different depths, and various degrees of density or closeness of texture, probably proceeding from some original differences in the vegetable substances from which it was formed, or the greater advances which it has made to the state of perfect decomposition. The sub-soil in most of the deep mossy districts is of the clayey kind, more or less stiff and heavy, over which the peaty or mossy material is deposited, generally in a sort of stratified order; the first layer of which being commonly not more than ten or twelve inches in thickness, exhibits the appearance of a richish brown earth, in all probability from the incorporation of the loamy or clayey matters with the peat or vegetable earth, lying immediately upon them, and constituting, originally, perhaps, the surface of the ground. The layer that succeeds to this is mostly of a dark colour, and considerable thickness, apparently formed of a great variety of vegetable or other materials in the more perfect stages of resolution and decay, united together by time and other circumstances, with more or less decompactness and solidity. The uppermost stratum, or that which is placed upon this dense, peaty matter, is, in general, of a very pale colour, and very light spongy texture, arising possibly from the grasses, leaves, and other vegetable substances of which it is formed, not having attained that state of decay which constitutes the darker sorts of peaty earth." However, "in the more superficial peaty soils, little or nothing of this stratified appearance is met with. A coat of peaty earth, differing greatly in thickness according to the peculiarity of the situations, and other circumstances, is formed by a great length of time from the destruction and decay of successive crops of grasses, leaves, and other substances of different kinds, and deposited upon, and intermixed with, the various harder materials of the soils which happened to be underneath them." It is observed that, by these means, much variety is produced in the soils. Where the under-strata of earthy matter are tolerably good, and the crops of vegetables large and luxuriant, the better sorts of light peaty soils seem to be predominant; but where the quality of the under-strata are indifferent, and the vegetable products scanty, as well as feeble in their growth, the poorer sorts of these soils are formed.

In many districts this, as in the sandy soil, being deposited or superinduced, the bottom being uniformly the same as that of the adjoining grounds, in the low flat parts, owing its origin evidently to the stagnation of water; in these places the moss consists of the roots and decayed leaves of aquatic plants, which are found in distinct strata, and of different kinds, according to their depth. But in situations more elevated, and upon the tops of the highest hills, the moss has been formed in some cases, merely by the decay of the plants, which falling down yearly, without being intirely rotted, have, in process of time, accumulated and formed the moss there met with; but in the hollows its formation is owing to the same description, with the addition of a great proportion of earth, washed from the sides of the hills during the floods. In some parts of the county of East Lothian this soil has made considerable progress towards decay, and nearly resembles black rich loam; but in by far the greatest part, the roots and leaves of the different plants concerned in its formation, are in a tolerably perfect state, and, when freed from moisture, presents little else than a collection of these.

The following is the analysis which has been given of these soils by Mr. Somerville.

"*Experiment* 1.—Half a pound of moss distilled in a retort, yielded nearly two ounces of an acid liquor which effervesced strongly with alkaline salts, and turned the syrup of violets red: towards the end of the process a good deal of oil was obtained."

"*Experiment* 2.—The same quantity of the same moss being boiled a considerable time in water, yielded an acid liquor possessing the same properties as the former.

"*Experiment* 3.—The same moss burnt, and the ashes lixiviated with boiling water, afforded about a twenty-eighth part of its weight of fixed alkali; the remainder appeared to be vegetable earth.

"*Experiment* 4.—The same quantity boiled with a ley, made of alkaline salts and quick lime, and the liquor saturated with vitriolic acid, yielded an oily matter in considerable quantity.

"*Experiment* 5.—The same quantity boiled in water, and the liquor saturated with vitriolic acid, discovered no gypsum.

"*Experiment* 6.—A quantity burnt, and examined with the magnet, discovered no iron.

"*Experiment* 7.—Half a pound of moss in a more decayed state than that made use of in the last experiment, yielded upon distillation, nearly one ounce and a half of an acid liquor, which effervesced with alkalies, and turned syrup of violets red.

"*Experiment* 8.—A quantity of moss boiled in water likewise afforded an acid liquor.

"*Experiment* 9.—The same moss burnt and the ashes lixiviated, yielded nearly a twenty-fourth part of their weight of fixed alkali.

"*Experiment* 10.—The same quantity boiled in a ley, made of alkaline salts and quick lime, and the liquor saturated with vitriolic acid, yielded an oily mass in a greater proportion, than the moss made use of in the first experiments.

"*Experiment* 11.—A quantity of this moss was boiled, and the liquor treated with acids as in Exper. 5. discovered a very small quantity of gypsum.

"*Experiment* 12.—The trial by the magnet discovered no iron either in this or the moss that was the subject of the first experiments."

It is observed that "many more trials were made upon moss in all the different stages of decay, the whole of which went to prove, that the predominant principle in the whole is an acid; and, according as the moss is more or less decayed, the prevalence of this principle is more or less observable. In the experiments upon moss not much decayed, the quantity of acid was greater, and that of the oil and alkali less, than in any of the other trials; on the contrary, where it was most decayed, it was found to contain the least acid and the greatest proportion of oil and alkaline salts. A knowledge of these circumstances is of considerable importance in agriculture, for by observing the progress, that moss has made towards decay, a tolerable idea can be formed of the trouble and expense, that will be necessary either to bring it into cultivation, or render it useful as a manure."

It is suggested "that from the above experiments it would appear, that the constituent parts of moss are, 1. an acid; 2. an alkali; 3. oil; 4. vegetable earth; 5. iron. The iron was met with in one instance only, and in that, the quantity of acid was greater than in any of the other trials; the nature of the acid was also different, being evidently vitriolic, a thing seldom met with, unless in cases where the moss contains iron, which is certainly the worst of all its principles, and the most difficult to correct." And it is added that "upon comparing the constituent parts of moss with those of the best soils, they are found nearly the same, with the exception of the acid, but in some different proportions. The alkaline principle in some kinds of moss is scarcely equal to what is met with in good loam or clay, while the oil and vegetable earth are much greater; a great proportion of other soils consists of sand, gravel, earth, &c.; but the earthy part of moss consists entirely of a mould formed by the earthy part of decayed vegetables, together with the sediment of water."

From their composition, these soils must of course be extremely retentive of moisture. It has indeed been remarked by the Earl of Dundonald, "that from the rays of the sun and drying winds being exerted during the summer season in carrying off, by means of evaporation, the superabundant moisture in such cases; and heat being known to be abstracted from bodies, and cold generated thereby, effects must be produced highly injurious not only to climate but vegetation in general, and more particularly to such plants as stand in need of a higher degree of heat, and more nourishment, than such soils are capable of supplying." And further that "there can be very little doubt but that these prejudicial effects on the growth of vegetables extend themselves to the more dry lands adjoining such fens or deep mosses."

It has also been found that the surface-stratum of peaty soils, from its being more exposed to the influence and action of the pure air of the atmosphere, is much less soluble than the under-strata, consequently in its simple or unmixed state less proper for the purposes of agriculture. From the same cause too, it becomes less capable of supporting flame, and is therefore improper for the purposes of fuel, in the way of turf or peat.

These sorts of soil stand in need of different methods of management in bringing them to the condition of producing crops. In those of the deeper kinds, the first thing to be done is to draw off, as much as possible, the superabundant moisture, by the cutting of proper drains, and such other means as the nature of the situation, and other circumstances will admit of. It has been observed that, "in places where water in sufficient quantity can be conveniently made to pass through such mosses, and where the soil underneath is good, much may be effected by floating away the principal part of the mossy substance; but where the mosses are not deep, or the soils under them of a good quality, after the making of proper drains, the best way is, probably, to ridge them in such directions and modes as are the most effectual in promoting the exit or passage of the stagnant water which they contain. Different materials may then be applied with the intention of improving their textures, and promoting the dissolution of the undecayed parts of the vegetable matters that are contained in them. The first may be accomplished by the application of various gravelly substances, sand and coarse earth; and the latter, especially where there is a large growth of coarse plants, by the use of lime in its caustic state; but where such plants do not so much abound, alkaline substances, chalk, calcareous marle, the shelly kinds of sea sand, and the carbonate of lime, may be more advantageously made use of." And as shell marle, chalky substances, rich clays, and limestone gravels, are frequently met with under deep peaty mosses, they should be tried for by boreing in various parts. Paring and burning is also useful where the quantity of vegetable matters on the surface is considerable, and of the coarse kind; but the method of applying good earthy matter is to be preferred where it can be procured in an easy and cheap manner. And advantages may

be gained in promoting the fertility of these soils by cropping with particular sorts of vegetables, as such as have large branching stems and cover the surface of the ground very much, so as to exclude the action of the air in a great measure upon it.

Boggy-Soils. These are soils that have much of the nature of the preceding, but which differ in some respects from them, being chiefly in low confined situations, and of less depth than the heavier mossy soils, and of more than those of the lighter description of that sort of soil.

Soils of this description are frequently met with in Ireland, and occasionally in low meadows and near large ponds or lakes in this country. These soils are gradually formed by the deposition and decay of the different vegetables that grow in such situations as those of the luxuriant aquatic kinds; and the stagnation of much moisture upon them, by which the roots also become destroyed and reduced to the state of earth. They have of course different appearances or colours according to the state of putrefaction and decay to which the different parts have advanced, and the nature of the other earthy materials with which they are blended; in some cases being of a lightish brown aspect, as where the fibrous and ligneous matters have only undergone a slight change; but where this has been carried to a considerable extent, they are of a dark colour approaching to black. See *Peaty or Mossy Soils.*

As the great defects in soils of this nature are those of their being too much charged with moisture, and of too open and porous a texture, the means of bringing them into a proper condition are obvious.

In deep, boggy soils, the business of draining should first when practicable be resorted to, in order to draw off the excessive moisture. After which various hard, dry earths will be found of great use, in improving bogs, such as gravel, chalk, stones, sand, shell marl, &c. as these substances contribute to bind, ameliorate, and warm the soil, while they prevent springs from oozing and overflowing the surface. Where they are overrun with rushes and similar coarse vegetables, quick-lime may be beneficially applied, and paring and burning may be employed, sometimes with advantage. And another useful mode of reclaiming such soils is by planting on them those vegetables whose spreading roots serve to bind the earth together, and at the same time in a great measure exclude the action of the atmosphere upon it. And the practice of flooding where a command of water can be obtained, has also been proved a cheap and efficacious mode of reclaiming them in some instances.

Some cases at least have occurred where such soils have been brought into a state of cultivation for *meadows*, with the happiest success, by it, which had failed under contrary methods of management.

Heathy or Moory-Soils. These are a class of soils that occupy very extensive tracts in different districts, of the kingdom and which have considerable relation to those of the peaty sort, though they differ in many particulars. In this part of the country they are mostly known under the titles of *heathy* or *moory* soils, but in Scotland they have the name of *muir* soils.

It is remarked by Mr. Somerville in the Survey just noticed, that these soils like those of the mossy kinds owe their "origin evidently to the same cause, namely, the decay of the plants that formerly occupied the surface. This muir soil is of two kinds, one of which is black, soft, and porous, and admits moisture in a greater degree than any other soil; it is at the same time covered with stones of a white colour; evidently whinstone bleached with an acid; the parts when examined exhibit the appearance commonly met with in turning over the ashes formed by the burning of vegetables, where the skeletons of the plants and roots are seen naked, sapless, and destitute of any of the useful properties they once contained. It is difficult to form an opinion of the cause of these appearances, or to conceive how lands that had once been covered with plants so strong and numerous as to form a thick sod, should become so barren as to be totally unfit for vegetation, as the greatest part of these muirs are. Were a judgment to be formed from appearances, fire might be supposed to have been the cause; but as the consumption of vegetables by that element, however great the waste may be of a part of their useful principles, is always productive of more or less fertility, the appearances above mentioned must be owing to causes of which no correct opinion seems to be at present entertained. This description of muir is the most barren, and its improvement the most hopeless of any soil known there, and no attempts hitherto made have either rewarded the enterprise of the undertakers, or held out inducements to others to follow their example."

But there is "another species of muir soil, which, consists, like that already described, of a stratum of vegetable substances upon the top, not of a black or burnt appearance, but resembling the plants in a dry state intermixed with earth, without having been acted upon by any thing but the weather. These, when examined, are found to contain a considerable proportion of the properties common to all vegetables, and when properly treated are capable of being converted into a soil friendly to vegetation. The stones upon this kind of muir are of the same colour with those met with upon the best soils. There are considerable tracts of this soil, which by good management might be considerably improved: indeed a great part has been much ameliorated of late years, in many districts, and is in a progressive state of improvement."

In the analysis of the same writer of the turf of these soils in the district noticed above, he discovered nearly the same principles as are found in those of the mossy kind.

"*Experiment* 1.—Half a pound of turf pared off very thin yielded, upon distillation, one ounce and six drams of a liquor possessing the properties of an acid.

"*Experiment* 2.—A quantity of the same turf boiled

in water yielded a liquor possessing the same qualities.

"*Experiment* 3. Half a pound of the same turf burnt, and the ashes lixiviated, yielded about three drams of fixed alkaline salt; the remainder consisted of vegetable earth insoluble in water.

"*Experiment* 4.—The same quantity boiled with a ley made of lime and potash, and the liquor strained and saturated with vitriolic acid, yielded an oily mass.

"*Experiments* 5 and 6.—No gypsum was obtained from this turf, nor did the trial by the magnet discover any iron. Many other trials were made with different kinds of turf taken principally from muirish soils, the result of which seem to establish the constituent parts of turf to be, 1. an acid; 2. an alkali; 3. oil; 4. vegetable earth in a considerable quantity. In cases where the turf is pared very thin, it is found to contain less acid and more alkaline salts and vegetable earth, than where it is deep cut, and much of the soil taken along with it."

In the improvement of these soils different methods must be pursued according as they possess more or less of the vegetable principle, and as they are of the deeper or thinner kinds. Where there is much heath the great object will however be that of destroying it as quickly as possible, in which view paring and burning may be had recourse to with vast advantage and success. The application of caustic lime, has likewise been found highly beneficial in the same intention.

The use of different substances of the animal and vegetable kinds, as dung and the mud of ponds, in the form of earthy composts, may likewise be found advantageous on soils of this nature, with judicious modes of cropping with plants of the grain and green kind; the latter being fed off as much as possible upon the land by sheep.

SOILING, the practice of supporting animals of different kinds, in the summer season, with green food of various sorts, cut daily and given to them in the houses, stalls, or yards. A vast number of different plants and grasses may be had recourse to in this intention, as almost all those which have a quick and luxuriant growth; as lucern, tares, clover, chicory, &c.

It has been suggested, "that by having recourse to soiling, a greater variety of plants will be consumed, and consequently prevented from running to waste." And that if "the consumption of plants be an object principally regarded, it is obvious that the benefits thence derived will be very great, as experience has clearly proved that cattle will eat with avidity many plants, if cut and given to them in the house, which they never will touch while growing in the field: such are the dock, cow-parsley, thistles, nettles, and numerous other plants. But to whatever circumstance this may be attributed, the fact is, that the animals will eat them without exhibiting any marks of dislike or reluctance, even when they are not pressed by hunger, and they often greedily devour such plants as soon as they are brought in from the field, and before they can have possibly had time to become hungry. There are even vegetables which, in a green state, are poisonous to cattle; but which, when cut and dried into hay or fodder, may not only be given with impunity, but are also eaten with avidity. Such as the *water crowfoot*, with which, Dr. Pulteney says, the cottagers in the vicinity of Ringwood, on the banks of the Avon, almost entirely support their cattle; and so eagerly do these animals consume it, that they deem it unsafe to allow them more than a certain quantity. Cows indeed are asserted to be so peculiarly fond of that vegetable (which keeps them in good milking condition) that, exclusive of the scanty pittance they obtained on an adjacent heath, *five* cows and one horse did not consume more than half a ton of hay in the course of a year. Thus it is evident that fewer plants will either be rejected or suffered to waste." And that it is further well known that many of the best and finest grasses which, when young, form a most palatable food to cattle, are, if once suffered to get into ear, so much disliked by them, that the beasts will never taste them unless compelled by extreme hunger. And, as in most pastures many of these grasses get into ear from various causes, their produce is of course inevitably lost to the farmer; whereas, if cut down by the scythe in proper time, not one plant will be suffered to get into that nauseating state, and consequently no waste be sustained on this account. And that, in addition, those few plants which are totally disregarded by one class of animals, so as to be rejected by them even in the house, will not on that account become less acceptable to others, but greatly the reverse. Thus grass or other food that has been *blown* or *breathed upon* by any animal for a considerable time, becomes unpleasant to other beasts of the same species, but not so to stock of another class or variety, as for them it appears to acquire a higher relish. "Even greater defilement by one animal seems to render food more acceptable to others; for straw, which in a clean state has been refused by cattle, if employed as a litter for horses, acquires for the former such a relish that they seek for it with avidity. Hence it happens that the sweepings of the stalls from one animal supplies a pleasing repast for those of another kind, which can be easily removed from one to the other if the plants are consumed in the house, but which must otherwise have been lost in the field."

It is a practice also recommended by the food being consumed with much less waste, consequently going much further than when fed upon the land; by the great increase of good manure that is produced, and by that of the stock feeding with less interruption and inconvenience, from their being more effectually shaded from the excessive heat of the sun, and better protected from the attacks of flies and other insects. In all these respects it would seem to have a great superiority over that of letting the animals range over the pastures or other grass lands. "One great objection that has been opposed to this plan of feeding is that of the expence of conducting the business being too considerable. But the extensive trials of

Mr. Young, Mr. Mure and other cultivators, fully show that it may be executed at an expense that can never form any real objection to it. It has likewise been contended in opposition to this practice that such parts of the live stock as are in milk do not afford it so abundantly as when fed in the pastures, but which is probably a mere supposition, as it has been almost invariably found that most of the green crops that are cut and employed in this manner have greater effect in exciting that secretion than the common pasture grass." But as particular sorts of vegetables as well as other substances act more powerfully on some of the glandular organs than others, it is probable that some kinds of plants may have a greater tendency to promote this kind of secretion than others, and on this account, cows fed on one sort of food in the practice may afford less milk than on others.

It is a process of feeding that has also been opposed on the idea that animals do not thrive so well as when grazed in the pastures. It is however well remarked that the more quiet and free from disturbance cattle are kept, the better they thrive and improve in their flesh; it is not probable that green food when properly consumed in the sheds of a farm yard will be less advantageous in promoting the growth and fattening of stock, than when eaten in the field, when exposed to the great heat and constant attacks of flies, and of course kept in a continual state of restlessness and inquietude. Besides, in the experiments already alluded to, the cattle were found to go on better than stock of the same kind, fed in the pastures in the most favourable seasons for the purpose. And which is further supported by trials carefully made and detailed in the Annals of Agriculture. This notion does not therefore appear well supported by facts, or to have had any foundation in the experience of farmers in general.

Its superiority in respect to the economical consumption of the food cannot be disputed. In numerous experiments made in proof of the great saving in this way, it has been found to go from twice to four or five times as far as when fed on the land, and in some trials much more. Mr. Close found that with grass, clover, lucern, and tares, three times as many cattle were capable of being supported in better condition than in the pasture mode of feeding; and with other experimenters, it has been found equal to five or six times as many. The author of a late work has remarked, that "in the field it is obvious that great waste must be committed by the grass being trampled down, dunged upon, and in many other ways, especially where a great number of cattle are pastured together, most of which are avoided in the stall method."

Also it has been stated that it is "an error to suppose that all the waste is in feeding in the field and none in the stall: there is on the contrary a waste in soiling; as in cases where the tares become podded from the butt ends of the plants being course and in a state of decay by lying on the ground, and of course rejected by the animals; the same thing also occurs with lucern when in full blossom." Also "in the heating of the food by its remaining heaped together, loss may likewise be sustained."

However, whatever the waste in these different ways may be, various trials detailed in the Annals of Agriculture clearly prove, that a greatly increased stock may be kept upon the same extent of land in the soiling method over that of the grazing the cattle in the fields where the plants grow.

The most interesting circumstance in which this practice excels that of pasture feeding is, however, in the immense quantity of excellent manure, that is raised and provided for the production of increased crops of various kinds, and the additional improvement of the lands.

It has been well remarked that this is a "method admirably calculated for producing an abundance of manure; as from the great increase in the urinary discharges in the consumption of green food in this way, and the heat of the season, the littering material, whatever it be, is speedily converted into manure, by which means, with proper attention, vast stores of dung may consequently be raised, where there would otherwise be none; which is a circumstance of the greatest importance, and which abundantly shews the great utility and superiority of the practice. By these means the summer produce in manure may, probably, be made to exceed that of the winter, and at the same time be superior in quality, as there is reason to suppose that the manure produced by any kind of cattle fed in the same way, when not in a state of fattening, is much better in the summer than in the winter season. The proportion of valuable manure that the careful farmer may be capable of providing by this system of management is scarcely to be conceived, except by those who have been in the practice. In this view it is of much importance to have reservoirs for the reception of the urine in order that it may be occasionally thrown up over the litter, and thereby promote its speedy conversion into manure. The manure afforded by fattening animals, such as hogs and neat cattle, is in all seasons of a rich and valuable quality." But that in "order to ensure the fullest benefit and advantage from this system of management, the most strict attention is necessary to different circumstances; such as those of having convenient sheds and yards for the purpose, providing suitable crops in proper succession to the proportion of stock to be kept; the feeding and managing the animals in a proper manner; and the making a full provision of the materials for the purpose of littering down the stalls or farm yards."

And further that in this system of management "much depends on the convenience of the yards and sheds in respect to the economy of labour in feeding the cattle as well as making of manure; it is of course necessary to have them upon such plants as may afford the greatest advantage in these ways." It has been suggested by some, "in order to save the labour and expence of cleaning and feeding, in this system, to have the cattle left loose in the yards so as to consume the food from racks or cribs, the bottom of the yards being prepared by marl or other similar

materials, and a coat of litter applied so as that the urine may be retained and contribute to the conversion of them into manure: but a superior plan is probably that of having them tied up in stalls in sheds for the purpose; as, although something may be gained in the former mode in the labour of cleaning, the latter has considerable advantage in the goodness of the manure, and in the animals being kept more quiet and less exposed to disturbance from insects of different kinds. In the former of these modes, the stock should be sorted, and those of the same age or size fed together."

In the experience of Mr. Close it was found advantageous to soil horses in cheap thatched sheds in which they have room to walk and roll, and with bullocks and cows, in stalls seven feet wide, each stall holding two fastened by the necks to the sides, by which they are prevented from inconveniencing each other while feeding.

In order that this business may be conducted in the most beneficial manner, it is necessary the farmer should carefully attend to the culture of such green crops as have been mentioned above, and which can be best applied in this way, on a scale fully sufficient for this purpose. "In the view of early application a full proportion of lucern should be raised on the most deep and fertile soils, and on the better sorts of land that may be in the condition of fallow, clover and tare crops may be grown. These must be sown so as to come into use at different times; the first crop of winter tares succeeding to the early cut lucern; the later put in winter tares following, after which the clover will most probably be ready, to which the third crop of tares and the second cut of lucern may succeed; at a still later period the spring tares may be employed; and in succession to this the third cutting of lucern will in general be ready. But there are many other plants that may perhaps be made use of in this way, as chicory, which may be had recourse to with advantage in this management; as in soils that are tolerably fertile it will admit of repeated cutting. With these different crops there will probably be seldom any necessity for the use of common cut grass, though this may be employed if there should be occasion. The proper foddering the animals in this practice is a matter of great consequence." It is observed in the Annals of Agriculture that "one great object is never to suffer them to have too much at once, as when this is the case, from the heat of the season it quickly takes on a degree of fermentation, and is rejected or only picked among by the cattle, in consequence of which much waste may be committed, which would otherwise be avoided; and in addition it is not improbable but that the stock may thrive better by having their food more frequently, and of course in a more fresh state. But it should never on any account be left packed in the carts for any length of time. The best mode seems to be that of adapting the size of the cart to the exact consumption of the stock, as in this way the whole may be conveniently distributed in the cribs or racks at once the moment it is wanted, before it becomes unpalatable by fermentation, and the least possible loss may be incurred. It is constantly necessary to watch the conduct of labourers in this particular, as they are in general much disposed to overfeed. And there is another matter that should not be disregarded, which is that of not suffering the crops that are used in soiling to advance to too great a head, as by attention in this repect the food may be more cleanly eaten up and consumed."

It must be observed, a late writer says, that "in this system litter becomes an object of the greatest importance, as the large quantity of urine that is made by cattle when soiled on these luxuriant sorts of green food, is capable by its moistening property of aiding in the hot season the more quick fermentation of such materials, and of reducing a very large proportion into the state of manure. In this view, the attentive farmer should therefore make an abundant provision in the winter time of other sorts of materials, where a proper supply of straw cannot be reserved for the purpose. There are various matters that may be made use of in this intention, such as stubble, fern, rushes and other aquatic plants, which may be cut and raked together in the places in which they are most abundantly produced, in order to be stacked up for future use. Leaves might also in woody situations be useful for the same purpose. And in addition to these vegetable matters there are other substances that are capable of being employed with utility, such as peat or bog earth, fresh vegetable mould, sand and the scrapings of roads; as during the decomposition of the various vegetable materials made use of in this practice, not only much hydrogen and carbonic gas is set at liberty, but ammonia is formed in large quantities in the manner that has been already explained, which, from its action upon such earthy materials, is highly useful in bringing them into the state of manure," for the improvement of lands. See *Manure*.

In support of the advantages of this management various facts have been stated by writers on farming. It is remarked by the Rev. Mr. Duncan, in the fourth volume of Communications, that he "always keeps his work horses on red clover through the summer, and they are as healthy and fit for labour as any of their neighbours that are turned out into the pasture. Last year he cut the clover three times, and thirty falls or perches yielded as much as one horse was able to consume. He has frequently intended to try a crop of goose-grass for hay, upon some piece of ground which was not to remain in pasture; but he has always met with some avocation at the time when the seed of this grass could be procured. He is surprized that goose-grass has been so long neglected, nay despised. It is considered as a weed among rye-grass, though he has observed that the horses are not of the same opinion. Its hay is most substantial; and were it allowed to come to maturity, its seed would, he supposes, be little inferior in weight to oats, and would probably be an excellent substitute for them in the food of horses."

It is added that "he who can procure 200 carts of dung, from the same extent of ground where 100 only were formerly produced, certainly possesses a double power of improving it. A great reserve of

straw is necessary for litter to horses when living on red clover. When the straw fails, some bed their horses with dried rushes; but rushes contribute very little to the manufacture of dung. When fern, or as it is sometimes called the "braken," can be gotten, he would recommend it as next to straw for littering of horses or black cattle, and as the best of all land vegetables for the dunghill."

And Mr. Rawson in the same work highly "approves of, and has long practised, the feeding of horses and spring cattle in summer, upon clover; he has found that an acre of clover, cut and carried to the cattle and horses in their hovels and stalls, will maintain double the quantity of stock to an acre pastured; besides the very great quantity of manure produced by this mode of feeding, which secures almost to a certainty the turnip crop."

In a trial made by Mr. Mure in soiling bullocks with winter tares, as stated in the Annals of Agriculture, the advantages of this practice over that of feeding in the pastures is very fully shown. "In June 1782, the experiment was made on 81 Scotch beasts, which were regularly soiled in the farm-yard. The tares being given in cribs upon the dunghill of the preceding winter, the dung and the urine of the beasts added greatly to the value of the mass. Those 81 beasts eat just half an acre of tares every day. They throve on them very well. Forty-three of these beasts were bought Sep. 24th, 1781, weighing alive 2250 stone. May 31st, 1782, they weighed 2626, having gained in the winter on straw 376 stone. Turned to forward grass till June 27th, gaining in 27 days 150 stone. According to this increase, a beast of 50 stone gains eight between September and May, that is in eight months, or one stone per month; the gain on the spring grass is such a beast getting $2\frac{1}{2}$ stones in less than a month. The experiment was repeated in 1783, on 68 bullocks:

	stones.
19 bought Nov. 14th, weighed alive -	858
June 6th, they weighed, being then put to tares	970
Gain in 28 weeks -	112
July 30th, the tares done, and the bullocks then weighed - - - - -	1127
In 7 weeks gain on tares - - -	157
Account of 49 others.	
Bought Nov. 19th, and weighed - -	2706
June 6th, put to tares, weighing -	3096
Gain in 28 weeks - -	390
July 30th, tares done, and weighed -	3397
Gain in 7 weeks - -	301
49 Bullocks in 7 week, tares - -	301
19 ditto - - - -	157
68 Live weight - - -	458

"The proportion is, each beast gaining 9lb. in 49 days: or a beast of 50 stone, getting five stone in seven weeks.

"The summer was so severe and continued a drought, that the advantage of the practice could never, it is observed, be more clearly decided. Many other graziers were driven to great shifts. But these lands being thus preserved, held the beasts forward in plenty of food; but they would have been very badly off had the tares not saved them.

"Weighed 60 Scotch beasts to grass:

	stones.
June 6th, 1783, their weight alive - -	3622
Nov. 23d, put them to turnips, when weighed again - - - - -	4726
Gained in 170 days - -	1104
or per beast - -	$18\frac{1}{2}$

In 24 weeks, which is three quarters of a stone per week."

It appears from the weight of the beasts that they gain flesh very well from tares thus given. And it seems that a beast of 50 stone gets one stone per month on straw in the winter; that by the first grass in the spring, he gets two and a half stone in something less than a month; that by the summer's grass he gets three stone a month; and that by soiling on tares, he gains five stones in seven weeks, which is above four stone a month. On this it is observed by Mr. Young, that it was with the utmost pleasure that so large a number of thriving bullocks were beheld by many persons feeding in a farm yard amongst the luxuriant plenty of tares, consumed with very little waste, and a rich compost forming beneath, ready for the improvement of other lands, and thus forming that noble circle in the farmer's business in which cattle are made the support of corn.

And Mr. I. Wright, in the 43d volume of the same work, has recorded an experiment with tares used in this way, in which he says, "June 15, 1802, began to mow tares for soiling cattle. July 27, finished; being just six weeks. Nine cart horses kept wholly upon them, without corn or any other food. They had been used to a good allowance of corn previous to soiling, and were in high condition, though wrought every day, Sunday excepted: kept their flesh and spirits, and were rather improved at the end of six weeks. He kept likewise during the same time forty swine; these had every day one bushel of offal barley, or bad beans, value 2s. 6d.

Improvement made.

	£.	s.	d.
The hogs improved one with another, as far as he could judge, 2s. per week	24	0	0
The horses kept upon this excellent food he valued at 5s. per head per week	13	10	0
	37	10	0

	£.	s.	d.
Brought forward - -	37	10	0
Mowing and bringing home tares - -	1 10 0		
Corn for hogs 2s. 6d. per day	5 5 0		
	6	15	0
	30	15	0

"Clear profit, £.30 15s. for five acres of tares, including seed and once ploughing, which were but a small crop. He has had a considerable quantity more upon the ground; however £. 6 3s. per acre, for a fallow crop, as this evidently was, is, he thinks, no despicable profit. The land must have been naked fallow, had it not been for this crop; and from its being off so early, the land got a complete fallow of three excellent ploughings and harrowings, and was in good time sowed with wheat, which now looks very well, and the land, in his opinion, is not at all injured."

In Mr. Cook's trials with lucerne, as stated in the 41st volume of the Annals, drilled at 20 inches on a rich, deep, dry loam, on a gravelly bottom in a garden situation; he dug between the rows every autumn, leaving it rough for the winter, and raking it in the spring, and manured once in three years with rotten dung, the crop being cut with a reaping hook, thrice in the season. "The first cutting in May (1803) kept six horses six weeks, the second cutting produce rather less. The produce of the third is more uncertain, as it depends much on the season. It should not be cut till in bloom, as it does better than if earlier:

	£.	s.	d.
First Crop—Six horses six weeks, at 3s.	5	8	0
Second Crop—Six horses four weeks, at 3s.	3	12	0
Third Crop—Six horses two weeks, at 3s.	1	16	0
	10	16	0
Per acre -	21	12	0

Expenses of Cultivation per Acre.

Digging - - -	1	0	0
Raking - - -	0	5	0
Hoeing - - -	0	15	0
Manure - - -	2	0	0
Reaping - - -	1	0	0
Conveying to stable - -	0	10	0
Rent, tythe, and rates - -	5	0	0
£.	10	10	0

And "with lady Monnoux in Bedfordshire, on the fine loamy sand of which the famous gardens consist, has an acre, which has succeeded greatly; she drilled it in rows eighteen inches and two feet asunder, and, when young, drew it to be one foot in the rows. It is a very fine crop, and kept in very clean order by hoeing, weeding, and raking. Upon an average, it feeds five horses through the summer; and one man reaps it, cleans, and carries to, and feeds and cleans the horses, &c. This is a large produce, yet is certainly less than it would afford broadcast, as there is an evident loss of land besides the expense of cleaning and reaping instead of mowing. Here the produce cannot well be reckoned less than 17s. 6d. a week, and if 8s. are deducted for labour, there remains 9s. 6d. which for 20 weeks are 9l. 10s. which is a great return per acre."

These statements place the advantages of this system of management in the clearest point of view; but in order to derive the utmost possible advantages from it, a strict regard should be had to its performance, and that the animals should be kept perfectly clean in the racks, cribs, and places in which the food is deposited, as well as have a full supply of pure water, to drink at as they may be disposed. The food must also constantly be given them in a perfectly fresh cut state, and in but small proportions at a time; in the hot season, the cattle being let out a little in the evening for the sake of exercise. Where there are different sorts of green cut food for soiling with, it might also be beneficial in forwarding the condition of the cattle, to have recourse to them alternately.

It is a method of practice that has been found by the most exact trials, to answer perfectly both with horses, neat cattle, and swine, and with cows it has been found very beneficial in the trials of Mr. Curwen and several others. See *Swine* and *Team*.

By an extensive and judicious use of soiling, the farmer may derive vast benefit in being enabled to have a considerably larger extent of land both under the states of tillage and grass, from the vast increase of manure that is produced.

SOKAGE, a term applied to the water that drains through the banks in fen districts.

SOKE, an ancient term used to signify the privilege of mills, &c.

SOL, a term signifying to pull by the ear in the manner the dog does swine.

SOLE *of a Horse*, in *Farriery*, that plate of horn which, encompassing the fleshy sole, covers the whole bottom of the foot. The sole ought to be thick and strong, and the shoe of a horse so set upon the hoof as not to bear upon it, for otherwise the sole would be hurt, and not only make the horse lame, but destroy the flesh that separates it from the coffin-bone. See *Shoeing*.

It has been an absurd practice with some farriers, to take out the sole. It is done without touching the outside of the hoof, as taking off the crust makes a *hoof-cast*. And a horse that has been unsoled, it is said, will recover in a few weeks time.

But this custom of *drawing* horses' *soles*, in order to relieve the inflammation of the part, and to promote a free perspiration, is not in the least beneficial, as it leaves such a weakness and tenderness behind, that the poor creatures mostly ever afterwards labour under an incurable lameness. And La Fosse, though he has recommended the practice, has not produced a single instance of its success. In lieu therefore of tearing the sole up by the roots, Mr. Wood advises

the following method: in the first place, to take off from the tension of the vessels, and lessen the inflammation, to draw away blood at the toe and above the hoof. After which, the poultice composed as below may be applied.

Take of linseed boiled in water to a pulp, then add goose-grease, tar, and cow-dung; boiling them all together to the consistence of a poultice.

This may be put to the foot, and all round the hoof; and a cold charge applied above the coronet. Where there is no great inflammation, the addition of a little soap to the poultice, may assist much in removing any coagulation of blood in that quarter.

When the foot is shaped like the back part of an oyster shell, and the sole higher than the hoof, so that the whole foot is quite filled up on the lower part, it is called a *crowned sole* by farriers.

SOOT, a fuliginous substance formed and collected in chimnies, and which is found useful as a manure.

Soot, either of vegetables or of coal, is good both for corn and grass, especially on cold moist grounds, or lands apt to over-run with moss. Many have found their account in strewing it early over their green wheat and barley: but Mr. Ellis says neither of them ought to be sooted after the 25th of April, because the wheat, and generally the barley, have then done gathering and branching, and are upon the spindle. He likewise thinks it proper to be sown over young turnips, just after they have appeared. But care should always be taken not to strew it too thick, lest its hot nature should hurt the plants. Mr. Worlidge seems to think wood-soot the best; but Mr. Mortimer prefers that which is made from sea-coal, of which about forty bushels are commonly allowed to an acre; though some grounds will require more: to which he adds, that it produces a very fine sweet grass, and destroys worms and weeds; and that it ought not to be sown upon wheat till Candlemas, because the long cold rains and snows are apt to wash it in too soon: nor is it safe to lay it on later, lest a drought succeed, and burn it up. See *Manure* and *Top-dressings*.

Mr. Donaldson says, that "this useful manure can be obtained in considerable quantities only from great cities, or large manufacturing towns. The price in London, whence great quantities are carried to the adjacent districts, is eight-pence the bushel. The ordinary allowance, is from twenty-five to thirty-five bushels an acre. Soot is used in many parts of England, as Middlesex, Buckingham, Gloucester, Wilts, Lancashire, Yorkshire, &c. The mode of application is chiefly as top-dressings for young clover, sainfoin, and old worn-out meadows. The best season for laying it on, is in February or March. It is carefully spread over the field with the hand, and always succeeds best, if rain immediately ensues."

Mr. Marshall recommends it being sown before rain, when a shower washes it in, and will be of obvious service; but that if it lie on the surface long without rain, there will be no benefit derived from it. A rich soil wants no soot, but a soil much out of heart wants 40 or 50 bushels. In his Rural Economy of Norfolk, he says that "the time of sowing is considered as very material. If it be sown early, and the frost catch it, its strength is thereby lowered: if late, and no rain falls to wash it in, it is thought to be rather injurious than beneficial to the crop of wheat. And it is not, in any case, found of much, if any service to the succeeding crop of barley.

"The method of sowing it is extremely simple; and, in the only instance he saw, the sowing of soot practised there, was very complete.

"A favourable opportunity being embraced, when the wind blew gently and in the direction, or nearly in the same direction, as the lands or ridges lie, the same waggon which brought it from Norwich, and which, until the opportunity offered, had stood safe under cover, was drawn, in a furrow, against the wind; while a man, standing on the outside of the waggon, spread the soot, with a shovel, several yards wide, on either side of him; the height of his situation at once enabling him to spread it wide and even. As he reached the windward end of the lands, the team wheeled round under the hedges, and took a fresh width.

"The quantity set on was forty bushels an acre."

Mr. Young says, that in general thirty bushels are used for a complete dressing; *i. e.* when dung, or some other manure has not been previously applied to the same crop, which is very frequently the practice, and the quantity of top dressing is then diminished to about one half of a complete dressing. Of soot a complete dressing as above, costs 30*s.* to 36*s.* per acre. Soot is found to answer best on wheat, in April. It likewise succeeds on pease or clover, in the same month, and has a good effect sown *with* barley in the beginning of April, and harrowed in. A slight dressing of soot is used at any time in the spring, when grubs or worms appear to injure the young corn. The worms frequently make havock by drawing the blades of young corn after them into their holes; this soot, prevents best: soot thinly distributed on newly sown turnips, *just before* they come up, prevents the fly or grub from injuring them, provided no rain falls to wash it into the soil. Soot answers best on light dry chalky soils, and in moderately wet seasons. It does little good on strong or wet land, or in very dry seasons, unless sown earlier than usual. The London soot from coals is rarely bought unmixed with cork-dust, coal ashes, or sweepings of the streets; yet even in this adulterated state it is found to answer much better than real country soot from wood.

It is remarked in the Survey of Hertfordshire that about Stevenage, they spread 20 to 40 bushels an acre, bringing it from London: it costs 8*d.* and the carriage 3*d.* in all 11*d.* per bushel. And Mr. Clarke of Sandridgebury, spreads 35 to 40 bushels an acre on wheat. Mr. Wangford, of Bushy, uses 30 bushels an acre on wheat. But about Beachwood they sow 30 to 40 bushels on wheat in February or March, bought at 1*s.* a bushel at London, and bring

160 bushels in a waggon with four horses. Around Hitchin 40 bushels are sown on wheat. And a great deal is used at Watford at the rate of 40 bushels an acre. Also about Barkway, they have a very high opinion of it; 50 bushels an acre, brought 30 miles from London, is seen on wheat to an inch.

It is stated in addition by the writer, that the practice is universal through this county; insomuch, that the question is, whether there is a parish in it in which some men are not in the habit of using this manure from London.

With cabbage crops that have been sown, it has been found that if, as soon as the plants appear distinctly above the ground, a surge of soot be drilled upon them, to the amount of from ten to twelve bushels the acre, it affords much security against the fly. It has been suggested that this business may be cheaply and conveniently executed by a hopper and round of cups similar to Cook's but larger, fixed to a frame similar to that of the Northumberland drill. When employed for preventing the fly in drilled turnips, it should be sprinkled along the rows, from a scuttle by the hand, or some such mean, in the proportion of about twenty bushels the acre.

In respect to the application of this sort of substances to land, it is however remarked by Mr. Kiddle, in the fourth volume of Communications to the Board of Agriculture, that "all manures that are laid on the surface of land, cannot be laid on too early in the season. Soot, for instance, is always recommended to be sown on wheats or clovers, and grass lands, in the month of February, from a notion, that if sown sooner, they would exhaust themselves too soon. This, he thinks, absurd reasoning. No manure can be of any service to the crop which it is meant to advantage until it reaches the roots; and what contributes more to save it than the winter rains, and the dissolving of the snow? He has, in consequence, always sown the soot for wheat and clover, when he has been able to procure it, in the month of November, or December, and always with satisfaction to himself. He last year sowed with soot an inclosure of wheat of eight acres, part of which was sown in the beginning of December before the frost set in, and a heavy rain succeeded the sowing; on the remaining parts, owing to his not being able to procure more soot at that time, the sowing was postponed until after the frost was gone, in the month of February. The quantity sown on an acre, in both instances, was equal; but the superiority of the crop of wheat, where it was sown early, might be discerned by the eye. He had the curiosity to have it thrashed separately, and found its increase beyond the other considerable. If he could procure soot at the time of sowing wheat, he should be under no apprehension of its answering then, if the land was worked for the wheat. Some years since, having bought a small quantity of soot immediately after harvest, he had the desire to try its effects on the crop at that early season, and having a pea-stubble which had been ploughed twice, and was designed for wheat, after sowing as much of the land as he had soot for with wheat, he then had the soot sown, and ploughed both in together. He owns he was anxious to see the success of his experiment, as it was a novel one, as were his neighbours also who had seen it done. The remainder of the land was sowed with soot, as he was able to procure it. The wheat, where the soot was sown with it, kept the lead during the first months; this he did not wonder at, but expected it from its forcing quality; but he was very much pleased to see it continue to do so during the remainder of the season, and at harvest the superiority in favour of it was easily to be seen."

SORDES, in *Farriery*, a term applied to the matter discharged from ulcers, when it is rather viscid or glutinous. This matter is frequently of a brownish red colour, somewhat resembling the grounds of coffee or grumous blood mixed with water. *Sordes*, *sanies*, and *ichor*, are all of them terms which imply a discharge much more fetid than purulent matter, and none of them are altogether free from acrimony; but that which is generally termed *ichor* is by much the most acrid of them, being frequently so sharp and corrosive as to destroy large quantities of the neighbouring parts.

SORGHUM, a term sometimes applied to Guinea corn, or white round-seeded Indian millet; a species of *Holcus*.

SORRANCES, in *Farriery*, an extraordinary epithet used among old farriers. It is said to signify two things, viz. "either an ill state or habit of an horse's body, arising from some part diseased; or a looseness of continuity of the parts, which, according to the various circumstances, acquire new names, as fracture, wound, ulcer, rupture, convulsion, cramp," &c.

SORREL, in *Horsemanship*, is a reddish colour, with which the mane ought to be red or white; it is distinguished according to the degree of its deepness, into a burnt sorrel, and a bright or light sorrel; but generally speaking, it is the sign of a good horse.

SORT, a term provincially used to signify a kind, as a good sort, bad sort, &c.

SOUGH, a covered drain of any size.

SOUND, a term applied to a horse that does not halt.

When a jockey sells a horse, he warrants him sound, hot or cold; that is, that he does not halt, neither when first mounted or when he is heated, nor yet after alighting, when he stands and cools.

SOUNDNESS *in Horses*. See *Buying of Horses*.

SOUP, a term applied to such animal food or provisions, as are formed by cutting various dry materials, such as hay, straw, &c. and blending them with liquid matters; and also to such as are prepared with meals of different sorts, such as that of oats, peas, beans, and others of a similar kind. By this practice, the substances are not only found to go much farther, but to have a much greater effect in promoting the growth, or fattening of the animals. See *Swine*.

SOUR-DOCK, provincially signifying the weed sorrel. It is sometimes written *Sour Docken*.

SOUR-*Food*, such food as has been rendered sour by acetous fermentation, and which has lately been said to be of superior utility in the fattening of animals. See *Stall-feeding*.

Sour *Grass*, the coarse herbage usually met with about the dung heaps in fields, and where there is much stagnant moisture.

It is observed by Darwin, that "where a piece of grass is over-run with tussocks of sour grass, which often happens near towns, he has been informed, that lime or coal ashes spread on them, would render the grass sweeter, so that horses or cattle would eat it. But he supposes the more certain and advantageous management would consist in mowing it frequently, and giving it to horses or cattle in the stable or stall; as he believes they will eat it greedily after it has been a few hours withered, and thus the land will not only yield more provender at present, but after a few mowings a sweeter grass will rise in the place of that which was of a bad kind, or of too luxuriant growth, for which purpose it should be mowed as near the ground as may be; or if it be frequently mowed during the summer, and left on the ground, some cattle will eat it, when it is withered to a certain degree; by which the disagreeable flavour of it is probably lessened or destroyed."

Proper drainage and close feeding such lands, are likewise useful methods of bringing them into a state of better and sweeter grass.

Sour-*Land*, a term applied to cold clayey soils. See *Clay*.

SOUTH DOWN *Sheep*, a breed of improved fine wooled sheep, of great value to the farmer. See *Sheep*.

SOW, the female of the swine kind. See *Swine*.

SOWING, the act of scattering or putting the seeds of plants on or into the ground, in order to their producing crops.

With regard to the period or season of sowing, or putting crops into the soil, it is evidently a point, a late writer says, that must depend in a great degree upon their habits or economy, and their peculiar nature. "On this account, says he, the most proper and advantageous season for sowing or setting such as possess the habit or are capable of perfecting and ripening their seed or produce in the same year, is that of some of the more early spring months, according as they are more forward or late in their kinds, and the climate more mild, or the contrary;" while on the other hand, "such as are, from the peculiarity of their nature or habits, incapable of completing their vegetation in the same year, the most favourable period will be some of the more early autumnal months, according to the differences of their habits, and the variations of climate and season, as by these means in the former case the seeds, grains, or roots, become perfectly evolved, and the radicles of the young plants firmly established in the soil, and capable of sustaining themselves against the hot season sets in, which is to bring them to maturity; and in the latter the seeds have attained such a state of growth and so far fixed their roots in the ground, as to be capable of supporting themselves without sustaining much injury from the severity of the winter season, and consequently advance with greater rapidity in their vegetation in the spring, in order to perfect their seed by the heat of the summer season."

And he further states on the authority of Lord Orford that the practice is advised "of sowing certain sorts of grains and seeds, and also of setting particular kinds of roots, at much earlier periods in the spring than is commonly had recourse to by the farmer. Thus, says he, by putting barley into the ground in the beginning of February, great advantage has been supposed to have been derived in the forwardness and fineness of the grain." But against this method it is however, he says, ingeniously suggested by Dr. Darwin, that "as much moisture, with or without subsequent frost, is more liable to destroy the embryo in its very early state in the seed than after it has shot out roots and a summit, and thus acquired some habits of life, such early sowing must in some cases be practised with caution." But that "such an objection cannot be brought against the early autumnal sowings."

"The crops of autumn sown wheat should be constantly put into the ground in the latter end of September or beginning of the following month, but the former if possible." And the spring sown should not be later than the end of March, as when later sown, they never ripen well. And with oats and barley crops, February, March and April are the seasons usually had recourse to. But from grain seeds and roots requiring such different lengths of time in arriving at maturity, the particular period at which each sort of grain, seed, or root, should be sown, set, or put into the earth, with the greatest chance of success, will be more fully noticed in speaking of the cultivation and growth of the different sorts of crops.

The last mentioned ingenious writer has likewise remarked that the difficulty of determining the best season for sowing or putting in seeds in the spring, owing to the variation of the weather in the same latitude, as well as of laying down or fixing the exact seasons for sowing in different latitudes, occasioned Linnæus to form or construct what he terms a calendar of Flora, which was afterwards adapted to this climate by Stillingfleet; and which consisted in observing the first appearance of the root-scions, or flowers of the uncultivated native vegetables, with directions to sow the *cerealia*, or harvest seed, when such plants or flowers became visible. By attention to observations of this kind on such sorts of uncultivated plants in many climates, the above writer conceives such tables might be constructed as would point out the most proper times of sowing the most useful seeds or grains in every latitude and situation. And he further adds, that "another tabular view of the climates where plants grow naturally, and of their native situations in respect to moisture or dryness, hill or valley, with the kind of soil where they were originally found, might also contribute to their successful cultivation."

The following is the order of leafing of a few trees and shrubs which Mr. Stillingfleet has put down as noticed by himself in the county of Norfolk, in the year 1755.

1.	Honey Suckle	January 15
2.	Gooseberry	March 11
3.	Currant	11
4.	Elder	11
5.	Birch	April 1
6.	Weeping willow	1
7.	Raspberry	3
8.	Bramble	3
9.	Brier	4
10.	Plumb	6
11.	Apricot	6
12.	Peach	6
13.	Filbert	7
14.	Sallow	7
15.	Alder	7
16.	Sycamore	9
17.	Elm	10
18.	Quince	10
19.	Marsh Elder	10
20.	Wych Elm	12
21.	Quicken-tree	13
22.	Horn-beam	13
23.	Apple-tree	14
24.	Abele	16
25.	Chesnut	16
26.	Willow	17
27.	Oak	18
28.	Lime	18
29.	Maple	19
30.	Walnut	21
31.	Plane	21
32.	Black poplar	21
33.	Beech	21
34.	Acacia Robinia	21
35.	Ash	22
36.	Carolina Poplar	22

The conformity between vegetation and the arrival of certain birds of passage is, he says, extraordinary. Of this he gives an instance marked down by himself in the above mentioned county in his diary of the same year.

April the 16th, young Figs appear,
——— 17th, the cuckoo sings.

And he notices that "the word κοκκυξ, signifies a cuckoo, and likewise the young fig, and that the reason for it is that in Greece they appeared together. And he states, that the same year he first found the cuckoo-flower to blow the 19th of April." He likewise further states that "according to Linnæus the wood anemone blows from the arrival of the swallow: in his diary for the year 1755, he finds the swallow appeared April the 6th, and the wood anemone was in blow the tenth of the same month."

He adds "that the marshmarigold blows when the cuckoo sings: and according to his diary the marsh marigold was in blow April the 7th, and the same day the cuckoo sung."

It has also been remarked that "a due temperature of the season, with respect to heat or cold, drought or wet, for all these greatly influence the state of the earth, is essentially necessary, and should be carefully attended to by the cultivator when he sows: but the precise time most proper for this work cannot, by any means, be invariably fixed, because it will always depend on the concurrence of a variety of circumstances. The seasons are more or less forward, and the ground is more or less dry in some years than in others. A proper series of well made observations would furnish the best rules in this respect, but certainly would not fix the time of sowing to any particular day, or week, for years to come. Linnæus's method, of carefully observing the foliation of trees, &c. would determine the proper time for spring sowing. And Pliny, after mentioning the several constellations by which farmers were guided in his time, instructs the farmers with regard to autumnal sowing, upon a principle similar to that of the great modern naturalist. "Why," says he, "does the husbandman look up to stars, of which he his ignorant, whilst every hedge and tree point out the season by the fall of their leaves? This circumstance will indicate the temperature of the air in every climate, and shew whether the season be early or late. This constitutes an universal rule for the whole world; because trees shed their leaves in every country according to the difference of the seasons. This gives a general signal for sowing; Nature declaring, that she has then covered the earth against the clemency of the winter, and enriched it with this manure."

It can therefore only be observed in general, that it is better, as has been suggested, to sow early in autumn than too late, provided the season will admit of it; because the plants are better able to resist the severity of the winter, after they have acquired a certain degree of strength; and their roots being then longer, and consequently better fixed in the earth, they will be less liable to be thrown out by frost. For this reason, in particular, perhaps the colder the climate is, the earlier the wheat should be sowed. Some lands are of such a nature, that they swell greatly in hard frosts, and subsiding again upon a thaw, leave the roots of plants quite bare upon their surface. There have, indeed, been years in which fields sowed very late, for instance, in December, have done extremely well: but that ought not, on any account, to be made a rule, experience shewing that such late sowings very seldom answer. On the other hand, the corn is likewise exposed to many dangers when sowed too early, for the stalks which shoot up before winter cannot well bear hard frost, though wheat would not be hurt by them when only in the blade. M. de Chateauvieux is clearly of opinion, that though the proper time of the year for sowing be come, the corn should not be put into the ground, if the temperature of the season be not favourable, and that on the contrary, the sowing of it ought to be deferred, in hopes of a change. "If, says he, the weather is very hot, and the earth extremely dry, it will be absolutely necessary to wait till some rain has fallen; for otherwise the seed will rise but very imperfectly. This he is sure of, by which he contradicts the common saying of some farmers, that the

earth is the best granary to keep the corn in. Full of this notion, whenever the stated times come round, they sow without distinction, in wet land or in dry: even heat does not hinder them: they think their seed will certainly sprout well after the first rain; but he has always experienced that the plants have come up thin.

"To satisfy himself still farther on this point, he tried an experiment purposely to know whether corn can be sowed with any reasonable expectation of success, when the weather is very hot, and the earth very dry. Upon reading M. Duhamel's Treatise on the Preservation of Corn, he observed that he had found by his experiments, that wheat dried in a stove heated to sixty degrees of M. de Reaumur's thermometer, had lost its faculty of growing. From thence he conjectured, that wheat which should undergo a heat, for example, of thirty degrees during a longer time, would be equally parched up, and rendered incapable of vegetating. He considered the earth, when hot and dry, as a kind of stove, in which the seed, if it remain too long without receiving any moisture, may become so dry, that the greatest part of it will never be able to sprout. This reasoning is just, and he therefore determined to have recourse to that trusty guide experience.

"On the 18th day of July, 1754, at four o'clock in the afternoon, he placed M. de Reaumur's thermometer two inches deep in the earth, and screened it from the immediate impression of the rays of the sun. The liquor rose to the thirty-first degree, which showed him the heat of the earth. The thermometer being afterwards exposed to the sun, the liquor rose to thirty-six degrees.

"The same day he sowed eighty grains of wheat in his ground. The heat continued near the same during the rest of that month, and almost all August. On the 21st of July, only ten grains had shot up, and on the 16th of August there were in all sixteen; after which not one more rose; consequently sixty-four grains out of the eighty never sprouted at all.

"On the 28th of July he sowed fifty grains. Only four of them rose by the sixteenth of August, and not one after. Here were again forty-six grains which did not grow at all.

"The same day he sowed sixty grains in another place. On the sixteenth of August only six grains had sprouted, and not one plant more ever appeared after: consequently here too were fifty-four grains which never grew. All these grains were sowed in his garden, in exceeding good mould.

"He was sure that the wheat which he sowed, was perfectly sound, and in every respect capable of growing. It was therefore quite clear, that so great a number of grains out of the whole, which did not sprout at all, lost the faculty of growing, by their being parched up by the heat, and dryness of the earth. To be still more certain of this, three weeks after he had sowed these grains, he watered half of them several times: but to no purpose; not one of them rose, and he found several of them quite whole in the earth where he had sown them.

"After this experiment, on the 11th of August he suspended the sowings he had begun on the 8th, and did not resume them till the 26th, after some rain which fell on the 22d and 23d. These last sowings rose much better than the first."

Upon the whole he concludes, from his own repeated practice, that the best time for sowing in such a climate as Geneva, (which differs very little from ours) is from the 20th of August to the end of September: and thinks that even the first fortnight in October may be taken in, if the land cannot possibly be sowed sooner. But he allows of this only in a case of necessity, and judges that, rather than sow later, it is best to stay till spring. "Thus, says he, it is, that experience and observation teach us to leave off bad customs, or such as are not founded on principles with which a man of sense may rest satisfied."

It is of the greatest consequence to the farmer that seed be placed in the earth at a proper depth and in the best manner: but experience is yet wanting to determine with due exactness, what is the depth which best suits each kind of grain in different soils.

In the spring sowings, when there is much moisture in the soil, from the wetness of the previous seasons, less depth may be required than in the summer, where the land is rendered more dry and parched. From half an inch to an inch and an half, may be fully sufficient for the seeds of the grain, turnip, and carrot kinds, so as that they may be fully protected from birds and insects. And for root sets, such as potatoes, from two to four inches in proportion to the state of the soil, may be sufficient.

But, in the very early autumnal sowings, as from the excessive drying heats of the summer season, there must in common be a deficiency of moisture in the earth, it may be better to have the seed put in somewhat deeper, as from two inches to three or more, in order that their vegetation may not only proceed more speedily, but their roots be more fully guarded from the effects of the frosty nights, which usually take place soon after such sowings. And in this way they are more effectually protected from the attacks of birds and other vermin, which are generally more eager and destructive in their attacks, from the diminished quantity of food at such periods of the year.

However, in general, as the process of sprouting or early vegetating is found to be greatly promoted by the seed being fully supplied with oxygen air, it may be the most beneficial practice to have them put into the soil, in rather a superficial manner, or but lightly covered, as by such means they may be the most fully supplied with atmospherical air. And for this reason too it may be the most advantageous method to have the seeds or roots deposited in the soil as soon as possible after it has been turned up by the plough or spade, as, in such circumstances, it must contain the largest proportion of atmospherical air among its constituent particles; which, it is observed by Dr. Darwin, may be necessary to stimulate into elevation the plume of the embryo plant, as the moisture of the earth is necessary to stimulate the root into its elongation downwards.

The particular state of the season and climate in

which the sowings or plantings are performed, may likewise have some influence on the crops. It has been commonly supposed that "the best practice is that of sowing in dry seasons, and setting out plants in such as are moist; but it is obvious, a late writer says, that, in so far as the sowing is concerned, this business ought, in some respect, to be conducted according to the differences of the qualities of the lands, and the nature of the climate, in regard to its warmth or the contrary. Thus, in the drier and more mellow and porous descriptions of soils, and the more warm and genial climates, it may, in many cases, be advantageous, not only to sow in the wet, or rather moist seasons, but also at more early periods than in such as are more retentive of humidity; as from the moisture being commonly, in such sorts of lands quickly dissipated, a more certain and expeditious vegetation of the seed may in this way be secured. But in the more heavy and wet kinds of soil, where the climate is colder, it will constantly be a more beneficial method to choose, if possible, a dry and warm season for performing the business of sowing or putting in the crops, as by such means, the grain will be more certain of vegetating, and in less danger of perishing by the over-abundant wetness, and the want of heat in such lands and climates." And it has been justly remarked by Dr. Darwin, that "in some clayey grounds, much softened by rain, if the seed be put into holes and a dry season succeed, an almost impenetrable crust may be produced by the quick exhalation of the moisture, and what is termed by farmers, the setting of the clay; and in this manner the vegetation and early growth of the crop be much retarded, or in a great measure prevented." And that though it has been ingeniously suggested that useful purposes in the early vegetation of some sorts of plants may be answered by the sowing of the fruits or husks that surround particular kinds of seeds and berries, no experiments have yet been made to shew whether the sowing the chaff, or covering of the grain with it, might not, in particular circumstances of the soil and climate, be of utility in affording it warmth and protection in the first stages of its growth.

With regard to the methods of sowing, or putting the seed into the earth, there are different ones in use, not only in districts where the nature and qualities of the soils are different, but in those in which they have much similarity. It is observed that the most general and common mode, as well as that which is more or less prevalent in almost every part of the kingdom, is that of sowing or casting the seed over the surface of the ground by means of the hand, having it afterwards covered to a proper depth by harrowing. In this method of performing the business, the most usual practice, especially where the ridges are equal in breadth, and not of too great a width, as five or six yards, is that of dispersing the seed regularly over each land or ridge in once walking round; the seedsman, by different casts of the hand, sowing one half going and the other in returning. In doing this, it is the custom of some seedsmen to fill the hand from the basket or hopper which they carry along with them, as they make one step forward, and disperse the seed in the time of performing the next; while others scatter the seed, or make their *casts* as they are termed by farmers, in advancing each step.

Mr. Parkinson states, in his Irish Farming, that he found a good sower the most difficult thing to be met with; in fact, he did not himself know the true art of sowing seed broad-cast until he went to America, and the man from whom he took the idea there, attracted his notice from the particular manner in which he walked while sowing, which was precisely as if he had been blind, keeping his eyes on the seed as he threw it, by continually looking upwards. It is consequently evident, the first writer says, that in accomplishing this business with regularity and exactness, upon which much of the success of the crop must depend, there is considerable difficulty, and the proper knowledge and habit of which can only be acquired by experience. Wherever this method of putting in the seed is had recourse to, it is consequently of importance for the farmer either to perform the operation himself, or to be careful in selecting such persons as are conversant with the business, as he may otherwise incur much unnecessary expense in the waste of seed, and run considerable risk in respect to his crop.

"Mr. Marshall finding a great waste and inconveniency attending the broad-cast sowing, ordered his seedsman to walk on the left hand inner furrow, with his face towards the land to be sown, and to make his cast diagonally, not across the land. This gave him a great scope; and after a few minutes practice he made very good work: before night he walked at the rate of three or four miles an hour, and though a young seedsman, made as good work as could be wished. A man walking in the smooth, open inner furrow, may sow three acres in less time, with more ease, than one walking among the rough clods and loose mould could sow two acres. This method proved superior to the usual way, being cropped as well, and with less seed. The extra expense of sowing is about two-pence an acre, but the saving of the seed was at least two shillings per acre. The method observed was, for the seedsman to walk up one side of the ridge or bed, and down the other side; always keeping his face and the hand with which he sows, towards the bed he is sowing. He also keeps his eye on the edge of the opposite interfurrow, and delivers his seed, principally on the side of the bed next to it: as he returns, the sides of course are reversed, and the beds become evenly seeded. An old seedsman who has been used to throw large handfuls with all his might, in wide casts straight across his walk, will find it aukward at first to make the snug diagonal cast which is necessary in sowing five-bout beds singly.

It is observed that "the usual way of sowing in broad-cast cannot answer all the intentions of placing the seed properly in the earth, and must be attended with several inconveniencies; such as the

seed's becoming the prey of various birds and animals; its being laid so superficially, that the sun often parches it up, or a long continued rain, instead of promoting a kindly vegetation, soaks into the grains, and bursts them; the seed is very unequally sowed, because of the inequality of the handfuls which different sowers grasp: and a great part of it necessarily falls together into hollows, where the surface of the ground is any way unequal, &c. And that sensible of these disadvantages, farmers have, especially for their winter grain, sometimes adopted the method of sowing under-furrow, that is, sowing one half of the seed in broad-cast, and then ploughing it in, and afterwards sowing the other half, which is covered by harrowing. But this method is also liable to almost as many objections as the other. for the quantity sown in each particular spot, and the equal distribution which ought to take place throughout the whole, cannot but be even more uncertain than in the broadcast, where the whole is sowed at once; nor dares the farmer, in this sowing under furrow, omit sowing the second quantity, lest a great part of what has been ploughed down be buried so deep that it cannot rise, especially if the soil is at all strong." And another general fault in the common way of sowing, is, that too much seed is employed; partly, because custom has established a kind of rule in that respect, and partly on account of the allowances which it is necessary to make for what the birds eat, and for what lies too deep ever to rise; the circumstances by which a very great quantity of corn is absolutely lost. See *Broad-cast Sowing*.

It is supposed, that these inconveniences may be prevented by the drill method of sowing, which drops the seed at whatever depth and distance experience has shewn to be fittest for the particular kind which is sowed; fills all the furrows with earth, so that none of the grain remains uncovered; and lets fall into each furrow the exact quantity of seed which has been found to be most proper.

In this way the seed is of course distributed with greater regularity and exactness both in regard to depth and the distance of the rows, by which the crops not only succeed better, but are more capable of being assisted in their culture afterwards; while much seed is saved. It is likewise believed to have many other advantages over the common method of sowing. See *Drilling* and *Drill Husbandry*.

There are also other methods of sowing, as by dibbling, dropping, and setting with the hand, which, under different circumstances, are found very beneficial modes. See *Dibbling* and *Ridge*.

Sowing *Machine*, any sort of contrivance for the sowing or depositing grain or seeds in the ground.

Various machines for this purpose have been constructed at different times, but none of which have been found of much use, except for particular purposes.

Mr. J. Horn of Dover, Kent, constructed an *universal five-furrow machine* of this nature, which he recoommended as suited for either broad casting or drilling all the different sorts of grain, pulse, and seeds, with equal regularity and ease, as well as in any quantity or proportion, and depth, that may be thought proper.

It also possesses he says, the peculiar advantage of sowing turnips, so as to ensure the crop against the ravages of the fly. This advantage is obtained by sowing the *usual quantity* of turnip seed *broad-cast* by the machine, and at the same time striking furrows at a proper distance apart in the land; by this means part of the seed is deposited in the drills and the rest sown in broadcast between them; so that if it proves a dry season, it is favourable for that deposited in the drills, if a wet season, for that which is sown broad-cast between them: and if that part of the seed which is sown broadcast is carried away by the fly, that which is deposited in the drills by coming at another period of time, is saved, and *vice versa*. If the whole grows, the farmer has then the opportunity of selecting the most vigorous plants from both."

But notwithstanding these stated advantages the machine is, we believe, little employed by the cultivators of land.

SPADE, a well known implement used in digging.

Spade, provincially to pare or breast-plough.

Spade-*Bit*, the quantity of earth raised by the spade in one effort. Hence probably spit. It also signifies the broad iron part of the spade.

Spade-*Bone*, a term provincially applied to the shoulder-*bone*, probably from its being used formerly as a spade.

Spade, *Paring*. See *Paring Spade*.

SPANNER, the name of a wrench or nut screw driver.

SPANISH *Sheep*, a breed of very fine short woolled sheep. See *Sheep*.

Spanish *Chesnut*, a tree of the deciduous timber kind. See *Chesnut Tree*.

Spanish *Wool*, the finest sort of short wool. See *Wool*.

SPANCEL, a term signifying a rope to tie a cow's hinder legs.

SPARKLING, a term applied to the claying between the spars to cover the thatch of cottages.

SPARROW, a mischievous bird in corn fields, and which should be destroyed. It is observed, that were all the farmers in a neighbourhood to agree to their destruction, by offering rewards for their heads, their numbers might be lessened; and that were the practice general, surely the whole race might be extirpated. It is supposed sixpence a dozen the first year, nine-pence the second, and a shilling the third year, would nearly reach their extirpation. To enforce which, it should be considered how soon twelve sparrows destroy twelve penny-worth of wheat.

In Kent, they use a species of trap, which is very effectual in taking them. It, according to Mr. Marshall, consists of a small wicker basket, resembling the fruit sieve of the London markets; with a cover of the same material fitted to it, and formed on the principle of the fish-pot, and the vermin trap, into which the entrance is easy, but the return difficult. These traps, which are an ordinary article of sale in the

markets of the district, are of brown unpeeled oziers. The diameter about two feet: the depth nine inches. The cover is somewhat dishing with a tunnel, or inverted cone in the centre, reaching to about within an inch of the bottom of the basket: the aperture or entrance, formed by the points of the twigs of which the tunnel is constructed, being about one inch and an half in diameter." And "the usual bait is wheat scattered in the basket. The number caught at once, is frequently more than theory would suggest; the contentions of a few that have entered, seldom failing to bring others to the combat."

SPARS, a name often applied to thatching rods.

SPATTLING *Poppy*, a term sometimes applied to chickweed. See *Chickweed*.

SPAVIN, in *Farriery*, a disease in horses, consisting of a swelling in or near some of the joints, by which a lameness is produced: and of which there are three kinds, the *blood-spavin*, the *bog-spavin*, and the *bone-spavin*.

The first is shown by a swelling and dilatation of the vein that runs along the inside of the hock, forming a little soft swelling in the hollow part, and is often attended with a weakness and lameness of the hock.

In this case the cure should be first attempted with restringents and a bandage, which will contribute greatly to strengthen all weaknesses of the joints, and frequently remove the disorder, if early applied; but if by these means the vein is not reduced to its usual dimensions, the skin should be opened, and the vein tied with a crooked needle, and wax-thread passed underneath it, both above and below the swelling; and the turgid part suffered to digest away with the ligatures: for this purpose, the wound may be daily dressed with turpentine and honey incorporated together. But Mr. Denny advises repeated blistering, and afterwards a compress of folded linen, moistened in the following lotion, and confined by a long bandage:

Take of Sal ammoniac, four ounces;
Acetated ceruse, two ounces;
Vinegar, two quarts;
Water, four quarts. Mix them.

The horse being allowed only walking exercise for three or four weeks.

The second or *bog-spavin* is an encysted tumour on the inside of the hough, or, according to Bracken, a collection of brownish gelatinous matter contained in a bag or cyst, which he supposes to be the lubricating matter of the joint altered, the common membrane that incloses it forming the cyst: this case he had taken pains to illustrate in a young colt of his own; where he says, when the spavin was pressed hard on the inside of the hough, there was a small tumour on the outside, which convinced him the fluid was within-side the joint: he accordingly cut into it, discharged a large quantity of this gelatinous matter, dressed the sore with dossils of lint dipped in oil of turpentine, putting into it, once in three or four days, a powder composed of calcined vitriol, alum, and bole: by this method of dressing, the bag sloughed off and came away, and the cure was successfully completed without any visible scar or other injury.

From this account the disease will scarcely submit to any other method except *firing*, and then the cyst ought to be penetrated to make it effectual: but in all obstinate cases that have resisted the above methods, both the cure of this and the swellings called wind-galls should be attempted in this manner. If, through the pain attending the operation or dressings, the joint should swell and inflame, it may be fomented twice a day, and a poultice be applied over the dressings till it be reduced.

In the third or *bone-spavin*, there is a bony excrescence, or hard swelling, growing on the inside of the hock of the horse's leg. A spavin that begins on the lower part of the hock is not so dangerous as that which puts out higher, between the two round processes of the leg bone; and a spavin near the edge is not so bad as that which is more inward towards the middle, as it does not so much affect the bending of the hock. A spavin produced by a kick or blow is not at first a true spavin, but a bruise on the bone or membrane which covers it; therefore not of that consequence as when it proceeds from a natural cause: and those that put out on colts and young horses are not so bad as those that happen to horses in their full strength and maturity; but in very old horses they are generally incurable. The usual method of treating this disorder is by blistering and firing, without any regard to the situation or cause whence it proceeds. But if a fulness on the fore-part of the hock comes upon hard riding, or any other violence, which threatens a spavin; in that case, such cooling astringents are proper as are recommended in strains and bruises. These happening to colts and young horses are generally superficial, and require only the milder applications; for it is better to wear them down by degrees, than to remove them at once by severe means of other kinds.

In blistering, the hair is to be cut from the part as close as possible, and then the ointment applied pretty thick over the skin; this should be done in the morning, and the horse kept tied up all day, without any litter, till night, when he may be untied, in order to lie down, and a pitch, or any sticking plaster, may be laid over it, and bound on with a broad tape or bandage, to keep all close. After the blister has done running, and the crust begins to dry and peel off, it may be applied a second time, in the same manner as before; and this second application generally takes greater effect than the first, and in colts and young horses makes a perfect cure. But when the spavin has been of long standing, it will require to be renewed perhaps five or six times; however, after the second application a greater distance of time must be allowed, otherwise it might leave a scar, or cause a baldness; to prevent which, once a fortnight or three weeks is perhaps enough: and it may in this manner be continued six or seven times, without the least blemish, and will generally be attended with success.

The spavins that put out on older horses, or full-aged horses, are however apt to be more obstinate

as being seated more inward; and when they run among the sinuosities of the joint they are for the most part incurable, as they then lie out of the reach of applications, and are arrived to a degree of impenetrable hardness. In the cure, the usual method in these cases is to fire directly, or to use the strongest kind of caustic blisters; and sometimes to fire, and lay the blister immediately over the part; but this way seldom succeeds farther than putting a stop to the growth of the spavin, and is apt to leave both a blemish and stiffness behind; besides the great risk run (by applications of so severe a nature to the tendinous parts about the joints) of exciting violent inflammation, and destroying the limb. The safest and best way, therefore, is to make a trial of the blistering ointment, and to continue it according to the directions laid down, for some months, if found necessary: the horse, in the intervals, being worked moderately. The hardness will thus be dissolved by degrees, and wear away. But where the spavin lies deep, and runs so far into the hollow of the joint that no applications can reach it, neither firing nor medicines can avail. Though bold ignorant farriers have sometimes succeeded in cases of this sort (by men of judgment deemed incurable) by the application of caustics which act very forcibly, yet a properly prepared cautery, made like a fleam, under the direction of a skilful hand, which may be applied with less danger of injuring either tendons or ligaments, should probably be preferred. After the substance of the swelling has been properly penetrated by the instrument, it must be kept running by stimulating powders, or mild blistering ointment. Where the spavin lies not very deep in the joint, and the blistering methods do not succeed, the swelling may be safely fired with a thin iron forced pretty deep into the substance, and the part be dressed as has been directed.

SPAWDER, provincially signifying injury, by the legs of animals being forced too far asunder on ice, or slippery roads.

SPAYING, the operation of castrating the females of different kinds of animals, as sows, heifers, mares, &c. in order to prevent any future conception, and promote their fattening.

It is performed by cutting them in the mid flank, on the left side, with a sharp knife or lancet, in order to extirpate or cut off the parts destined for conception, and then stitching up the wound, anointing the part with tar salve, keeping the animal warm for two or three days. The usual way is to make the incision in a sloping manner, two inches and a half long, that the fore-finger may be put in towards the back, to feel for the ovaries, which are two kernels as big as acorns, one on each side of the uterus, one of which being drawn to the wound, the cord or string of which is cut, and thus both taken out.

In the Annals of Agriculture Mr. Foot has suggested the practice of spaying old cows and heifers; as it is a method, he apprehends, that "might be performed with safety, and prove of general use in grazing, as cows when they grow old and fail in their milk, are often attended with difficulty, especially where the bull goes at large, to keep them from him, especially on commons, during the summer, which put him on trying the experiment on a cow of small value, whose profit for the pail was so far over, she would not milk for about three months before she became dry. After she had calved about a month he had her cut; the operator was an ingenious fellow, and performed the business well, that with a little care of keeping her from the cold (being early in the spring) for about a fortnight, he thought her out of danger: continued milking her as usual all the time. She soon began to thrive, gaining flesh, and before the summer was over, by the time she was quite dry, improved, though kept no better than the other part of the dairy on very middling pasturage at Michaelmas; had she been put to turnips, or good rouen, would have been fat by Christmas or soon after. When killed, sold at 3s. 6d. a stone, about half fat at that time, which he laid at one shilling a stone more than she would have done, had she not been cut. And afterwards he had other two cut, that continued to be milked and grazed well; one he had killed, the other sold alive which improved and paid beyond expectation. And though little has yet been done in this way, he is persuaded it will be found of general utility if attended to. But however lately he accidentally met the person that performed the operation, who informed him that he had been sent for within twelve months, or there abouts, to cut near forty in like manner, which having all done well, none failed; that there appears little or any danger in the case, and he believes it may be found of great advantage to the grazier and farmer, if they are inclined to practise it, as well as to the public at large. In confirmation of the above, the persons who have tried the experiment are, he is informed, Will. Colhoun, Esq. Norfolk, 8; Mr. Martin, Exning, Suffolk, 6; Mr. Cayson, Chippenham, 20; Mr. Robinson, Eriswell, 4 or 6."

He may further add, that "most of these were young heifers between two and three years old (some old cows) that had not taken bull; the young stock appear to thrive apace, and grow in size, as well as likely to answer for the butcher soon; they may be fatted with turnips in the winter, or kept on another summer as the grazier pleases. And in Yorkshire it is very common to fat their heifers at three years old, which answer as great a purpose for grazing, and more profitable than older steers or heifers &c. but those are kept from the bull."

But "although there is a method generally practised in spaying calves that are intended for heifers of that name, which are usually cut about six weeks or two months old, yet this other method of treatment, he thinks, is preferable and not so dangerous, for the two years old may be supposed stronger and more fit to undergo the operation: and in the next place it is performed *quite differently*; what is cut away, is only the ends of what is termed the *lusts* or generative parts, which are not when separated from the other parts bigger than the end

of a man's thumb to the first joint, that makes the operation less painful and dangerous when rightly performed. But he would not advise every butcher or inexperienced artist to undertake what they do not understand. He thinks this observation is due to the operators who have cut upwards of forty head of cow stock in this manner (as they informed him), which have all done and are doing well, and he recommends them to public encouragement in an art that is likely to be attended with general utility to the public at large. They are William Bailey and son, Lakenheath, Suffolk. He may further add, a heifer at two or three years old may be defective, in the bag, in the loss of teats, or small size, not larger than an ewe's, which seldom are profitable for the pail, which may be cut after this mode and grazed."

And Mr. Marshall in his Rural Economy of Yorkshire remarks, that "it is a fact well established in the common practice of that district, that spayed heifers *work better*, and have in general *more wind* than oxen; and it is not doubted that spayed mares would have an equal preference to geldings. The reason held out against this practice, though formidable at first sight, proves, he says, a mere shadow on examination. The spaying of fillies would undoubtedly spoil them for *brood mares*. But does not the gelding of a colt spoil him for a *stallion*? What breeder when his mares foal wishes for fillies? and what dealer would not willingly give 2s. 6d. for each, to have his mares changed into geldings, or perhaps into animals superior to geldings. Besides, in the spring of the year *open mares* are faint and troublesome. The only requisites appear to be a safe cutter, and a man of spirit to set him to work, to bring the spaying of female foals into common practice; and it does not follow that because a part of the female foals should be cut, there would not be open mares to breed from, more than it does, that because some heifers are spayed for the yoke, or for fattening, there are not cows sufficient for the purposes of breeding and the dairy." He does not mean however to *recommend* a practice of which he has had no experience; but if the experiment has not been tried, it strikes him forcibly, that it is worth the trial; and that it is more than time it were set about. Since this, he however states that it had been tried in the southern districts, as he saw a mare in 1791, then rising five or six years old, which had been spayed at eight days old by a colt cutter in the neighbourhood of Petworth. And that she was a well bred mare, and of a size proper for hunting. The farmer to whom she belonged asked seventy guineas for her, a proof that in his estimation at least, she had not been injured by the operation. And it is probable that this practice had been attempted long before that period. See *Cattle*.

SPEAR, in *Horsemanship*, a term applied to a mark in the neck, or near the shoulders, of some Barbs, Turkish and Spanish horses, representing the blow or cut of a spear in those places, with some resemblance of a scar. This feather is deemed an infallible sign of a good horse.

SPEARWORT, a plant of the weed kind very prejudicial to sheep, as causing the rot.

SPECIFIC GRAVITY, a term applied to the appropriate and peculiar gravity or weight which any species of natural bodies have, and by which they are plainly distinguishable from all other bodies of different kinds. By some it is not improperly called relative gravity, to distinguish it from absolute gravity, which increases, in proportion to the bigness of the body weighed. Thus if any body weigh a pound, one as big again will weigh two pounds; and let the bodies be of what nature or degree of specific gravity soever, a pound of one will be as much as a pound of the other, absolutely considered; thus, as commonly said, a pound of feathers is as heavy as a pound of lead. But if you consider lead and feathers relatively, the specific gravity of the former will be much greater than that of the latter; or lead, bulk for bulk, will be much heavier than feathers, and gold heavier than lead. In the nature of land there is likewise much difference in this respect, upon which their difference of fertility probably also much depends. See *Soil*.

SPEEAN, provincially to wean from the dams, as calves and hogs.

SPEEAV, provincially to spay.

SPEEDY-*Cut*, in *Horsemanship*, a kind of cut which happens to a horse when put to his speed. See *Shoeing of Horses*.

SPEL, provincially used to signify a bar.

SPELK, a small thin rod, or piece of wood used in thatching.

SPELT, a term applied sometimes to wheat grass, a species of *triticum* or wheat. It is sometimes written *spelta*.

SPERGED, a word signifying pied, as cattle.

SPIKE-*Roller*, a very useful implement of the roller kind, introduced by Mr. Randall of York to the notice of the farmer. It has been found of much advantage in bringing stiff cloddy lands into a state of suitable pulverization and fineness of mould for being sown.

It is likewise employed in a beneficial manner on sward land that is worn out and mossy, by preparing it for the application of earthy composts and grass seeds.

It is remarked by the inventor, that in this business "the roller must go up and down, till the swarth and ground are pretty well broken up: this being done, the seeds of clover, trefoil, and rye-grass, or any other mixed with them, must be sown in the usual way and quantity: then the compost must be spread over the seed, so as to cover them, and a common barley roller, with a thorn-bush fastened to it, must follow, and the ground be shut up, lest cattle should do harm, by treading."

In respect to the roller, "the dimensions in length were seven feet, the diameters at the ends eighteen inches, and the whole cylinder made of the heart of oak: and when the irons were burnt in, and the man seated on the box designed for that purpose, the weight of the whole was about a ton. But the blunt ends of the irons were opposed to the clods, and run

more taper, till they came to the surface of the cylinder, into which the irons were burnt, and inserted about three inches, which was their length above the surface of the roller, and which he always found very sufficient to crush the hardest clod that ever came in their way. Had he, indeed, attempted to go on the ground when the soil was not perfectly dry, this position of the irons would have carried the clods round with the roller; for it is not its province to squeeze but crush. Nor indeed can a man do more harm to his ground, than going upon it when it is not quite dry, with a roller constructed in this way. He had the irons fixed in four inches asunder, in the first row, from end to end. The second row began just between the first and second irons of the first row. The third row was like the first, and the fourth like the second. Then alternately for the whole surface of the cylinder, as near as could be, the irons were four inches asunder in each individual row, and four inches from row to row, as nearly as the superficies of the cylinder would permit. He does not know how to convey a juster idea of the shape of the irons, than to call them ox-harrow teeth, or those of a very large harrow: for, when he sent for the workman, he desired him to make so many of this denomination, six inches in length; and burn the small end three inches into the wood." This is a roller that requires a strong team in performing its work.

In addition to these uses, it has been suggested that it "may likewise be very useful in preparing clay for the making canals or pieces of water. For where, as sometimes happens, the clay grows dry, and will not admit of being duly tempered for use without great pains in breaking it, a very large quantity may very soon be reduced to the requisite fineness, by spreading it on hard ground in a due thickness, and passing this roller a few times over it. In extensive works, much trouble and labour may sometimes be saved by this means, where such a roller is at hand, and the clay prepared in a manner that will answer the purpose much more effectually."

This is a sort of tool which "no farm, where the land is stiff, or in the least liable to clot, should want. For besides the constant advantage of saving labour, and bringing land to a better condition for any kind of sowing than the plough and harrow with any assistance of the work of hands can make it, in favourable seasons, and under certain circumstances, the loss of the whole crop, by an otherwise unavoidable delay beyond the seed time, may be with certainty prevented."

It has been stated as an improvement in this implement, in order to prevent its tearing up the ground, and the great stress that is upon the frame in turning, to have it divided into two parts.

"Let the ends of each part be bound with narrow but strong bands of iron, and let the spikes at the ends be placed close to them; let each part have a separate frame, but let the cheeks in which the inward gudgeons turn, be made of iron plates, about two inches wide above, and four where the gudgeons enter; the thickness, a common flat bar of iron; and these fixed in any firm manner, to two cheeks of wood reaching down just to the bands, and of such a thickness at bottom as not to interrupt the spikes. Let the inward gudgeons be made with quite flat heads, to prevent their slipping out in working, and bring the two ends of the roller nearer together, which is of consequence, as the fewer clots will be missed in working.

"Let the frames be joined together by four eyes, like those of a small gate, two at one end, about five or six inches apart; the two at the end of the other, to take place just within them; an iron pin being put through all four, and keyed. Let the trills be placed just on the middle of each frame, and a bar of wood just behind the horse to strengthen them; the bar sawed through in the middle, and joined by a strong flat hinge: one side made to hasp upon a staple, kept down with a wooden clet. This gives the whole proper play in working.

"The spikes are about four inches without, and three within the wood; the thickness of the roller and number of spikes may be determined, in some measure, by the nature of the soil it is to work upon."

Thus formed it will be found, it is said, next to the plough, the most useful instrument in tillage, not only in reducing a stiff soil, but with a bush at its tail, to cover the seed when sown much more effectually, and in a better manner, than a harrow, as it turns up the earth light and fine behind it; and though seemingly unwieldy, will turn with ease, and may be worked with one, two, or three horses at most, upon any land that is of a proper dryness to work upon.

This implement may be employed to assist in reducing the half burnt turf of burn-baked land, which requires much labour, as commonly done by hand; but by going over the land several times with the spike roller, and harrowing it with heavy harrows alternately, to pull up the turfs, or ploughing them up, they may be reduced fine, in a much shorter time, and at a much less expense, than by beating or breaking them by hand. See *Roller*.

A clod or improved roller of this kind has been constructed by Mr. Blithe Harries of Benthall-house near Shiffnal, in which the danger of the horses being injured in turning, by the spikes, is obviated. It is found very effectual on strong soils, and well adapted for breaking and reducing clods, pulverizing old turf fallows, and preparing land previous to sowing barley, and many other purposes. He describes it in the Agricultural Magazine as consisting of twenty-one cast iron wheels, twenty-one inches and a half in diameter; the edges three inches asunder, or a smaller pattern consisting of fourteen wheels twenty-three inches in diameter, the edges four inches and a half asunder, fastened upon an iron axle-tree, with a large wheel at each end to carry it to the field.

It is further stated, that the invention is Mr. Gittin's, of the Isle, Shropshire, an ingenious farmer, who had one made at Mr. Onion's foundry, Broseley, and Mr. Harris now makes them at his iron

works, the price of which in either of the patterns is 10*l.* exclusive of the row of spikes to clear dirt or stones, and the shafts. It is represented at *fig.* 2. in *Plate* XIV. of the first volume, in which A. is the shafts; B. two cast iron wheels to convey it to the field; C. cast iron wheels to cut the clods; D. spikes to clear the wheels from dirt or stones.

SPILE, a piece of wood sharpened at the point, and drove down into the ground, on the sides of rivers or other places, for the purpose of protecting their banks or other parts against the destructive violence of the waters. They should be well proportioned for the purpose, and be very firmly driven down by proper machinery.

Spile, provincially used to signify the vent peg of a cask.

SPINDLING, the act of running to seed in plants.

SPINAGE, *Wild*, the name of a weed, as the goose-foot.

SPINE, provincially the surface turf, sod, or sward.

SPINNEY, provincially a clump or small grove or plantation.

SPIRE, a term signifying to sprout, as grain in the malting process.

SPIRES, provincially used to signify timber stands.

SPIRKET, a term applied to a hook to hang any thing upon.

SPITTLE, a spaddle or small sort of spade.

SPLENT, in *Farriery*, a hard excrescence growing on the shank bones of horses. Some horses are more subject to splents than others; but young horses are most liable to these infirmities, which often wear off, and disappear of themselves. Few horses put out splents after they are seven or eight years old, unless they meet with blows or accidents.

A splent that arises in the middle of the shank bone is no ways dangerous; but those that arise on the back part of this bone, when they grow large and press against the back sinew, always cause lameness or stiffness by rubbing against it; the others, except they are situated near the joints, seldom occasion lameness.

In respect to the cure of splents, the best way is, not to meddle with them unless they are so large as to disfigure a horse, or so situated as to endanger his going lame.

Splents in their infancy, and on their first appearance, should be well bathed with vinegar, or old verjuice; which by strengthening the fibres, often puts a stop to their growth; for the membrane, covering the bone, and not the bone itself, is here thickened; and in some constitutions, purging, and afterwards diuretic drinks, will be a great means to remove the humidity and moisture about the limbs, which is what often gives rise to such excrescences.

Various are the remedies prescribed for this disorder: the usual way is to rub the splent with a round stick, or the handle of a hammer, and then touch it with oil of origanum. Others lay on a pitch plaister, with a little sublimate, or arsenic, to destroy the substance: some use oil of vitriol; some tincture of cantharides; all which methods have at times succeeded; only they are apt to leave a scar with the loss of hair. Those applications that are of a more caustic nature often do more hurt than good, especially when the splent is grown very hard, as they produce a running for several months, which often leaves an ugly scar.

Mild blisters often repeated, as recommended in bone spavin, should be first tried as the most eligible method, and will generally succeed, even beyond expectation: but if they fail, and the splent be near the knee or joints, fire and blister in the same manner as for the bone spavin.

Splents on the back part of the shank-bone are difficult to cure, by reason of the back sinews covering them; the best way is to bore the splent in several places with an iron not very hot; and then to fire in the common way, not making the lines too deep, but very close together.

SPLINT, in *Farriery*, a thin scale of wood, pasteboard, or leather, of adequate shape and dimensions, applied to the sides of broken bones to keep the ends in contact. It is sometimes written splent.

SPLINTER, in *Farriery*, a small fragment separated from a bone by some kind of violence, as shot from a gun, &c. These sort of wounds are sometimes rendered dangerous by splinters separated from the adjoining bone. See *Wound.*

SPOKEN-*Chain*, provincially a chain of great strength and sufficiently long, for fixing upon the spoke of the wheel of a waggon, when the team is set fast in a slough to draw it out by.

SPOULT, a word signifying brittle, as applied to wood, &c.

SPOUT, a trunk for conveying water from off the roofs of buildings, which should always be attached to those of the farm kind.

SPRAIN, a term applied to sowing of seeds by hand, signifying to throw them with a single motion of the hand at a certain distance from one another.

SPREAD, a term signifying to break grass out of the swath or to ted.

SPRIG, a small branch, a spray. It also signifies a brad.

SPRING, the season in which plants vegetate. Late springs are in general the most beneficial to the farmer.

Spring *of Water*, a fountain, or issue of water from the earth. See *Draining and Water.*

Springs are of several different kinds from the different manner in which they present themselves or burst forth from the soil: thus we have *oozing* or *weeping* springs, where the water gently trickles through the pores of the land; *pipe* springs, where they appear in a single rill; and *wall* springs, where the water issues, as it were, through the joints of a wall. But besides these, springs have many other local names, which serve to distinguish them in their particular situations.

In speaking of the situation of the earth as connected with the formation of springs, Dr. Darwin observes that "it consists of strata, many of which were form-

ed originally beneath the sea. The mountains were afterwards forced up by subterraneous fires, as appears from the fissures in the rocks of which they consist, the quantity of volcanic productions all over the world, and the numerous remains of craters of volcanoes in mountainous countries. Hence the strata which compose the sides of mountains lie slanting downwards, and one or two or more of the external strata not reaching to the summit when the mountain was raised up, the second or third stratum or a more inferior one is there exposed to day; this may be well represented, he says, by forcibly thrusting a blunt instrument through several sheets of paper, a bur will stand up with the lowermost sheet standing higher in the centre of it. On this uppermost stratum, which is colder as it is more elevated, the dews are condensed in large quantities, and sliding down pass under the first or second or third stratum which compose the sides of the hill; and either form a morass below, or a weeping rock, by oozing out in numerous places, or many of these less currents meeting together burst out in a more copious rill."

But "as the springs consist of the water, which slides between those inclined strata; it is evident that in some eminences of ground they are only to be met with on one side of the mountain: and in other eminences of ground on all sides of it. In searching for springs therefore, attention should be given to the inclination of the strata of that part of the country which may be often seen in marl-pits, gravel-pits or in hollow lanes. But they may in general be found above any moist or morassy place or valley; the moisture of which shows that springs exist in the strata on that side of the mountain. And another observation for the purpose of detecting springs, may be made on misty evenings; as those parts of the ground where the mist commences, are moister than those in their vicinity on the same level, and in consequence may generally, if they are not hollow basons, possess springs nearer the surface; for these moister parts of the ground, having evaporated more during the day, are become colder on their surfaces than the drier ground in their vicinity; and in misty evenings, which are at the same time calm, the stationary air over these moist parts of the ground is also more loaded with the evaporated moisture; and on both these accounts these moister situations are liable to show a condensation of aerial vapour sooner than other places on the same level.

And "as mountains are colder in proportion to their height, 1. Their being in a manner insulated or cut off from the common heat of the earth, which is always of 48 degrees, and perpetually counteracts the effects of external cold beneath that degree. 2. From their surfaces being larger in proportion to their solid contents, and hence their heat more expeditiously carried away by the ever moving atmosphere. 3. The increasing rarity of the air as the mountain rises. All those bodies which conduct electricity well or ill, conduct the matter of heat likewise well or ill. Atmospheric air is a bad conductor of electricity, and thence confines it on the body where it is accumulated; but when it is made very rare as in the exhausted receiver, the electric aura passes away immediately to any distance. The same circumstance probably happens in respect to heat, which is thus kept by the denser air on the plains from escaping, but is dissipated on the hills where the air is thinner. 4. As the currents of air rise up the sides of mountains they become mechanically rarefied, the pressure of the incumbent column lessening as they ascend. Hence the expanding air absorbs heat from the mountains as it ascends. 5. There is another and perhaps more powerful cause, he suspects, which may occasion the greater cold on mountains and in the higher parts of the atmosphere, and which has not yet been attended to; he means that the fluid matter of heat may probably gravitate round the earth, and form an atmosphere which may diminish or become rarer as it recedes from the earth's surface in a greater proportion than the air diminishes. And the greater condensation of moisture on the summits of hills has another cause, which is the dashing of moving clouds against them; in misty days this is often seen to have great effects on plains, where an eminent tree, by obstructing the mist as it moves along, shall have a much greater quantity of moisture drop from its leaves than falls at the same time on the ground in its vicinity.

"Hence it is concluded that the evening mist commences sooner on them than in the valleys, but is seen earlier in the situations over the moister places if they are on the same level with the drier ones, exactly as on the plains or valleys; and may therefore indicate the existence of springs, unless these moister places consist of a hollow bason containing water, which if not attended to may in all situations deceive the observer. And further observations for detecting springs may be made in rimy mornings; for as moist earth is a better conductor of heat than dry earth, the rime will sooner melt on those parts of the soil which are kept moist by springs under it than on other parts; as the common heat of the earth, which is 48 in this country, will sooner be conducted upwards in moist places to dissolve the rime on the surface. On this account the rime is frequently seen on frosty mornings, when the heat of the air is not much above 32, to lie an hour longer on dry cakes of cow dung or on bridges or planks of wood, than on the common moist ground, as the latter much better conducts the common heat of the earth to the incumbent rime which is in contact with it. But as the heat of the common springs in this country is 48, where they exist, the rime is sooner dissolved than on the stagnant moisture of bogs or morasses."

He therefore concludes that "the common cold springs are thus formed on elevated grounds by the condensed vapours, and hence are stronger when the nights are cold, after hot days in spring, than even in the wet days of winter. For the warm atmosphere during the day has dissolved much more water than it can support in solution during the cold of the night, which is thus deposited in large quantities on the hills, and yet so gradually as to soak in between

the strata of them, rather than to slide off over the surfaces like showers of rain. The common heat of the internal parts of the earth is ascertained by springs which arise from the strata of earth too deep to be affected by the heat of the summer or the frosts of winter. Those in this country are of 48 degrees of heat, those about Philadelphia were said by Dr. Franklin to be 52 : whether this variation is to be accounted for by the difference of the sun's heat in that country, according to the ingenious theory of Mr. Kirwan, or to the vicinity of subterranean fires, is not yet, he thinks, decided. And in the winter months the rise of springs may be detected in moist ditches by the presence of aquatic plants, as of the water-cress, water-parsnip, brook-lime; as in those ditches which become dry in the summer, these plants do not exist; and when those ditches with springs in them are nearly dry, it may be discovered which way the current has formerly descended, by the direction of the points of the leaves of the aquatic plants as certainly as by a level; an observation which he learnt from Mr. Brindley, the great canal conductor of Staffordshire."

The proper application of these principles may lead to many useful conclusions, both in respect to agriculture and rural economy, and is a sort of knowledge which those engaged in the providing of water from wells or pits should be well acquainted with.

Spring *Crops*, such as are put into the ground in the spring season.

Spring *Grass*, a term sometimes applied to the sweet-scented meadow grass. See *Anthoxanthum odoratum*.

It also signifies the grass that springs early in the spring, and which affords the first bite for live stock.

Spring *Sowing*, such sowings as are performed in the spring season, as that for spring wheat, oats, barley and other crops.

Spring *Wheat*, a species of wheat sown in the spring. See *Wheat*.

SPRINGY *Land*, such as is subject to the breaking forth of small oozing springs. It is a sort of ground very troublesome to the farmer in the cultivation, as requiring much draining and other management, to render it proper for cropping. See *Draining of Land* and *Soil*.

SPRIT, a term applied to a shoot or sprout.

Sprit, a term signifying sprouted, as corn in the field.

SPROUT, the young shoot of a plant.

SPROUT-*Hill*. See *Ant-Hill*.

SPRUNT, a term signifying a steep road.

SPUNGE, in *Horsemanship*, the extremity or point of a horse's shoe, that answers to the heel of his foot, and upon which the calkins are formed.

SPUR, in *Horsemanship*, a well known small piece of iron, consisting of two branches, bending in the form of a semicircle, for receiving the horseman's heel, with a rowel or small piece of iron with eight or ten points advancing out behind, to prick the horse's side with occasionally in travelling.

SPUR, the name of a vegetable disease which frequently attacks rye, and which sometimes likewise damages wheat. It is found that "the grains which have the spur are thicker and longer than the sound ones, and generally project beyond their husks, appearing sometimes straight, and sometimes more or less crooked. And that their outsides are brown or black; their surface is rough, and three furrows may frequently be perceived in them, which run from end to end. Their outward end is always thicker than that which sticks to the chaff, and the most swollen end is sometimes split into two or three parts. It is not unusual to find on their surfaces cavities which seem to have been made by insects. Further, that when a spired grain is broken, in the middle or centre of it is seen a pretty white flour, covered with another flour, which is reddish or brown. Though this vitiated flour has some consistency, it may nevertheless be crumbled between the fingers. M. Aimen has sometimes found this powder almost as black as that of smutty wheat. That these grains, when put into water, swim at first, and afterward sink to the bottom. If chewed, they leave a bitter taste on the tongue. The chaff appears sound, though what is outmost, is somewhat browner than when the ears are sound."

But all the grains of the same ear are not ever attacked with the spur. The grains which have this distemper stick less to the stalks than sound grains do. And the above writer "imputes the distemper to the grains not being impregnated: and asserts that he has not ever found a germ in grains which had the spur."

It has been supposed by some that fogs, dews, rain, and the moisture of the earth, may give the distemper to rye, but without any sufficient reason.

M. Tillet is however strongly inclined to think that it is occasioned by an insect, which turns the rye into a kind of *gall*; and he suspects a small caterpillar as being the cause of this mischief, but cannot speak affirmatively on this point.

It has been absurdly supposed to affect those who consume the bread made from grain thus diseased with a sort of dry gangrene in the extreme parts of the body.

SPUR-WAY, a term applied to a bridle or horse-way through inclosed lands, and free to any one to ride in by right of custom.

SPURREY, the name of a plant of the weed kind common in many parts. It seldom rises above six inches in height, flowers in the beginning of July, ripens its seed in August, and is an annual plant. When it is troublesome as a weed, the best method of exterminating it is by summer fallows, and cutting it down before it can scatter its seeds, which are very small.

Two species of this plant however are said to be cultivated in Holland and Flanders for the winter food of cattle, when there is a scarcity of grass. It is said to enrich the milk of cows so as to make it afford excellent butter; and the mutton fed on it is preferable to that fed on turnips.

Hens eat this plant greedily, and it is supposed to make them lay a great number of eggs.

But though it cannot, from the lowness of its growth, afford a great quantity of fodder, as it will grow on the poorest land, it may perhaps be cultivated to

advantage in some places; and be useful by feeding it off on the ground.

It is sown twice a year; the first time in April and May, to be ready in June or July; and the second time after the rye-harvest, to serve the cattle in November and December. The usual allowance of seed is about twelve pounds to the acre.

SQUALLY, a term provincially applied to such crops of turnips, corn, &c. as are broken by vacant or unproductive patches.

SQUINDER, a word signifying to burn inwardly or in a smothering manner, as charcoal, &c. is burnt.

SQUIRREL, a small well known animal of the quadruped kind. It is stated in the 3d volume of the Farmer's Magazine that great depredations are committed by this little animal on the young woods in North Devonshire, especially on the larch."

The writer says that "this lively little quadruped was not known in the Lothians of Scotland, till within these 30 years, when it is said to have been introduced by the benevolent Dutchess of Buccleugh, as an ornament to the woods of Dalkeith; from whence it has spread its species over most of the forests in Mid and East Lothian.

"The squirrel feeds on nuts, fruits and corn, of which it lays up great stores for winter provision: but in summer it generally lives on the tender shoots of trees, particularly of the larch. Hence it becomes so destructive to young plantations.

"Almost every species of squirrels, also where they become numerous, are destructive to fields of corn of all kinds, as well when green as when ripe. In North America some years ago, the crops of grain were so devoured by these animals, that the states found it necessary to offer a reward of 3d. *per* head for every one that was killed. How numerous they were, may be guessed from this, that, in one year, Pennsylvania alone paid in rewards on this account, 8,000*l.* currency.

"These observations are designed to put gentlemen on their guard; and to show, not only to the planters of trees but also to the farmers, and of course to the community at large, the necessity of destroying instead of fostering squirrels."

STABBING *of Cattle*, an operation sometimes found useful where animals are hoven, or the business of discharging the *flatus* from the animals in such cases.

"The operation must be performed, according to Downing, on the contrary side the beast is milked on; by piercing a very sharp knife just in the centre between the first rib and the hip bone, about three inches from the point of the short ribs, making an orifice an inch long or more; there cannot, he says, be any danger attending this operation; and if the knife be even as long as a butcher's knife it will not, he thinks, do an injury in that place, if the operator be careful to avoid hitting against the bones. See *Hoven*.

STABLE, a building or house for horses, &c. being furnished with stalls and proper contrivances to contain their food, &c. It is found by experience that nothing conduces more to the health of horses than the having a good and wholesome stable. The situation of course should always be in a good air, and on a firm, dry, and hard ground, that in winter the horse may go out and come in clean; and where possible be built somewhat on an ascent, that the urine and other liquid matters may be easily conveyed away by means of drains for the purpose. As there is no animal that delights more in cleanliness than the horse, or that more dislikes bad smells, care should be taken that there be no hen-roost, hog-sties or necessary houses near the place where the stable is to be built, for the swallowing of feathers, which is very apt to happen, when hen-roosts are near, often prove injurious to horses. The walls of a stable, which ought to be of brick rather than stone, should be made of a moderate thickness, two bricks or a brick and a half at least, for the sake of warmth in the winter, and to keep out the heat in the summer, but for farm purposes they may often be made of other materials. The windows should be proportioned in number to the extent, and made on the east or north side of the building, that the north wind may be let in to cool the stables in the summer, and the rising sun all the year round, especially in winter. They should either be sashed or have large casements for the sake of letting in air enough; and there should always be close wooden shutters, turning on bolts, that the light may be shut out at pleasure. Many pave the whole stable with stone, but that part which the horse is to lie on is often boarded with oak planks, which should be laid as even as possible, and cross-wise rather than length-wise; and there should be several holes bored through them to receive the urine and carry it off underneath the floor into one common receptacle; the ground behind should be raised to a level with the planks, and be paved with small pebbles. There are mostly two rings placed one on each side of the manger, or stall for the reins of the horse's halter to run through, and a logger is to be fixed to the ends of these sufficient to poise them perpendicularly, but not so heavy, as to tire the horse, or to hinder him from eating; the best place for him to eat his corn in, is a drawer or locker, where there is no manger, made in the wainscot partition, which need not be large, so that it may be taken out at pleasure to clean it, by which means the common dirtiness of a fixed manger may be avoided. Many people are against having a rack in their stables; they give the horse his hay spread upon his litter, and if they think he treads it too much, they only nail up three or four boards, by way of a trough bin, to give it him in.

Where there is sufficient stable-room, partitions should be made for the different horses to stand in: these should always allow room sufficient for the horse to turn about and lie down conveniently, and they should be boarded up so high towards the head, that the horses placed in separate stalls may not be able to smell at one another, nor molest each other in any way. Behind the horses there should be a row of pegs, to hang up saddles, bridles, and other utensils; and some shelves for the

brushes, pots of ointment, &c. or what is better a conveniently fitted up room adjoining. The other requisites for a stable are a court, a dung-yard, a pump, and a conduit.

For farm stables it is not however necessary to attend so much to elegance in their construction; it is sufficient to have them neat and convenient. And in order to this they should be made so as to be contiguous to the other offices with which they may have the greatest connection.

It is observed by Mr. Beatson in the first volume of Communications to the Board of Agriculture, that "in the contriving and fitting up of the racks and mangers, great attention should be had to economy and convenience of labour. The most common and usual method of making them extend quite across the upper end of the stall, is a bad and expensive practice, and which has much inconvenience in the foddering of the horses, as in order to save trouble, servants are very apt to stuff the racks full of hay, however large they may be; from which many bad consequences arise, and much hay is lost or destroyed by being pulled down and mixed with the litter, or trodden under the feet of the animals. Besides, various bad effects result from the practice of suffering horses to be continually stuffing themselves with hay, as is well known to those who are accustomed to the proper management of such animals, as under their directions they are never permitted to have much hay in their racks at a time. Another disadvantage also attends this mode of fitting up stalls, especially for farm horses, as it ought to be the object to preserve every thing;—the hay-seeds are totally lost, which if good, and carefully secured, might be of great utility and value. And by the practice of placing the racks with so much inclination outwards, the seeds are also very apt to fall into the horse's ears and eyes, which often cause disagreeable effects. For these reasons it is supposed that racks should have a perpendicular direction, not having a space of more than fourteen or sixteen inches from the wall; the bottom being sparred, in order to let the seeds fall down below, whence they may be removed by a sort of sliding shutter. These advantages may also be obtained by leaving niches in the walls for the racks, on which plan the spars will be equal with the insides of the walls. Where the niches and racks are made in the middle of the stalls, two feet, or two feet and a half wide, will in most cases be sufficient; they should, however, be carried down low enough to admit of a small box or drawer being placed under them, for the reception of the hay-seeds. Racks of this sort may likewise be placed in the corners of the stalls, and be made in such a way as that one nich may serve two stalls. And they may be placed in the angles of the stalls without having any nich, and may be made of a semicircular form. In whatever way they are formed, there should constantly be a division betwixt them, which is probably best made of deal. By this means, the farmer will be able to ascertain with exactness, what each horse eats, which cannot be done in any other manner. Where the racks are put in the corners of the stalls, it may, perhaps, be more advantageous to have them straight than circular; but in whichever way they are formed, the farmer should always have a hatch fixed for each stall, as by that means a great deal of time may be saved in feeding his horses.

From the above it must be equally unnecessary in the making of the manger to have it the same width of the stall; as a box or drawer sixteen or eighteen inches long, and twelve or fourteen inches wide, will answer every intention perfectly well. But it should be so contrived that it may be readily taken out and cleaned whenever it is fouled or becomes furred with dirt. With the fixed mangers this can never be done, however they may be daubed by the saliva issuing from the horse's mouth during the time of feeding, or the discharges proceeding from his nostrils when labouring under colds, or other disorders of a more dangerous nature.

Besides this, there is another method of making stalls, which, as being cheaper and more economical, deserves to be regarded by the farmer: on this plan the stable has neither racks or mangers; the head of the stall is boarded about three feet from the ground, having a space of about two feet from the wall, in which the hay is to be deposited, the horse pulling his hay from below, instead of drawing it from above; which is not only more natural, but prevents the waste of hay, much of which drops down and is lost when the horse eats from a rack; but by this method, there is an inconvenience, as whatever falls is again received among that from which it was drawn. And even in this construction it will be necessary to have the bottom sparred, within eight or ten inches of the ground, and a box, hopper, or hay-manger, and drawer, so contrived as to receive the seeds of the hay: where there are double stalls the boxes may be divided in the middle. Single stalls, where they can be conveniently made, should, however, always be preferred, as being much more safe and convenient in different points of view.

It is likewise conceived that the paving of stables is a matter of great importance, though it has been hitherto but little attended to: whether the stall should have a slight declivity or be perfectly level, has not, perhaps, yet been so fully determined as it ought. It would appear, however, to be more natural and easy for these animals to stand and rest themselves on a level surface, than on one that is sloping, as it is evident that the tendons, or sinews of the pastern joints, must be kept more upon the stretch in the latter, than in the former case. The main difficulty in regard to a level stall has been the conveying away of the moisture; but this may be well effected by paving the stall perfectly level, and only leaving a small drain in the middle, extending within two or three feet of the upper end of the stall; but which should not be more than seven or eight inches wide at top, forming an angle at the bottom. The depth of the end nearest the head of the stall need not be more than three or four inches deep, having as much slope as can be conveniently given it backwards, in order that it may carry the moisture

off quickly to the main drain, into which all the stall drains should have a fall and the moisture be discharged. And the small stall-drains must be covered with a piece of good strong oak-plank, in which a great number of holes are bored, and which must be so fastened as to admit of its being readily raised up and let down, as by this means the drains may be washed and kept clean and sweet as often as they are found to be furred up and obstructed.

And besides, main drains must be made at the end of the stalls, or in some other convenient situation, for carrying off the moisture into the general receptacle. Where they are placed at the bottom of the stalls, they should not be closer to the stalls than two feet, in order that the stale of mares may get readily into them, which would not be the case if they were nearer, unless the pavement behind the stalls were made to decline a little towards them. These main drains need not be more than seven or eight inches wide at the top, but they should be covered with plank, in which holes are perforated for conveying away the moisture and wetness. But with the view of saving the expense of making main drains within the stable, a shallow open drain may be made in the common way, with which the stall drains may communicate by means of very small grates at the ends. And it should be observed that the pavement or floors of the stalls should have a very slight declination from their sides towards the drains, to prevent moisture standing on them; an inch, or an inch and an half will, however, be quite sufficient for these purposes.

It is added that by having stalls constructed in this manner different advantages will be gained; the horses, by standing on a level, will be less liable to disorders in the feet and heels, and from the great declivity of the drains the urine will be more readily carried away, and not be suffered to spread; and of course, much litter be saved, which is a matter of considerable importance where straw is scarce. With the farmer this is however not material, except in so far as the keeping the horses clean is concerned.

In regard to the sizes of stalls they differ much according to circumstances; but four feet and a half are the least they should ever be made, and five feet is much better. The divisions between them should be high, so that strange horses may not see each other. But where stallions are kept, or young horses required to be left loose in a stall, they should be so inclosed as to be incapable of doing mischief. And for these purposes, one or more stalls may be sparred to the top, or doors provided, which may be hung to the back posts of the stable. Where this last method is followed, the stalls serve extremely well for keeping different mares and their foals separate from others, as well as many other useful purposes.

The writer of the East Lothian Survey has remarked, that "sometimes stalls are made double, and as farm horses generally work in pairs, each pair that work together have one of these double stalls; for horses are a sociable animal, and it is said they feed better, and are more cheerful when they live in society. But even in this case it is proper they should be fastened to the opposite sides of the stall, and that each horse should have his own rack and his own manger; for although they may seem to have a very great attachment for each other (as it is evident they often have), yet if the dividing of their food is left to themselves, it is more than probable they will quarrel about it, and that the strongest horse will have the best share."

But such farm "stables as contain only one row of horses, with one horse in each stall, are the most useful and convenient; and if the stalls are sufficiently large, and the divisions between them raised sufficiently high, not with spars, as often is the case, but with boards closely joined, each horse will be allowed to eat his proportion of corn and hay equally, and allowed to take the necessary rest without danger of being disturbed by a troublesome neighbour. The stable ought to be well paved and of a sufficient breadth to leave a space of at least six or seven feet behind each for a safe passage to the servants hanging the harness upon the wall. The pavement should decline gradually, from the horse's head backward, towards the channel at his heels, which should also decline towards one end of the stable, where the urine may be received into a reservoir. Proper openings should also be left in the walls, for the purpose of ventilation: these should be fitted with sliding or flap boards, opened in the morning, when the horses go out to work, and shut in the evening: in that way the stables will be properly ventilated: and every risk of cold, from having these openings uncovered during the night, avoided."

It may be observed, as being of much importance to farmers, that where "the dung is not taken out of the stable so often as health and cleanliness require, the consequences are that while the horses have the appearance of a dry comfortable bed, they are half suffocated with the stench and fermentation of the dung thus accumulated. And as this is often the case not only in winter, when the dryness of their food, and the coldness of the atmosphere, prevent the process of fermentation from advancing hastily; but, in summer, when they are fed upon clover, or other green herbage, the moisture contained in which, aided by the heat, occasions a rapid fermentation. The smell of a stable where the dung has been allowed to remain for a week or ten days, is intolerable, and the volatile alkali generated, so strong as to penetrate and affect both the eyes and nose of persons entering into it, in a very disagreable manner. The consequence is, the horses are sickened and enervated by the heat and offensive smell during the night; a part of their food being impregnated with the effluvia, is loathed and rejected; and, in the morning, when they are taken out to work, in place of the sprightly appearance exhibited by animals that have been well fed and had a comfortable bed, their hanging ears, and heavy sluggish appearance, distinctly mark the state of the stables they have quitted."

But in order to render the forming and constructing of the different internal parts of stables more clear and easy it may be necessary to have recourse to representations of them.

At *fig.* 1. in *Plate* XXXII. is shown the common

or usual method of placing the racks and mangers in stables: *a* is the positions of the rack; *b* is that of the manger.

At *fig.* 2. is shown the improved position of racks 14 inches from the wall; in which *a b* exhibit the spars of the rack; and *a c* likewise the bottom of the rack sparred for the seeds to fall down through to *d*, whence they are taken out by a drawer at *e* in *fig.* 3. At *f* in *fig.* 2. is a door sometimes made use of in stables to serve different useful purposes in separating the animals.

At *fig.* 3. is a front view of the rack and seed box as when fitted up, And at *fig.* 4. is represented racks placed in niches in the wall so as to serve two stalls, in which *a* is the division betwixt the racks.

At *fig.* 5. is shown the same racks when placed in the angles without niches, in which *b* is the division betwixt them; and *fig.* 6. exhibits the form of the racks for the angles, in which c is the division of them.

At *figs.* 7 and 8. are shown the manner of fixing the windows or shutters in stables: in which *a*, *fig.* 7. is the front view of the window with shutter fitted to it, being suspended on iron pins in the middle, as at *b b*, on which it turns: *b*, *fig.* 8, is a side view showing the position of the shutters *c d* when opened a little so as to admit air.

Fig. 9. is the representation of a sort of hopper or contrivance in the form of a box, where neither racks nor mangers are employed; it is 14 inches wide at bottom, and sparred for the seed to drop into a kind of drawer; *a a* are boxes in the corners for corn; *b b* the hay manger divided by the dotted line *c*. And at *fig.* 10. is shown a stall; *a b c d* the ground plan; *a b* the inner end to which the horse is tied, which is paved on a level from *a* to *d* and from *b* to *c*, a small 7-inch drain being left in the middle, as seen at *e*, *f*, *g*, *h*, made to within 3 feet of the inner, and forming an angle at bottom as shown in cross section *fig.* 11. the depth at *g h* is 3 inches, sloping to *d* in longitudinal section, *fig.* 12. into which the stall drains pass, these being covered by two inch planks perforated with holes secured by hinges or two iron pins, *g h*, *fig.* 10. The main drain may be made at *d* in the end of the stall, or otherwise as most convenient in the particular situation.

Other contrivances in racks and stalls for preventing the unnecessary waste of food, and to guard against the inconveniences of hay seeds falling into the eyes and ears of horses, have been suggested by two good American farmers. The first are by Mr. West, in which the racks are upright, and the perpendicular falls on the inner edge of the trough below which has a shelving leaf as at *figs.* 13 and 14 in *plate* XXXII. in which *fig.* 13 shows the elevation of the stall, and *fig.* 14 is a transverse section of the same. In these cases, when the animal pulls out the hay from the racks, the waste part falls on the leaf and thus slides down into the trough, where it is secured from being spoiled by the breath of the animal, and the distance between the bottom of the rack and the trough is sufficient to permit the animal's heads to enter, in order that they may get at the hay which is dropped. The racks are two feet four inches deep, and two feet at the top from the edge of the rack; being plained within that the hay may fall to the bottom of the rack, in proportion as it diminishes in quantity, and the animals saved the pain of a long reach, which they are obliged to make in the stables fitted up in the usual method. And the animals are fed from the entry, which is 6 feet in width, the hay being dropped through a trap door from the store-room above the stable.

The other is by Mr. J. Cooper, in which the racks of the stalls are constructed as shown at *figs.* 15 and 16. the construction of which the following delineation will explain: At *fig.* 15 is given an elevation of the racks, and *fig.* 16. represents a transverse section of the stable. In these the advantages are very great, as the upright *slats* prevent the horses from wasting the hay as well as from blowing upon it; and besides the animals are prevented from looking round, a habit to which horses are much accustomed when any person enters the stable, neither can they thrust their heads over the trough, as the *slats* compel them to feed directly over them without turning to either side. At *fig.* 17, is a front view of stalls of an improved stable; *fig.* 18, side view of same; *fig.* 19, plan of stalls.

It has been already noticed, that in the stables, or very contiguous to them, a place should constantly be provided for the reception of harness and other articles of that kind; and likewise a convenient and well-secured place for a corn-bin. Where the stable is small, it is in general the most convenient to have the bin in the room above, and which should be so constructed as that the feeds may be regulated and obtained from a spout in the lower part which is in the stable, as by this contrivance, much time, trouble and grain is saved in going to the bin, measuring, &c. This sort of bin may be seen at *fig.* 6 in *Plate* XLVI, in the first volume.

STACK, a quantity of corn, hay, straw, stubble, or other similar material, regularly built or piled up, and generally thatched as a defence from the weather. Stacks are of various forms and dimensions, according to circumstances; but for grain those of the long, narrow, square shape are probably the most advantageous, where the quantity of corn is considerable; as they are found to stand more firmly, have a better appearance, are more conveniently and readily built, and preserve the grain better than those of other forms. And they have the great advantage of requiring less thatch as well as labour in putting it upon them. But that where the corn is only in a small proportion, the round or oblong shape may be more proper and suitable, as being more readily drawn up in the roof, and the circular with a conical top and cylindrical body diverging a little at the eaves, is esteemed the best form by the author of the Agricultural Report of Perthshire. For hay the form of the stack is a matter of still less consequence; the long square, or oblong shapes are perhaps the most safe and convenient, especially when not too broad, as they admit the air the most fully. Besides they are the most convenient to cut from in trussing hay for sale at the market. But the circular form for farm use, where straw is scarce, may be more

advantageous in saving straw in thatching or covering them. Different forms of stacks are represented in *Plate* XXXII; at *fig.* 20 is shown an oblong form of corn stack, with the manner of placing the sheaves in building it; and at *fig.* 21 is a corn stack, of the circular form, with the manner of securing the thatch. At *fig.* 22 is shown another form of grain stack, and the manner of securing the thatch is more fully explained. It is thus described in the third volume of the Farmer's Magazine: "A A A are the stone of supports with their flat caps, *a a a*; B B is the wooden frame. C C C the straight rope to which all the others are attached at *d d d*, and their ends firmly secured by passing several times round the belt rope E E. F is the crown or summit of the rick firmly fixed over the straight rope C, and is sometimes fancifully decorated. All the oblique ropes *d d d* are put on alternately from the opposite sides of the rick. Some farmers prefer fixing the ends of the oblique ropes to the buts of the sheaves, without using a belt rope.

At *fig.* 23. is given the representation of a sort of hay stack, which in Scotland, and some of the more northern English districts, is denominated a *hay sow.*

In respect to the sizes of stacks of the first sort, they of course vary greatly according to circumstances; but should never be made too large, as there is a great deal more risk in securing and getting in the grain from them; and from their being built at different times, they do not settle altogether in so perfect a manner, or resist the effects of the weather and keep the grain so well as those of less dimensions that can be completed at once: and in addition, they are more convenient in the threshing out, especially where the flail is employed. The chief advantages they possess are those of taking something less in thatch and labour in covering them. But in common, from about 20 to 30 two-horse cart loads may be sufficient for one stack on all the middling sized farms.

And in regard to the proper size of the hay stack, it should probably be different in some degree according to the state and nature of the hay; but a middling size is perhaps the best, as from twenty to thirty loads of about one ton each, as there are inconveniences in both small and large stacks, the former having too much outside, while the latter are liable to take on too much heat, and at the same time permit less moisture to be preserved in the hay. In small stacks the bellying forms with very narrow bottoms have often much advantage, and are in some districts termed sheep stacks, probably from the slovenly practice of sheep having been permitted to feed at them.

It is observed by Mr. Middleton "that there are no hay stacks more neatly formed nor better secured than those of Middlesex. At every vacant time, while the stack is carrying up, the men are employed in pulling it with their hands, into a proper shape, and about a week after it is finished the whole roof is properly thatched, and then secured from receiving any damage from the wind, by means of a straw rope, extending along the eaves, up the ends, and near the ridge. The ends of the thatch are afterwards cut evenly below the eaves of the stack, just of sufficient length for the rain water to drip quite clear of the hay. When the stack happens to be placed in a situation which may be suspected of being too damp in the winter, a trench of about six or eight inches deep, is dug round, and nearly close to it, which serves to convey all the water from the spot, and renders it perfectly dry and secure."

In stacks of both kinds, proper stands or staddles should constantly be provided, being well proportioned to the intended size of the stacks. Those for grain should have copings placed so as to prevent the entrance of vermin. But for hay there is no necessity for this, nor need they be raised so high, but be quite plumb and upright. It is evident that by the common method of placing them upon the ground, on a little drift or a few pieces of wood laid across each other, there must constantly be great loss in the bottom parts of the stacks from the moisture being absorbed by the hay, while by the use of stands this may be almost wholly avoided, and the expense be but trifling, as any old rough pieces of wood or other materials will answer the purpose in a perfect manner. See *Stand.*

Stack-*Bars*, a term applied to the large hurdles, by which hay-stacks in fields are inclosed.

Stack *Guard*, a cloth or other covering suspended over stacks during the time of their being built, to protect them from rain, &c. It is applicable both to the securing of corn and hay stacks. It is usual for this purpose to employ a large sheet or sail cloth, which answers the purpose perfectly, and prevents much injury and loss in wet bad seasons.

In the districts of Kent and Surrey, "the old or half-worn sails of ships, are, according to Mr. Marshall, made use of as guards. But, says he, a sail-cloth thrown over, and immediately upon the hay, of a stack in full heat, is liable to do more injury, by increasing the heat, and at the same time checking the ascent of the steam, than service in shooting off rain water. Beside, when the stack is broad, the cloth thus spread over it, is liable to bag in particular parts, and thereby to form receptacles and pools of water; which, unless the cloth be very tight, find their way in currents into the body of the stack. To obviate this, it is not uncommon to set up a tall post at each end of the stack, and having stretched a rope between their tops, to throw the cloth over the rope; and thus, not only prevent its bagging, but also giving a degree of vent to the steam. But this is immechanical, the posts want stays to keep them upright, and to prevent the rope from sagging in the middle; and the cloth, in this case, cannot easily be regulated to the given height of the stack."

"The improved method of spreading the cloth, which he observed in the district of Maidstone, is, he says, this. Two tall poles, users, fir balks, are stepped firmly in two cart wheels; which are laid flat upon the ground at each end of the stack, and loaded with stones to encrease their firmness. Another pole of the same kind, and somewhat longer than the stack, is furnished at each end with an iron ring or hoop, large enough to admit the upright

poles, and to pass freely upon them. Near the head of each of the standards is a pulley, over which a rope is passed from the ring, or end of the horizontal pole, by which it is easily raised or lowered, to suit the given height of the stack. In the instance observed, the rick was begun with two loads of hay; yet even these two loads were as securely guarded from rain, until more could be got ready, as if they had been housed: for a cloth being thrown over the horizontal pole, and its lower margins loaded with weights, a complete roof is formed and exactly fitted to the stack, whether it be high or low, wide or narrow; the eves being always adjusted to the wall-plate, or upper part of the stem of the stack; thus effectually shooting off rain water, while the internal moisture, or steam arising from the fermentation of the hay escapes freely at either end, as the wind may happen to blow. And what renders this ingenious contrivance the more valuable, is, its being readily put up or taken away. The poles being light, are easily moved from stack to stack, or laid up for another season, and the wheels are as readily removed, or returned to their axles."

On these hints, sir Joseph Banks seems to have made a considerable improvement, which is equally simple, cheap, and easy in the execution; and at the same time, perfectly calculated for the purpose.

This improved apparatus, as given by Mr. Young, in the tenth volume of his Annals, is shown at *fig.* 1, in Plate XXXIII. in which *a a* exhibits the two long upright posts, poles, or balks of wood, fixed into the wheels; *b b*, the ropes by which the cloth is suspended over the stack as well as raised or depressed at pleasure; *c* the middle part of the cloth well secured for the attaching the hooks of the tackle to; *d d d d d d*, the ropes on each side, by which the upright posts or poles are held steady, and which are fixed down to the ground by strong pegs, being fastened to rings on the tops of the poles at *e e*; *f* and *g* show the block and tackle by which the cloth is capable of being raised or depressed, *f* being the lower and smaller block, and *g* the upper or larger; *h h h h h h h h*, are pieces of ropes attached by rings to the bottom parts or edges of the cloth, by which they fix it to the ground, or stack by pegs.

At I, *fig.* 2, the block and tackle are shown separate and enlarged.

It is suggested by Mr. Young, that when the cloths are spread immediately on the hay, they soon become rotten by the reverberation of the heat and moisture jointly and directly under and in contact with them; while, at the same time, the surface of the stack is, as seen above, damaged by the steam being impeded from rising freely; consequently that by raising the cloth along the middle, a free current of air prevents both these inconveniencies.

Other more complex contrivances of these kinds have likewise been given in different works on husbandry.

Stack *Yard*, the inclosure or yard in which the stacks of hay and grain, &c. are placed. They should always be conveniently situated for the barns or threshing mills.

They should always be sufficiently spacious and airy, having a firm dry bottom; and some advise them to be ridged up, to prevent the accumulation of surface water, as by these being pretty well raised in the middle, and covering the places where the stacks are to be built, either with rough stones, with a mixture of gravel, or paving them in the same manner as streets, much advantage would be gained at little expense. But a much better method is to have them raised considerably above the surface, and placed upon pillars of wood or stone, with a covering of wood round the circumference, and beams laid across. The inclosing of stack-yards is also a matter that should be attended to more particularly, and be well performed in some manner or other, either by means of walls or palings.

Where there are trees they should be removed, as they are very unfavourable to the *winning*, or keeping of the stacks. Where circumstances will allow, stack-yards should be inclosed with a sunk fence; as in that way the stacks will have the full benefit of the air from top to bottom, a circumstance of no small moment, as it is often found, especially in wet seasons, where the fence of the stack-yards is only a low wall, that the whole of the stacks are damaged or spoiled as high up as the wall reaches, while the upper part is perfectly safe; should any addition be required to the sunk-fence, a railing upon the top may be quite sufficient. This fully shows the vast advantage of having stack-yards sufficiently airy. The proper arrangement of the stands, for their being removed to the threshing mill, is also a matter of much consequence in the economy of the work that is to be performed in them. See *Stand* and *Threshing Machine*.

Stacking *of Grain*, the art of building or forming stacks of corn, &c.

In the execution of this business, the stems of the stacks should be so formed as to swell gradually outwards, quite up to the part termed the eaves, as by this method they are more perfectly secured against the entrance of moisture, and at the same time require a less space of stand to rest upon. And when the building of them is well performed, they have equal solidity, and stand in as firm a manner. But Mr. Marshall, who had probably not fully considered the advantages of this practice, advises that the stem should be carried up as plumb as possible, (except the last course, which should project five or six inches, to form the eaves); for the weight of the roof will press out the upper part of the stem sufficiently. If it overhang in making, its own weight and the weight of the roof will squeeze it too flat, will spoil its appearance, and waste both thatch and time in thatching.

The stem should contain about two thirds, and the roof one third of the whole stack. If it be built on a frame, the stem should contain less and the roof more; if on a bottom, the reverse. The corners of the stem should not be built too sharp; should be carried up snug; by which the sides will look fuller, and the swell given by the pressure, will be more perceptible.

The ends of the roof should have a gentle projec-

ture, answerable to the stem; and the sides should be carried up rather convex, than flat or concave. Perhaps a roof gently convex shoots off the rains preferably to any other.

"A corn-stack should not, he says, contain above 21 loads, as the risk of making and getting-in is much less on a small than on a large stack; besides, a large stack does not settle so true as a small one, and of course will not stand the weather so well. It is true, a large stack does not in proportion take so much thatch and thatching, which is its only advantage.

In cases where corn is stacked in a loose manner, it is the usual practice to have a number of persons upon the stack, the corn being forked up and deposited on the different sides all round in a similar method; after this other parcels are laid all round on the inside of these, so as to bind them in a secure manner from slipping outwards; the operator proceeding in the same manner till the whole of the middle space is perfectly filled up: when he begins another course in the same method, and goes on in this mode, with course after course, till he has raised the whole of the stem; when he begins to take in for the roof, in a very gradual manner, in every succeeding course until the whole is brought to a ridge or point, according to the manner the stack is formed in. But for the purpose that the roofs may throw off the water in a more perfect and effectual manner, they should be made so as to have a slight degree of fulness or swell about the middle of them, and not be made flat, as is too frequently the practice with indifferent builders of stacks.

The method of proceeding where the corn is bound into sheaves, is however quite different, as there is seldom more than one person employed in managing the work of building the stack, except in cases where the dimensions are very considerable; in which cases it is found necessary to have a boy to receive the sheaves from the pitcher, and hand them to the man who builds the stack. And in executing the work it is of the utmost importance that the centre of the stack be constantly kept in a somewhat raised state above that of the sides, as by this means the sheaves have a sloping direction outwards, by which the entrance of moisture is more effectually guarded against and prevented. And in order to accomplish this in the most perfect method, it is said to be the best practice for the workman to begin in the middle of the stand or staddle, setting the sheaves together, so as that they may incline a little against each other, placing the rest in successive rows against them till he comes to the outside, when he carries a course of sheaves quite round, in a more sloping manner than in the preceding courses. The bottom of the stack, being formed in this way it is afterwards usual to begin at the outside, and advance with different courses round the whole, placing each course a little within the other, so as to bind them in an exact and careful manner, till the stacker comes to the middle. And all the different courses are to be laid on in a similar manner until the whole of the stem is raised and completed; when the last outside row of sheaves is, in most cases, placed a very little more out than the others, in order to form a sort of projection for the eaves, that the water may be thrown off more effectually. But in cases where the stems of the stacks are formed so as to project outwards in the manner already noticed, this may be omitted without any bad consequences, as the water will be thrown off easily without touching the waste of the stack. And the roof is to be formed by placing the sheaves gradually a little more in and in, in every course, until it comes to a ridge or point, according to the form of the stack, as has been already observed. But in forming and constructing this part of the stack, great care should constantly be taken to give the ear-ends of the sheaves a sufficiently sloping direction upwards, in order that they may be the better secured from wetness. And to the outside should be given a rounded form, in the manner that has been already noticed.

It is observed in the Farmer's Magazine, after stating that the corn and its straw must necessarily be a great deal more dried in the field, to render it proper for being secured in barns, than when it is built in ricks, as these latter being exposed to the free air all round, are by no means so apt to heat or mould the grain and straw, as if it were stored in barns. And that in consequence of that superior degree of dryness necessary for barn harvesting, the grain is certainly a great deal more apt to shake out from the ear, in handling and forking into the carts or waggons, for being led home. And further, that when built in ricks properly contrived, the grain is likewise placed altogether out of the reach of rats and mice, which commit very great waste in barns; however well constructed, that it is of course better that all grain should be built in round ricks in the yard upon wooden frames open below, raised on stone supports similar to those on which granaries are fixed.

By this plan, it would, it is supposed, be more effectually secured against the depredations of vermin; and besides, the air having free access all round and even underneath, through the interstices of the frame, it will be completely prevented from all danger of spoiling in any way in the rick. And further that in this way of securing grain, the ricks do not by any means require to be thatched so very substantially, and of consequence expensively as is practised in general.

It is also advised that in building a corn rick, effectual care be taken to keep the centre or heart of the rick always considerably higher than the outer range of sheaves as noticed above; so that every sheaf in the rick has a considerable slope outwards and downwards. When this is properly attended to, and all the sheaves carefully locked together and the crown properly put on, the rick will, it is observed, even turn a very heavy shower, before the thatch is applied. The whole rick after the thatch is laid on, is finally covered with a net work of straw rope, leaving the meshes about 9 or 12 inches wider, all the ends of the ropes being secured to a belt rope which goes round the rick below the eaves, just within reach of a man, and the mid-

dles of all the ropes are tied to one that goes straight over to the top of the rick by small handfuls of straw, as seen at *fig.* 22 in *Plate* XXXII.

It is sufficiently obvious, that in stacking wheat-crops, these directions should be more fully attended to; and the sheaves have a rather more sloping direction outwards and downwards, when placed in the stacks, on account of the tallness of the straw, in order that they may be the better secured against the injurious effects of damp and moisture of all kinds.

It is stated by the author of Practical Agriculture, that "it is the practice in some districts, especially where the stacks are made of a circular form, and the weather is wet and unfavourable, to have a funnel or chimney left in them, in order to prevent their taking on too much heat. This is effected by tying a sheaf up in a very tight manner, and placing it in the middle on the foundation of the stack, pulling it up occasionally as the building of the stack proceeds all round it. And in setting up ricks in bad harvests, it is a practice in some places, particularly with barley crops, to have three or four pretty large poles tied together, by winding straw ropes round them, set up in the middle, round which the stacks are then built. But that except the stacks are large, or the grain when put into them in an imperfect condition, such openings are quite unnecessary. These openings in the northern parts of the kingdom are denominated *fawses.* And it is probable that in some instances, they may be prejudicial to the stacks by the admission of too much moist air." See *Harvesting of Grain.*

STACKING *of Hay*, the business of putting hay up into ricks or stacks. This is an art which requires much care and attention in the person employed for the purpose, though much less than that of building corn stacks. There should constantly be a proper stand or foundation, somewhat raised by wood or other materials, prepared for placing the stacks upon; but nothing of the coping kind is here necessary. See *Stack* and *Stand.*

In performing the business of stacking hay, the work should constantly be performed as much as possible while the sun is upon the hay, as much advantage is thus gained in the quality of the hay: and it is necessary to have a stacker that has been accustomed to the business, and a proper number of persons to help upon the stack, in order that it may be well spread out and trodden down.

The building of these sorts of stacks should be conducted much in the same way as those of the grain kind; the middle of the stack being always well kept up, a little higher than the sides, and the sides and ends be well bound in by the proper application of the successive portions of hay as the work advances, and during which it is a good way, where there are plenty of hands, to have the sides and ends properly pulled into form, as by this means much after labour is prevented. It is likewise of advantage, that the hay should be well shaken and broken from the lumps, during the operation of stacking. The form in which the stacks are built, is not of much consequence, but if large and made in the square form, it is better not to have them too broad, or of too great width, as by this means they are less apt to heat. In Scotland, where all their hay is formed into ricks or stacks, the former has usually the shape of the corn rick, but much larger in general, and the latter that of the shape of the barn or long cottage, with a sort of pavilion roof. See *Stack.*

With the intention of preventing too much heat, sometimes in building these stacks, as well as those of the grain kind, holes, pipes, and chimnies are left in the middle, that the excessive heat may be discharged. But there is often injury sustained by them, from their attracting too much moisture. See *Hay* and *Hay-making.*

In building the upper parts of these as well as grain and other stacks, the use of a stage often becomes necessary, in order that the materials may be pitched more conveniently to the stacker. See *Stacking Stage.*

STACKING *Stage*, the scaffold or platform employed in building stacks of corn, hay, &c.

These are constructed in different ways, some being fixed together in a sort of frame, so as to be set up against the stack, and is suited to the height of pitching by a moveable stage. But this has been considerably improved by being so contrived as to be capable of being readily taken in pieces and laid by. It is the contrivance of a gentleman in the county of Suffolk, and described in the Survey of that district.

"It consists of two parts, one of which is a frame, eight feet wide, made of two fir balks twenty-two feet long, braced together in a parallel position, and having several holes bored in them, about fourteen feet from the ground, for the reception of the hinges of the stage; and an hook in each of them, to hang the chains on which to support the outward edge of the stage, and serve to raise it or lower it at pleasure. The other part is a moveable stage, eight feet long, and three feet eight inches broad, having an hinge under each end, at the hinder, or edge nearest the stack; one end of the hinges is made like a bolt, to enter the holes in the balks; the stage likewise has an iron plate under each end, with an hole in it to receive an hook on the chain."

It is added, that "the stage is set against the stack when it grows so high that it is inconvenient to pitch on to it from the buck of an empty waggon. The holes in the balks most commonly used, are fourteen feet from the ground, about the height of a waggon load of hay. Should the stage be fixed lower, it would be of no use, not being wanted whilst a man can conveniently pitch from the buck of a waggon on to a stack; and should it be fixed much higher, it would be found too high for a man to pitch on to, when the waggon is nearly empty."

And it is suggested, that "a stage like this is not expensive, and might be used for nailing up weather-boarding, painting, plaistering of walls, and other purposes."

But it may be better understood by a reference to

Plate XXXIII. in which *fig.* 3, is the frame of the moveable stage; *i i*, the iron hooks. *Fig.* 4 is the stage, to be fixed by means of the pins *l l*, into the holes of the frame. The chains are fastened on the plates *m m*, and from thence put over the hooks *i i*, *fig.* 3. At *fig.* 5 is shown the manner of fixing the chains to the stage or scaffold; and at *fig.* 6, is shown a stack with the moveable frame erected against it, in the manner of using it.

STACK *of Wood*, a pile of wood three feet long, as many broad, and twelve feet high.

STADDLE, the bottom of a corn mow, or hay-stack. It also signifies a tree suffered to grow for coarse or common uses, as posts, rails, &c. See *Stand.*

STADDLE *of Hay*, a term applied to a plot of hay thrown abroad in making. See *Hay-making.*

STAG, a term applied provincially to a young horse. Also to a male animal of the deer kind.

STAG-*Evil*, in *Farriery*, in horses a kind of universal cramp or convulsion. See *Convulsion*, &c.

STAGGERS, in *Farriery*, a disease in the horse, which is mostly considered the same with apoplexy. It has however been described as consisting of two distinct species, named the *sleepy* and the *mad* staggers. See *Apoplexy.*

But according to Mr. Denny, "the disease receives the former of these epithets when the animal becomes inactive, with a heaviness of the eyes, and inclination to sleep; the head resting in the manger, accompanied with costiveness and other symptoms of fever."

And the *mad* staggers are supposed to be present "when, without any previous sign of disease, the horse falls down deprived of all voluntary motion, the eyes are insensible to light, the breathing is difficult, with great motion of the flanks, and a quick and full pulse; he often rises, and, after plunging violently in the stable, falls down in the same insensible state."

He supposes that "it may be occasioned by a disease of the brain, either in the membranes or blood-vessels; from violent exercise, plethora, or rupture of a blood-vessel; or external injuries to the head." And that the "danger will be in proportion to the violence of the attack; viz. to the degree in which the powers of sense and motion are affected. The disease is more fatal in old than young horses."

With regard to the cure, "the first and immediate indication is to take away, from a large orifice in the neck vein, four or five quarts of blood; and to repeat the operation according to the strength of the animal and continuance of the symptoms." And immediately afterwards, the following ball is directed to be given.

Take of Calomel, two drachms;
Barbadoes aloes, in powder, one ounce;
Ginger, two drachms;
Honey, sufficient to make them into a ball.

It is added that "in this disease the bowels are remarkably inactive, and require a larger dose of purgative medicine to produce a common effect. The large intestines should be relieved by giving the following clyster moderately warm:

Take of Oatmeal gruel, three quarts;
Common salt three ounces;
Olive oil, half a pint. Mix them."

He observes that the "horse is often very much relieved after bleeding, and requires nothing more than rest and moderate feeding to restore him to perfect health. But should the disease continue, a rowel must be put under the jaw, and another in the chest; applying at the same time behind the ears, some blistering liniment." And when "he refuses mashes, let him be supported by gruel, given in the quantity of two or three quarts frequently."

After the bowels have been sufficiently opened, the following febrifuge powder is directed to be given every four hours.

Take of Camphor, pulverised, one drachm;
Antimonial powder, a scruple;
Nitre, in powder, six drachms:
Mix them well together.

And "the horse ought not to be confined in a stall, but have a loose stable, or two or three stalls made into one; taking care that every thing liable to injure him be removed. The stable should be of a moderate temperature.

"When the symptoms are relieved, mashes of bran and oatmeal, or malt, may be occasionally offered him, with a small quantity of corn. Hay should be sparingly allowed on these occasions." And "the powders may then be omitted, and the following restorative ball given every morning, until he recovers his strength; the bowels, in the mean time, being carefully kept open by mashes:

Take of Peruvian bark,
Gentian, in powder, of each half an ounce;
Ginger, two drachms;
Vitriolated iron, one drachm;
Honey, enough to make them into a ball."

And it is advised that "the rowel under the jaw should be continued at least a fortnight after the removal of the disease."

It is very properly recommended that great attention be paid to the animal till he has recovered his appetite, and the proper food be given, but not too plentifully. Much is also supposed to depend on good grooming, and taking care that the exercise be proportioned to the strength of the animal.

Where the disease is caused by the accumulation of dung in the bowels, that should obviously be removed in the first place, and afterwards recourse may be had to other proper remedies as above.

Sheep are also subject to the staggers, and the remedy for it was formerly to drive them to change of grounds often, to keep the grounds from tainting. It has been noticed by Lisle, that "those lambs which die of the staggers, do not die till they begin to eat grass, and of those the finest and lustiest; whence, he concludes, that it is not the cold weather alone that brings the staggers, but from their feeding on cold watery grass in the months of March and April. The disease was much prevented by the early folding of the lambs. See *Gid*.

STAGGERWORT. See *Ragwort*.

STAFF, a measure of nine feet, or half a customary rod. It also signifies the rod set up as a mark in levelling, &c.

STAKE, a piece of wood, or strong stick fixed upright in the ground, in making hedges.

STALE, a term applied to the urine of animals.

Stale, provincially the handle of any thing, as fork stale, &c.

STALING, in *Farriery*, a term used to signify the act of evacuating the urinary bladder, in the horse or mare. It is a humane and necessary practice to suffer horses to void their urine at full leisure; and to encourage them to it by *whistling*, or any other of the soothing methods which they may understand. The evacuation of urine is liable to interruption from various causes.

But horses are seldom subject to stale blood, unless when they have received some strain in the kidneys, or when some blood-vessel has been ruptured about the neck of the bladder, or from some erosion either there or in the urethra, by which some of the small blood-vessels may have been laid open and send forth a bloody discharge; but when this happens, it is generally very small in quantity, and often goes off without the help of medicine. These effects may also proceed from sharp rugged stones in the kidneys, ureters, or about the neck of the bladder; though from what authors have hitherto observed on the subject, horses are not very frequently so affected from this cause, but, for the most part, in consequence of very hard labour or some other ill usage.

But in cases of this kind the urine becomes bloody, and sometimes even clear blood will pass off just after staling. In order to a cure, if the horse be fat and lusty, it will be proper to bleed plentifully, but if he be low in flesh, more sparingly, or not at all. It has been the practice to follow this by the internal use of mild astringents, such as the following, which is advised by Gibson:

Take of Conserve of red roses,
Locatelli's balsam, of each six drachms;
Spermaceti, half an ounce;
Nitre, in powder,
Irish slate, of each two drachms;
Syrup of poppies, sufficient to make them into a ball.

It may be repeated until the symptoms go off and the horse stales in a free manner. Bleeding cautiously and the free use of mucilaginous substances may often be beneficial.

STALK, the stem, or stock of a plant.

STALL, a place in which a horse or cow is fed or kept; a stable or cow-house. See *Stable* and *Cattle Sheds*.

Stall-*fed*, a term applied to animals fed in the stall with dry food, not with grass.

STALLED, a term signifiying tired with eating. It also signifies set fast in a slough or bad road.

Stall-*feeding*, the process of fattening cattle in the stall. The best practice in this sort of fattening is probably, that of wholly confining them to the stalls, or what is usually termed stall-feeding, as by this means they are kept quiet, and free from interruption, and of course feed more quickly and with greater regularity, which seem to be points of great importance in this system of management.

There are however many other methods adopted in different situations and circumstances. In regard to the sorts of food that may be employed in the way of winter fattening animals, they are very numerous, but the principal sorts of the more succulent kinds are carrots, parsnips, potatoes, Swedish turnips, cabbages, common turnips, grains, &c. and of the more dry sorts oil-cake, oats, barley-meal, rye-flour, bean and pea-meal, and others of the same nature, with different sorts of straw cut into chaff by means of machinery, or hay cut in the same manner. It is usual with some to employ the different meals in a state of mixture in nearly equal proportions, except the bean meal, which from its heating quality is mostly made use of in smaller quantities. But on the principle of fresh sorts of food having a more powerful effect on the systems of animals when first applied, it may be more beneficial to have them given in alternation, or at distant intervals as their effects may in this way be more fully experienced.

In respect to the cut straw and hay that is made use of in this way; the first should, contrary to the practice usually adopted, be prepared from that which is fresh threshed out, and not such as has been long packed together and is become fusty. The hay, instead of being of the inferior kind, should be the best that the farm affords, and such as is not in the least injured in the smell or taste by keeping. It has however been stated by Mr. Dark of Herefordshire, an experienced grazing farmer, that the more inferior sort of hay has by the addition of a very small proportion of common salt, been made to be preferred to the best when not prepared in that way. The quantity used with flooded meadow hay was only about eight pounds to the ton. And his oxen of the breed of that district did better with it than others which had the best hay. The whole of the advantage is ascribed to the portion of saline matter mixed with it acting as a stimulus or condiment on the stomachs of the animals.

On the principles of this sort of feeding the author of the System of Practical Agriculture has offered the following physiological observations. "For, says he, as the art of fattening, whatever the nature of the animal may be, would seem to depend in a great degree on regularly keeping up the excitement of the system, by the use of suitable rich food, to that high pitch that tends towards indirect debility, which is probably the point most suitable for inducing rest and a disposition to sleep, which experience has shown to be the conditions the most favourable to the deposition of the fatty material in the cells of the adipose

membrane; it is obvious that the fattening process may be greatly accelerated or retarded by the method of distribution that is adopted in respect to the food. If much nice attention be not bestowed in this way, great loss may be quickly sustained, especially where the more expensive sorts of dry food are made use of. On the same principle of promoting the full and equal excitement of the system, it will be of the greatest utility and importance not only to keep the animals warm, perfectly clean in themselves, and free from all kinds of filth; but also their sheds, stalls, mangers, troughs, or other places from which they take their food; as by such means that constriction of the hide which is the sure indication of their not thriving in a proper manner, may be avoided, and at the same time that disgust which probably arises in consequence of the parts of the food left upon the places where the cattle feed, taking on or running into a state of fermentation, be prevented; and of course, the feeding of the animals proceed in the most expeditious and uninterrupted manner. And where both moist and dry food are given at the same time, it may be necessary, in the view of promoting the more quick fattening of the cattle, to combine them in such proportions, according to the constitutions of the animals, as that the too laxative effects of the former may be kept in order by the constipating powers of the latter; and thus a due balance be preserved, which is the state most adapted to the purpose of fattening. But besides this effect, the combining of dry food with those rich and juicy substances, which have their nourishment in a close or concentrated state, may be advantageous in another point of view, which is that of affording a due degree of distention to the stomach, a condition that is also probably necessary to the expeditious fattening of animals. Without this, that sort of fullness or satiety which induces the animals to take their rest cannot, perhaps, be so completely produced. It is on this principle that in man a full meal cannot be made on flesh meat alone without the assistance of bread or some other similar substance. On this ground, hay or cut dry meat must therefore be constantly used in stall-feeding with such rich roots and plants as are capable of being employed so as to produce the necessary degree of fulness." And it is added in the same useful work that, "in order to accomplish these different objects in the most perfect and effectual manner, it is essential that the closest attention be bestowed by the farmer to see that the stock, whether foddered in open sheds or tied up in stalls, be regularly fed, adapting the proportion of food employed each time to the state of the digestive organs of the animals; cautiously avoiding, as much as the nature of the business will admit, either giving too much or too little, as from both extremes injury may be produced: but it is better, as fattening animals are very nice, to let them have rather too little than too much; for, where any disgust is occasioned, they never feed so well afterwards. It is useful also to vary the kinds of food frequently, as noticed above, so that there may be less danger of their losing their beneficial effects. This circumstance is much attended to in other countries: fattening stock that is neglected in these respects never succeed well, or afford the farmer a just profit. It is consequently of vast importance to have this business conducted by a person accustomed to the practice."

And in this management it is likewise a matter of the utmost importance as hinted above for the animals to be kept constantly free from standing in any sort of dirt or nastiness, by having the dung daily removed and cleaned out, and their standings swept out as clean as possible, being then littered down with dry clean litter, so as to prevent any sort of nastiness from adhering to their skins, or affording them uneasiness during their fattening. And in order to effect the littering in the most perfect manner, as much straw or other similar matters should be made use of as can be converted into manure, as from one to two or three tons each beast, as the dung will fully repay the expense of it in the improvement which it must afford to the land on which it is applied. In this process it is also of much advantage to have the cattle sheltered and kept in a due degree of warmth, without being *too* hot, as, when the heat is *too* great, there may be disadvantage by *too* much perspiration being produced. In regard to the giving of the food in this process, the state of the appetites of the cattle or other animals, should be nicely watched, and the quantities adapted so as that it may be eaten up perfectly clean with the more sweet succulent sorts, *too* much should not, however, be given at a time; but be duly combined with some of the dry kind. And where cut dry meat is chiefly employed, it is the best practice probably to keep some of it always in the cribs or boxes, so that the cattle may take it at pleasure, or as they find themselves disposed.

This is a practice which with stock farmers usually begins about the period when the pasture and after grasses are nearly done, or decline in the quantity of food, as the latter end of October, and continues through the whole of the winter months, until about the latter end of April, or sometimes a little longer.

It has been stated that where succulent food is made use of with cut dry meat, which is in general a more profitable method to the farmer than that of having recourse to corn and oil cake, or the different sorts of meals stated above; carrots, parsnips, potatoes, and the Swedish turnip would seem to stand the highest as articles for this use, the common turnip and cabbages having been found much inferior in their fattening properties; the two first are equal to almost any other sort of food in this view, being capable of fattening the largest cattle. And the most general practice is to employ these roots and plants without any other preparation, except that of being sometimes cut, sliced, or chopped, in a box for the purpose, giving only a small proportion at a time at three or four different periods in the course of the day, in cribs properly contrived for the purpose, due supplies of such cut straw in mixture with hay, as has been suggested above, being, where necessary, provided and given in the intervals of such feeds. It is found that in this method, much less water will be necessary than when dry meat is wholly made use of in the process, as the animals are much less thirsty from the succulence of the food.

The nutritious properties of the carrot have been

found very considerable when employed in this way. And this root has some great advantages, as the animals readily take to it, and a great proportion of food is capable of being raised on the acre. It was found by Mr. Young in his trials with this root that the consumption with an ox of about sixty stone weight, was per day about ten stones, giving in addition cut hay and chaff or some other similar dry material. The parsnip is also a root of equal if not superior merit in this management. And from its containing an equal if not larger proportion of nutritious matter, nearly a similar quantity of that excellent root may be necessary; but experiment has not yet shown the exact difference in the fattening properties between this root and that of the carrot. The parsnip can however only be raised to the greatest advantage on a deep rich soil; in such cases it should of course never be neglected. An acre of either of these roots would complete the fattening of two such beasts as the above, if taken from the pastures in a half-fattened condition. It has been suggested that these two roots and the potatoe approach the nearest that of oil-cake in their fattening properties, but are certainly inferior to that substance in this intention.

On the experimental farm of the Marchioness of Salisbury, in Herefordshire, the parsnip has been raised and applied to the fattening of stalled cattle, especially oxen, with very great success.

The white and red beets, and the scarcity root or mangel wurzel, have also been found highly beneficial in this application, the effects of which may be seen in the tables below.

There have been many trials made with potatoes in the stall fattening of animals, and it has been fully shown that both in the raw and boiled or steamed states they are a root that answers very well. It has been stated that small cattle of the Welsh and Scotch runt kind have been found to consume about a bushel each in the course of the day, with from fourteen to sixteen pounds of hay or some other cut dry food. In the raw state some dry food of these sorts is indispensably requisite, in order to correct the purgative quality of the root, and when boiled or steamed, it has likewise a good effect in affording due distention to the stomach. When given to milch cows in a raw state, the milk is found to be greatly increased, but of a poor thin quality. There can be no doubt but that where the steaming or baking of the root can be accomplished at a cheap rate, and in a convenient manner, the food will be much better suited to the purposes of stall feeding, as being much more nutritient.

It is stated by an excellent grazier, J. H. Campell, Esq. of Charlton, in Kent, in answer to queries proposed to him by Mr. Young, that 100 bushels of potatoes, and 700 weight of hay are generally sufficient to fatten an ox that thrives tolerably well. And in giving the roots, they should at first be used in small quantities, which should then be gradually increased to one or two bushels per day, dry food being always intermixed, and the proportion of hay being uniformly regulated by the effect which the potatoes produce on the bowels. There ought to be at least *four* or *five servings* in the course of a day, as according to the quantity of roots which a beast can be induced to eat with appetite, he will fatten the sooner, and of course with less expense to the farmer, and consequently more profit be obtained. The hay should be cut once, or if it be not very weighty, twice along and three times across the truss, so as to be in square pieces of eight or ten inches, in which state the cattle will eat and digest it more readily, while their fatting is considerably expedited. But the potatoes need not, he says, be cut, except at first, in order to entice the beast to eat them, but they ought always to be *fresh* and *clean*. Corn or meal is not absolutely necessary; but when at a moderate price, it may be employed with advantage.

But in case a scouring should be brought on by the use of raw potatoes, which often happens, the quantity of hay, meal, or other dry food given with them, should be increased considerably till the beasts become accustomed to the roots, when this inconvenience will be removed. See *Steaming of Cattle Food.*

The Swedish turnip, when it is cultivated in a proper manner, is a most valuable root when used in this intention, being very sweet and palatable to the animals, and at the same time possessing more nourishing power than the common turnip, of course going much farther. In some trials which we have lately attended to, it was found to have the advantage nearly in the proportion of one fourth. And in other experiments, it is said to have gone still farther.

Cabbages in combination with dry chaffy materials of different kinds have been long known to answer well in keeping store animals in the winter; and when made use of with good hay to be capable of fattening large cattle in an expeditious manner. It has been found by correct trials, that the daily consumption of this vegetable is mostly in the proportion nearly of one fifth the weight of the animal; of course an ox weighing about sixty stone consumes about twelve stone per day. In some experiments made long ago and stated by Mr. Turner in the second volume of Mr. Young's Six Months' Tour, an ox of eighty stone was found to consume fifteen stone of this plant with the addition of half a stone of hay. And that with regard to its properties of feeding oxen put to them, when in low condition in November, became in a state of fatness and ready for the market in the March following, having the weight of eighty stone, mostly increasing in value in the course of four months, about five pounds ten shillings. It is evident that in this proportion, an acre of this crop of thirty tons, would be sufficient for stall-fattening three beasts of the same size and weight.

Common turnips, according to Mr. Marshal, are in Norfolk given in different ways to cattle in fattening them, as by being drawn and thrown *thinly* and *evenly* upon the grass, stubble and other lands, in order that the cattle may consume them in such situations; in which cases they have not any allowance of hay during the whole process of fattening.

And another mode of giving this root to fattening cattle, is, he says, by means of close bins, or small cribs, with boards or bars nearly close at the bottom, while the beasts are kept in a loose straw-yard. These bins are dispersed over the yard, and the turnips are put into them whole, the tap-root, and also the tops, unless they are fresh and palatable, being previously cut off, so that the fattening animals receive only the bulbs; the tops, if eatable, being consumed by store cattle. And that while the bullocks are in the yard, they have the straw sometimes given them in cribs, and at others it is scattered in small heaps about the yard, twice or thrice in the day; the quantity thus eaten is very trifling, and with the last mentioned management the yard becomes evenly littered without farther trouble. But this mode of fattening is attended with somewhat more labour than that of throwing turnips abroad, which, he thinks, is the preferable management if the soil be sufficiently dry to support the stock, and light enough to stand in need of being rendered firm by treading: on the contrary, where the land is deep and the season is wet or severe, the straw-yard is the more comfortable place, provided it be kept dry and well littered, and be furnished with open sheds in which the stock can shelter themselves. For though the *teathe* of fattening cattle abroad is greatly beneficial to light soils; yet, if bullocks while fed in the yard with turnips are well littered, they will make a large quantity of excellent manure that will amply compensate for the additional labour occasioned in that way.

And another method consists in keeping the cattle tied up in hovels or beneath open sheds, with mangers or troughs for receiving the turnips, which, in this case, are frequently *sliced*, or more generally (though perhaps less eligibly) cut into quarters by means of a small chopper upon a narrow board or stool, beneath which is a basket for catching the pieces. In this operation the turnip is held by the top, which, when wholly disengaged from the root (except the coarse part immediately about the crown) is thrown aside for the store cattle. The tap-root and bottom rind are separated with the first stroke, and suffered to fall on one side of the basket, so that the fattening cattle have only the prime part of the plant. And hence arises the quick progress in fattening, which bullocks fed under sheds sometimes make, especially in cold weather; but, from the increased trouble and expence consequent on this practice, though it requires less litter, it is confined chiefly to little farmers who have an opportunity to tend their own sheds. Under this treatment, the beasts have a little barley straw given them occasionally, in order to clean up their mouths and dry up the superfluous juices of the turnip. It is supposed, that an eligible plan of management may therefore be adopted, where circumstances will admit of it. In autumn, while the weather continues moderate, the bullocks may be allowed to remain abroad; but whenever it sets in wet, or becomes intensely severe, they should be taken and kept under shelter, either until their fattening be completed, or the warmth of spring again invites them abroad."

It has been supposed that turnips, though very frequently employed in the process of stall feeding, are greatly inferior to cabbages, as, besides their being more liable to injury, they probably possess the fattening property in a less degree than any of the substances that have been noticed above. And the proportion in which they are consumed by the fattening stock, has been found to be something more than a third of the weight of the cattle by some, but by others about a third, in the day, as stated in the Gentleman Farmer. However, in other experiments, carefully made, an ox of from seventy to eighty stone has been ascertained to eat something less than three hundred weight in the course of the day, besides chaff and hay; and small cows of about thirty stone one hundred weight and three quarters in the same space of time. And in the Rev. Mr. Close's trials, it was found, that when consumed in stalls or sheds, an acre of good turnips will "completely winter-fat an ox of fifty score," besides affording manure for an acre and a half of land; but if fed upon the land, two acres will not fatten one so well, and the dressing will be partial and of but little value. When this root is given in the stall, from its very succulent nature, it becomes necessary to employ as much dry food as possible during the use of this sort of meat, in order to the expeditious fattening of cattle in this way.

It has been practically remarked by a late writer that the turnip is often employed in the fattening of sheep; and in this application it is frequently advantageous, where the management is conducted with judgment: but to derive the greatest profit from this practice it is probably the best method to only make use of them for such sheep as are in a considerable state of forwardness; as such as are poor when turned to this sort of food are seldom found to pay well for it. Every farmer who has applied turnip crops in this way must, he says, have found this to be the case. Where the soils are sufficiently dry, the best method of consuming them may be on the lands, by means of hurdling; but under the contrary circumstances, they may be drawn and eaten upon a dry piece of sward. The advantage of this root will be more fully shown in the tables given below, and which were correctly made by Mr. Eastcourt, at the suggestion of the Board of Agriculture. The sheep were of the South Down, or a mixture of it and the Wiltshire horned breed, being all one year old, part rising two in the beginning of the experiment.

Experiment, Lot I.

No.	1802.		1803.		
	Nov. 22.	Dec. 21.	Jan. 18.	Feb. 14.	Mar. 14.
1	120	114	113	117	123
2	151	144	145	148	144
3	143	135	138	143	147
4	113	101	100	105	106
5	145	141	142	136	146
Total weight	672	635	638	649	660

Fed on turnips and hay in the field, where the turnips grew in the usual way: lost 12lbs.

Experiment, Lot II.

No.	1802.		1803.		
	Nov. 22.	Dec. 21.	Jan. 18.	Feb. 14.	Mar. 14.
No 6	147	145	153	153	159
7	119	118	115	114	117
8	118	117	115	116	116
9	136	137	134	133	137
10	115	106	108	106	107
Total Weight.	635	623	625	622	636

Fed on turnips and hay, given to them in a grass field, without any shelter: gained 1lb.

Experiment, Lot III.

11	156	154	157	159	164
12	146	143	146	146	148
13	Met with an accident, and was killed.				
14	131	125	123	125	128
15	124	120	120	121	121
Total weight.	557	542	546	551	561

Fed on turnips and hay in a paddock, with a shed to retire to at will: gain 4lbs.

Experiment, Lot IV.

16	166	166	174	173	167
17	129	121	125	126	131
18	145	148	153	158	160
19	136	128	135	137	150
20	124	117	125	126	135
Total weight.	700	680	712	720	743

Fed with turnips and hay in a warm open shed: gained 43lbs.

These trials fully show the effects of different modes of using this root.

By some it has been supposed that great advantage may be derived from the application of fire in the preparation of some of these roots and plants for the feeding of the animals. And it is stated that in the trials of the Rev. Mr. Close turnips were found to answer well in the feeding of cows in combination with cut chaff, when prepared by means of steam; and in different experiments, detailed in Mr. Young's Annals and by Mr. I. C. Curwen potatoes have been found to be better adapted to the feeding of horses and some other animals by undergoing the same sort of preparation. But it is probably much more necessary in the potatoe than the turnip, as many experiments have shown that they agree better with the animals and are more fattening when given in this state. The loss sustained in the operation of steaming in the potatoe is also much less than the turnip. But as there must constantly underthis mode of preparation be a considerable expense in labour and fuel, it is better to avoid it where the nature of the vegetables will admit of being made use of in their raw state, which is certainly the case with the turnip as well as several other vegetables that have been recommended in this practice.

The use of brewers' grains can only be had recourse to in this way in particular situations, as near large towns or other places where they can be had at a reasonable rate and in sufficient quantity. And of this sort of food that which is the produce of large distilleries is found the most beneficial in this sort of feeding. The quantity made use of for moderate sized beasts is usually from a bushel to a bushel and a half, three times in the course of the day, hay or cut dry food being given between the periods of feeding with these matters. But this sort of substance seems to be much less powerful in its fattening properties than any of those articles that have been mentioned above.

But with good hay it is probable that these matters may be made to fatten animals in a tolerably expeditious manner.

Besides these different substances there are others of a less succulent quality employed in this practice: the first perhaps, in respect to the properties of feeding, is that of *oil cake*, that is, the refuse material left after expressing the oil from linseed. It is a substance possessed of great powers of fattening, but which has been so much advanced in price within these few years, that it is an article of very great expense, and which can only be used under particular circumstances with much profit.

But where it is made use of, the manure is excellent and in pretty large quantity, as with this material as well as with those that have been already considered it is necessary to have recourse to some substance of the more bulky kinds, such as hay, cut chaff, and other matters of the same nature, by way of affording a sufficient degree of distension to the stomach. In this practice of fattening, it is the custom with some to begin by giving, to a beast of a hundred stone, two cakes per day, of about six pounds each, for six or eight weeks, and then to increase them to three, till the animals become fat; but a better method is that of beginning with a much smaller quantity, as at first the animals are seldom fond of it. The usual addition to the cake is from half a stone to a stone of hay each day: the whole consumption in cake being about 21 cwt., and in hay 26 cwt.; which, at the prices formerly paid for this article, rendered the expense of winter-fattening an animal of this size something more than seven guineas. But lean cattle of the smaller sorts have often been made perfectly fat in the course of eight or ten weeks by this substance, as stated in the trials of Mr. Moody by Mr.

Young in his Eastern Tour. In this application the cake is broken down into small parts, and frequently blended with the chaff or other substances that are made use of with it, but sometimes given to the animal without being mixed with any other substance, which is by far the better method. And it has been stated by Mr. Young that on the continent, linseed-cake is sometimes given in a liquid state, being difiused in hot water and drank by the cattle, hay and other substances being supplied to the animals at the same time. And in the Lincolnshire Survey on Agriculture a method is mentioned of giving cake to cattle while in the pastures, in a small proportion, with much success and advantage; which is a practice that may be had recourse to where the cake-fed beasts are not fully fattened for sale in the early spring months. It has been stated as an advantage in fattening with this and other similar substances, that the animals may be completed with them at much more advanced ages than in any other modes of stall feeding.

The cakes are likewise asserted to have a very extraordinary effect on cows before calving, causing their milk to flow more copiously, and preparing the animal in a good manner for the period of calving. But as the fat of beasts fattened on oil-cake is not supposed by some so good for food, and to be of a less firm texture, it has been advised to substitute linseed jelly, which is infinitely superior, and which when mixed with a due proportion of hay or meal, affords an excellent composition for stall feeding and fattening. This jelly is prepared in the following manner: to 7 parts of water 1 part of linseed is only put, for 48 hours, then boil it slowly for 2 hours, gently stirring the whole lest it should burn. Afterwards it should be cooled, and mixed with meal bran or cut chaff. In the experiment of Mr. Moody an eminent grazier, two quarts of this jelly were used per day, to every large bullock, which proportion amounts to little more than one quart of seed in 4 days, and produced a great saving in the article of food in this process.

And in America experiments have been made with *linseed oil* mixed with the meal of Indian corn. The stall-fed steer to which the composition was given was observed to thrive rapidly, and to sweat most profusely, but through inattention; too large a proportion of oil was given at one time with the food, which disgusted the beast, and occasioned the experiment to be discontinued. There can however be no doubt but that linseed or flax seed jelly is more agreeable to cattle than cake, while it renders them less liable to surfeit in case an extra quantity should be accidentally given, and is less liable to affect the meat with a peculiar taste than either oil or cake, and consequently it merits a trial. To each bullock or fattening animal about half a gallon of jelly may be given every day mixed with meal and cut straw; but it will be requisite to change this food about a month before the beast is killed, to prevent if possible the flesh from retaining the flavour of the oil cake or jelly.

Where sheep are fattened with oil-cake, they require it to be brought into a much finer state than for cattle in general, and which may then be mixed with bran or other similar substances, and put in the troughs or cribs for the animals to feed at.

And on the same principle as that of oil-cake, the use of linseed-oil and bran has been attempted, but probably with less success in the application. The consumption in this mode for beasts of the smaller size is something more than half a peck of bran three times in the day, with a third of a pint of linseed-oil well stirred into it; with this good hay or cut chaff is usually given. But it is a mode attended with more trouble than that of cake-feeding, without any great superiority in the effect that is produced, and it can only be employed where the oil is cheap and to be had with convenience.

Another article equal if not superior to any of these last sorts, in this sort of fattening, is that of oats, which may be given either in the straw or when threshed; for neat cattle it is probably best given in the former state, but for sheep in the latter, in shallow troughs or cribs made for the purpose, so as to prevent their being blown out of them. The consumption in this sort of food by sheep, is usually from two or three to four or more pounds each per day, according to the size and kind which are fattened; but with neat cattle it must be proportioned to the animals in different respects.

Where barley or other meals are made use of, they are best made use of in their dry states for sheep, in mixture with the cut or other matters that are given at the same time in their cribs or bins; but for neat cattle they are sometimes mixed up and blended with liquid materials in different forms. These substances have much effect in promoting the fattening of the animals in whatever way they are given; but they can seldom be made use of with much profit, except for the best sort of cattle or sheep. Where sheep are fattening on the turnips, these sorts of food are also excellent in correcting the watery properties of that root.

Several other substances of the dry kind, have likewise been employed in the stall feeding of different sort of animals, such as the dust and combs of malt, &c. being found highly beneficial, as may be seen below.

In this practiec the use of food in a sour state has been advised by some, as in this condition it is said experience has shown it to be useful in the keeping and fattening of swine. But experiments are still wanting on this subject. And on the same principle it has been recommended as a food for large cattle, which has been done by fermenting rye, flour, and water into a kind of paste, and then diluting it with water: and also when thickened with hay cut small it is said to fatten quickly. This practice chiefly prevails in France, whence it was introduced into this country. But concerning the efficacy of acid food in stall fattening animals, there is much difference of opinion. It has however been suggested by a late writer, as not improbable, but that acid substances may have some power in strengthening the digestive organs, and thereby promoting the consumption of a larger proportion of food in a given time, in consequence of which the animals become fat more quickly. But such acid messes can only, it is probable, be considered as preparatory to the more forc-

ing and essential articles of dry food, without which it is scarcely possible that any steer or bullock can acquire that firmness of texture in the flesh and fat which is so deservedly admired, and considered as the criterion of excellence in this sort of food.

It is found that the wash, or refuse of malt, remaining after distillation, which was formerly applied exclusively to the feeding of swine, may be used in this way with profit, as it has of late years been applied with much success. It is conveyed from the distillery in large carts closely covered and well-jointed, in order to prevent leaking. The liquor is then discharged into vats, or other vessels, and when these are about two-thirds filled, a quantity of sweet hay previously cut small, is immersed for two or three days, that the wash may imbibe the taste and flavour of the hay before it is used. In this state it is carried to the stalls, and poured into troughs, whence it is in general eagerly eaten by the cattle. Sometimes, however, the beasts are at first averse to this mixture, in which case it has been recommended frequently to sprinkle their hay with the wash; thus having the smell continually, and seeing other animals eating the same composition with avidity, they gradually become accustomed to it, and at length greatly relish it. The cattle fed in this manner are asserted, not only to repay the expense of their keeping by fattening speedily, but also to yield a large quantity of valuable manure. This substance has been extensively and successfully applied in stall-feeding by Messrs. Hodgson and Co. the proprietors of Bolingbroke house distillery, Battersea, near London, where the proprietors have erected stalls for fattening about 350 head of cattle at one time, with wash and grains and a certain portion of hay per diem with the view of enabling them to chew the cud. The beasts formerly stood or lay upon a framing of lattice work or *trellis* (which was raised a little above the pavement, and had neither straw, nor haulm, but only the bare boards for their bedding. But the unevenness of the surface being found exceedingly injurious to their feet, that practice has been relinquished and the stalls are now paved with bricks. They are said, between October and April, which is their regular working season in the distillery, to fatten about 600 bullocks, having generally about 300 in the house tied up at one time, and about 100 in an adjoining orchard to take in, to replace such as are sold off; or in consequence of any expectation of an approaching advance in meat. They have no stated period for fattening these bullocks, being regulated entirely by the state of the markets; but from ten to sixteen weeks is about the usual time, and the cattle are found to gain, upon an average, from three to four stone per week. Their food is wash, grains, and hay sometimes, though not regularly, cut into chaff: hay or straw is given to them twice a day in order that they may ruminate, and as much grains and wash as they can eat. In general, they come readily to this kind of food, though some are four or five days before they lose their aversion to it, and eat it with appetite. It is their practice to fatten cattle of every sort and size. They fatten many Scotch cattle, or Kyloes, as well as those reared in Northumberland, Wales, and Herefordshire, but none of the Sussex or Devonshire breeds, which they suppose are too dear for them. According to their quality, the cattle are supposed to pay from 5 to 20*s*. a week in this method of fattening.

And another substance has been employed in this way with equal success, which is *molasses* or *treacle*, though the expense incurred by the use of this article will probably prevent its general application. It was first used in the West Indies by Mr. Millington, who found it in combination with *farinaceous* substances, and when these could not be procured, with cane tops, oil cake and other articles of dry food, together with a little hay, or not too green fodder, greatly to expedite the fattening cattle in general, and of old and decayed oxen in particular. He gave from half a pint to a pint of molasses twice in the day to very starving animals, which had been exhausted by continual and severe labour for a long series of years. In adopting this article, a gallon of oats or other damaged grain roughly ground, or the same quantity of potatoes, should be boiled in a sufficient proportion of water to form a thick wash. It must be well stirred while on the fire, to prevent it from burning or sticking to the sides of the vessel; and when it becomes cool, the mixture is to be formed into balls of about one pound weight each. These balls are divided into two equal portions, which being previously immersed in the treacle, are given to the beasts in the morning and evening; they will devour them with eagerness, and will speedily thrive and fatten by the addition of a little hay or any green fodder, that is not too succulent. Farther, one or two spoonfuls of salt may be dissolved in the composition, which will contribute to preserve the health of the animals, and in case corn cannot be conveniently procured and ground, pulverized oil-cake, diluted in water and seasoned with a small quantity of salt with the same proportion of molasses may be advantageously substituted.

There are probably many other refuse saccharine or sweet substances formed in different manufactures that might be employed in the fattening of animals with success.

In this sort of management with all sorts of food, great care is necessary to see that they are regularly given to the animals, that they have it in due proportion, and sufficiently varied, that pure water be amply provided, and that they have litter so as to keep them perfectly dry and clean in their stalls or other places. And it has been stated by Mr. Young, that where this sort of business is conducted on an extensive scale, it is of the greatest utility to have a machine for the occasional weighing of the cattle as they advance in their fattening, as without such assistance, it is but few persons who are capable of judging whether they go on in a profitable manner or not. But by weighing them from time to time, at the distance of every eight or ten days, in the morning before they are fed; this may be correctly ascertained, and where they fall off; or do not advance in a sufficient degree to the preceding weighing, such changes may be made in their food, water, and ma-

nagement as are the most likely to promote their fattening in the most perfect manner and with the greatest profit.

In the table given below, the results of different trials made by Mr. Mure in fattening cattle with various kinds of food in the field and stall, are seen as stated in the nineteenth volume of Mr. Young's Annals.

Experiments in Field and Stall-fattening Animals.

Number and Sort of Bullocks.	When weighed.	Weight.	Sort of Food.	Time fed.		Increase.	Increase per Head.	
		Stones.		Weeks	Days.	Stones.	St.	lb.
19 Irish -	June 24	1650						
	July 12	1729	Tares - -	2	4	79	4	2
	- - 29	1748	Mowed grass -	2	3	19	1	0
	August 29	1781	Ditto - -	4	3	33	1	10
1 Ditto -	August 30	96						
10 Ditto	January 5	1024	Cabbages and hay	17	—	113	6	6
8 Ditto -	- - 9	774						
		1894						
12 Irish - -	August 22	829						
1 Bull -	- - -	90						
12 Irish -	January 30	983	Grass and cabbages	24	—	154	12	11
1 Bull -	- - - -	98	Ditto -	24	—	8	8	0
30 Irish -	July 3	2146						
	- 31	2243	Tares -	4	—	97	3	3
	September 27	2329	Grass and cabbages	7	6	86	2	12
	November 22	2466	Hay and cabbages	8	—	137	4	7
	February	2721	Potatoes, malted beans and hay	11	—	255	8	7
7 HighlandScots	July 5	470						
	- - 27	468	Tares - -	12	—	—	—	—
3 Home Breds	July 5	174						
	September 27	175	Ditto - -	12	—	1	—	—
40 Scotch Runts	- - 23	3320						
	November 7	3537	Loose at grass	6	—	217	4	7
	February 20	3801	Potatoes, beans, chaff, and hay.	16	—	264	6	8
10 Home Breds	July 11	333						
	September 28	401	Loose at clover	11	—	68		11½
24 Short horned Beasts	- - 19	2522						
	October 24	2695	Loose at grass	5	—	168	7	0
	March 16	3057	Potatoes, beans, chaff, and hay	20	—	362	15	2
1 Bull -	September 4	140	Ditto -	24	—	48	48	0
2 Ditto -	- - 12	165	Ditto - -	21	—	60	30	0
2 Ditto -	- - 19	153	Ditto - -	20	—	28	14	0
4 Ditto -	- - 22	312	Ditto - -	20	—	60	15	0

The malting of different articles having been found to render them more sweet and nutrient, and of course more proper to be employed in the process of stall feeding. The results of trials with these malted articles are shown in the following table:

Experiments with malted Substances.

No. of Bullocks.	Weight. Stones.	Quantity of food consumed, length of time 63 days.	Value of food. £. s. d.	Increase. Stones.
1,	59	4½ coombs steeped bean meal	2 4 4½	8
2,	59	3 coombs 3 bushels malted beans	1 17 6	11
3,	59	5 coombs 1¼ bushel malted beans and barley	2 11 0	14
4,	61	5 coombs 1 bushel malted barley	2 2 10	13½
5,	62	4 coombs 3½ bushels steeped barley meal	2 8 9	13
6,	65	4 do. 3 bushels dry barley meal	2 7 6	12
7,	66	4 do. dry barley meal	2 1 3	14
8,	72	As many turnips as were valued at	1 1 0	11½
9,	76	As many potatoes as were valued at	1 11 6	11¾
10,	88	4 coombs ½ bushel malted beans and chaff	2 6 6	15
11,	88	4½ do. malted barley and chaff	2 12 1	1 ½
12,	89	4 do. malted beans and chaff	1 19 4	14
13,	92	———malted beans and potatoes	1 0 3	12
14,	128½	———malted beans and potatoes	1 11 1	19½

Average increase 13st. each bullock in 63 days.

N B. The beans and barley value at 2*s.* 6*d.* per bushel, and the potatoes at 6*d.* per bushel.

These experiments not only show the quantity of the above sorts of food consumed, but the differences in the advantages or profit from the increase of flesh or improvement of the animals, in relation to the value of it.

And as juicy and green foods are employed in the practice of stall feeding, it is of great utility to ascertain the proportions of them per acre, and the number of live stock, that they are capable of supporting. This is shown below by the same ingenious experimenter in several sorts of crops.

Experiments on juicy and green Food.

	tons.	*cwt.*	*qrs.*	*lbs.*		*qrs.*	*lb.*
Weight of scarcity root from 1 acre	19	8	3	20	Weight of 1 bushel	2	1
turnips	16	14	3	18		1	20
potatoes	10	3	2	8		2	4
cabbages	14	3	2	8		1	16

Quantity of beans from 1 acre 8 coombs.

	£.	s.	d.	
Expenses of 1 acre of cabbages	1	0	0	
potatoes	1	7	6	
turnips	0	6	6	scarcity root about the same price.
beans	0	8	6	

1 acre of scarcity root will keep a middling sized bullock 254 days, at 3 bushels per day.

turnips	172	4 do.	1*s.* worth of cut chaff per week with this food.
potatoes	190	2 do.	
cabbages	180	4 do.	
beans	105	2¼ do.	

And it is stated that "it appears an acre of beans, cut green and given stalk and all, exceeds the dry beans 28 days— One acre of grass cut green will keep a middling sized bullock 112 days, supposing 1 ton 6 cwt. per acre—Three bullocks ate 35 rods of green beans in 12 days. The remainder of the crop was 12 coombs 2 bushels per acre; therefore an acre of green beans will keep one bullock 164 days.

And in the use of mangle wurzel or scarcity root, against potatoes, the results were as shown below.

Experiments with Scarcity Root and Potatoes.

	Food Scarcity-root.			*Food Potatoes.*		
Time.	Number, kind, and weight of beasts.			Time.	Number, kind, and weight of beasts.	
		Stones.	*lb.*			*Stones.*	*lb.*
Jan. 17.	8 short horns weighed	963	0	Jan. 17.	8 short horns weighed	955	0
	average	120	5		average	119	5
Feb. 28.	weighed again	1014	0	Feb. 28.	weighed again	1010	0
	average	126	10		average	126	3
	Gain in six weeks	6	5		Gain in six weeks	6	12

Quantity of food consumed per week by each beast :—1¾ peck of beans, and 4 bushels of cut chaff 1*s.* 8*d.* and 14 bushels of scarcity root.

Quantity of food consumed per week by each beast :—1 peck three quarters of beans, and 4 bushels of cut chaff 1*s.* 8*d.* and 8 bushels of potatoes.

Many other results with different sorts of food have been given by different writers, but which have been introduced under the heads to which they more particularly belong.

This is a sort of management, that where the cattle or other animals can be readily procured in such states, as they are wanted, either for complete fattening or only finishing, in general pays well, but which in situations where this is not the case, must often be precarious, and give place to other practices which will pay much better.

It has been already hinted, that a great deal of the advantage of this system depends upon the vast store of manure which it furnishes, and which is still farther shewn by the subsequent observations.

It has been stated by Mr. Young, that in the experiments of Mr. Moody, forty-five oxen were littered while fattening, with *twenty* waggon loads of stubble by which *two* hundred loads, of each *three* tons, of rotten dung, worth seven shillings and sixpence the load, were raised. And it has been fully ascertained that every load of hay or other litter that is given to cattle, while fattening on oil-cake, is capable of being converted into seven loads of dung of one ton and a half each, exclusive of the weight of the cake that is employed. And, that this, on being compared with common farm-yard dung, was found in the proportion of *twelve* loads per acre when spread out, to be considerably superior in its effects to *twenty-four* loads of that sort. In the experiments of Mr. White, it is shown that thirty-six cows and four horses, on being tied up, ate *fifty* tons of hay and had *twenty* acres of straw for litter, by which *two* hundred loads of dung were raised in proper order for application on the land. From these statements it would seem that straw may be safely purchased, even at a high price, with a view to the great benefit that may be derived from the dung or manure.

STALLION, a term applied to the male of the horse kind, when designed for the covering of mares, in order to propagate the species. Stallions should constantly be suited to the nature of the improvement or horse that is wanted. He should also have the best form and points for the particular purposes for which he is designed. See *Horse*.

STAMWOOD, the root of trees grubbed up.

STANCHING *of Blood*, in *Farriery*, the stopping of blood in cases of wounds.

STAND, any thing placed as a support for another.

Bee STAND. A sort of stand which is necessary where bees are kept, and is perhaps, the most convenient and least expensive, when constructed in the form and manner of slight sheds or stands, and made of good seasoned wood, so framed that the fore part of the shed or stand may be about six or seven feet high, and the hind part five or six. The top, and also the ends and back, must be well covered with strong boards. The inside should, likewise, have a lining of very thin deal boards, and be furnished with strong shelves, so proportioned as to suit the number of hives, boxes, or glasses, that are to be placed on them. And to the front, which should be open, thin shades of wood should be so formed and fixed up, that they may be raised or lowered, as may be necessary for the protection of the bees against either heat or moisture. See *Bee* and *Apiary*.

Corn STANDS ; such framed wood or other contrivances as are raised for placing grain upon in making it into stacks.

In all cases where the useful custom of stacking grain is practised and had recourse to, it is necessary to have proper stands or staddles constructed for securing the corn, not only against damp and moisture, but against the waste of rats, mice, and other destructive vermin.

But the method of forming and constructing these stands is very different in different situations and dis-

tricts, and circumstances. The most ordinary mode is merely that of placing two or three pieces of large timber length-ways, and then putting smaller ones cross-ways at the ends, filling up the middle parts with smaller pieces of wood or other materials.

But this is a mode by no means to be employed, as it provides no security for the bottom of the stack. In some other cases, a strong framing of good timber is put upon posts of wood, or what is better, of stones about two feet high, provided with round caps of good flat stones, and on these the stacks rest in a very solid and secure manner, and it affords a good and secure support for the corn.

They are, however, much better when constructed wholly of stone, being built to the same height as in the former case, in a rather slanting manner outwards, and covered on the tops with copings of oak planking or flat stones, which project over the edges several inches, and in that way prevent the depredations of rats and mice on the grain, as well as their lodging in the stacks. In both these modes, pieces of timber are placed as a frame in the middle to support the grain upon. Some suppose the first of these sorts of corn-stands to be the best for general purposes, as being more easily as well as more cheaply constructed, and at the same time permitting the air to enter and circulate with more freedom underneath, in the bottom of the stand, which is of much advantage.

In constructing these stands the foundations should be sunk a considerable depth into the ground, and the bottoms be well laid to prevent vermin getting to the grain of the stacks by working under them; and no sort of substances should ever be suffered to rest against them, or the loose corn to hang down during the time of building the stacks.

It is obvious that the form of these stands must vary according to that in which the stacks are to be made, which is different in different districts. The circular and oblong forms are the most usual; but the long narrow shape is probably to be preferred, as it is said, in the Report of Northumberland, to keep the corn better, more dry, and freer from heating. And that it is an advantage in this sort of stands that the crops, especially those of the wheat kind, may be carried and stacked upon them much sooner after being cut than in other circumstances. And they have likewise the advantage of preserving the grain in a more sweet condition, when kept till the following summer, or for a greater length of time than in other methods.

It has been remarked, that on brick or stone stands, stacks of the parallelogramical form may be built to any size; but that for small stacks, especially where wood is employed, the octagonal form of stand should rather be preferred to the circular one, as the copings may be cut with less waste, and from smaller timber; and it is just as easy to build a circular stack on an octagonal stand as on a circular one. But that where stone can be easily procured, it is without doubt the most proper material for the bottoms; and brick, when properly made for the purpose, answers very well, especially if proper care be taken in the laying of it. And slate is another material, where it can be had at a reasonable expense, that may be a very good substance for this use. And that flag stones would likewise answer extremely well; but that neither slates nor flag-stones are necessary, if the foundation be laid sufficiently deep to prevent the vermin burrowing under them. The celebrated Mr. Bakewell made use of stands of this kind with much advantage; and other farmers, in the same district, probably employed them before his time.

Different forms of stands of this sort, may be seen at *figs.* 2, 3 and 4 in *Plate* VII. in the first volume, as employed on the farm of the Duke of Bedford, at Woburn. And in *Plate* XXXII. in the present. See *Stack*.

Hay STAND. This sort of stand may be formed in the same manner as those for corn, only it is seldom necessary to have them made of such expensive materials. A simple frame of wood is mostly sufficient, with proper bearers laid across for the support of the stack. These stands are much better than the common practice of building the ricks on loose pieces of wood laid across in the bottom, and filled in with brush or fagot wood, as is often the case. And earthy floors or foundations should never be thought of for this purpose, as the dampness must injure a considerable part of the hay at the bottom. See *Stack*, and *Stacking of Hay*.

STANDS, a word applied to such young timber trees as are under six inches timber girt, or twenty four inches in circumference.

STANDARD *Bushel*, the legal Winchester bushel. In Hilary term in the year 1792, a case was decided before Lord Kenyon, in respect to the standard bushel, which was *that by law no corn or grain can be sold in any market in this country by any measure but the Winchester bushel.* See *Bushel*.

STANG, a word provincially signifying a long pole, &c.

Cart-STANG, the shaft of a cart.

STANDARDS, a term signifying the young trees reserved at the felling of woods, for the growth of timber. It is sometimes written *Standrels*.

It also signifies such fruit trees as are intended to grow in an open exposure, and not to be hacked and mangled with the knife: as the dwarf trees and those planted against walls are.

STANK, the name of a dam, or bank to stop water.

STANNER-*Wort*, the name of a weed. See *Rag-wort*.

STARING *Coat*, a term signifying the same as hidebound. It is that peculiar unthrifty appearance which denotes bad keeping and grooming, or an unhealthy state of the animal. And it takes place in most sorts of domestic animals that are not properly kept. See *Hidebound*.

STARK, a term signifying provincially stiff, tight, as a stiff rope, &c.

STARLING-*Colour*, particular colour of a horse. See *Colour*.

STARS, in *Horsemanship*, are distinguishing marks in the foreheads of horses. They are usually white. According to Solleysel, the method of making a star, is this: if you would have a white one in the forehead, or indeed in any other part of the body, first, with a razor shave away the hair

of the width or bigness intended for the star to be; then take a little oil of vitriol in an oyster-shell, and dip a feather or piece of stick into it, for it will eat both linen and woollen, and just wet it all over the place that has been shaved, and it will destroy the roots of the hairs, and those that succeed will be white. It need only be done once, and be healed up with green ointment immediately.

STARTING, in *Horsemanship*, is when the horse starts at trifling objects, stops, flies out, and runs suddenly to one side, insomuch that the rider cannot make him approach the place where the object is. This fault frequently arises from bad treatment, but it is more common to geldings than stone-horses. Such horses as have had bad eyes are particularly subject to it, as well as those that have been kept a long time in a stable without airing; but these last are easily cured of it. A skittish horse should never be beaten in his terror, but made to advance gently and with soothing means, to the object that alarms him, till he recovers and gains confidence. It is however very difficult to bring horses that are liable to take fright at trivial objects to become steady.

STATUTE, provincially a hiring day for farm servants.

STAVERS. See *Apoplexy* and *Staggers*.

STEAM, the smoke or vapour arising from water or any other fluid or moist body when considerably heated. It has been found that subterranean steams often affect the surface of the earth in a particular manner, and promote or retard vegetation more than any thing else. And it has been imagined in the Philosophical Transactions, that steams may be the generative cause of both minerals and metals, and of all the peculiarities of springs.

Steam has lately been applied to a great many useful purposes in agriculture, as that of preparing different sorts of cattle food and turning different sorts of machinery, as well as raising water. It is suggested by Dr. Darwin that the art of boiling vegetables of all kinds in steam instead of water, might probably be managed to advantage, as a greater degree of heat might be thus given them by contriving to increase the heat of the steam after it has left the water, and thus the vegetable mucilage in roots and seeds, as in potatoes and flour puddings, as well as in their leaves, stems, and flour-cups, might be rendered probably more nutritive, and perhaps more palatable; but that many of the leaves of vegetables, as the summits of cabbage sprouts, lose their green colour by being boiled in steam, and look like blanched vegetables. This etiolation of some vegetables by steam, is probably owing to its dissolving their colouring matter, which may then become decomposed, and may render them less agreeable to those who choose by the eye rather than by the palate; which green colour is, however, heightened by boiling them in some hard waters which contain dissolved lime or sea salt, or by a slight admixture of common salt with soft water. An effect which is owing to the evaporation of a part of the marine acid and to the remaining alkali which was the basis of it, when applied to blueish vegetables converting them into green, as in the common experiment of adding salt of tartar to syrup of violets, or according to the custom of some cooks who add a little pot-ash or fixed vegetable alkali, to the water in which young peas are boiled, to make them green, and afterwards a very little sugar to sweeten them. And the same effect of making vegetables green, when boiled in another kind of hard water, is probably produced by the lime which abounds in them, and which, like the vegetable alkali when the aërial acid which was united with it evaporates, is said to convert blueish vegetable colours into green ones.

STEAM-*Boiler*, a simple convenient contrivance for preparing different sorts of cattle food by means of steam.

A perfectly convenient and practical contrivance of this nature for farms, where the extent of this sort of food required is not upon a large scale, has been described in the first volume of Communications to the Board of Agriculture; and is shown in *Plate* XXXI. at *figs.* 5 and 6, in which A B C D, *fig.* 5 is of stone or brick, built in a cubical form, about three feet every way: *a*, is the door of a furnace; *b*, the ash pit; *c*, is a shallow iron kettle, about twenty inches in diameter and seven or eight inches deep, placed over the furnace. B C is a flat smooth stone covering the whole top of the building, in the middle of which, a round hole is cut out to admit the iron kettle being fitted closely in. E is a cask, the bottom of which is perforated with a number of auger holes, and is placed over the steam kettle, which is about half filled with water. The cask is then filled with potatoes, and being closely clayed all round the bottom, to prevent the steam escaping between it and the stone: the cover is put on also very close. *d*, is a short thick plug put slightly in a hole in the cover, to give air; or this hole may be covered with a piece of lead fitted closely upon it, and moveable on a leather hinge, that it may of itself give way to prevent the cask being endangered by the steam. F is the flue or vent which may be built to the wall of any house, or any other convenient place.

And when the potatoes are steamed or boiled sufficiently, which may be known by taking off the cover, they are either taken out with a shovel, or else the cask is turned over, and emptied into a barrow or tub, and again filled if necessary. By having it suspended in the middle on two pins on a frame, it might be made to readily turn upside down, and empty the potatoes or other roots with great convenience. Though this is the most simple construction of a steam-boiler, it may be fully sufficient to explain the nature of it. But they may be made of various other constructions, according to the extent required, and one steam kettle may be made to boil several casks at the same time; or instead of casks there may be fixed boilers with sliding bottoms, for emptying the potatoes into little waggons, or barrows, wheeled in under. The potatoes might also be taken out of a fixed boiler, by means of an iron basket, made to fit the inside of the boiler; which basket might easily be taken out with a lever, a small crow or some other similar contrivance.

Another excellent contrivance of this sort has been

made use of by Mr. Stares, and which is described in the Annals of Agriculture.

But the most complete apparatus for this purpose, where the business is conducted in a very extensive manner, is that which has been fitted up and described by Mr. C. Curwen in the fourth volume of Communications to the Board of Agriculture, and which will be further noticed in speaking of the use of steaming cattle food. See *Steaming Cattle Food.*

It has been suggested that if steam boilers be fixed up, in a contiguous manner to the kitchens or sculleries of farm houses, they may be occasionally converted to the use of the family, as this method is preferable to the practice of boiling in water for most culinary purposes.

STEAM-*Engine*, an engine constructed for raising water by the force of steam produced from boiling water, and of ten called the *fire-engine*, on account of the fire employed in boiling the water to produce the steam. It is one of the most curious and useful machines which modern art can boast, for raising water from ponds, wells or pits, for draining mines, &c.

Dr. Hutton supposes that were it not for the use of this most important invention, it is probable we should not now have the benefit of coal fires in England, as our forefathers had before the present century excavated all the mines of coal as deep as they could be worked, without the benefit of this engine to draw the water from greater depths.

He states that this engine is commonly a forcing pump, having its rod fixed to one end of a lever which is worked by the weight or pressure of the atmosphere upon a piston at the other end, a temporary *vacuum* being made below it by suddenly condensing the steam that had been let into the cylinder in which this piston works, by a jet of cold water thrown into it: a partial vacuum being thus made, the weight of the atmosphere presses down the piston and raises the other end of the straight lever with the water from the well, &c. Then immediately a hole is uncovered in the bottom of the cylinder, by which a fresh fill of hot steam rushes in from a boiler of water below it, which proves a counterbalance for the atmosphere above the piston, upon which the weight of the pump rods at the other end of the lever carries that end down, and raises the piston of the steam cylinder. Immediately the steam hole is shut, and the cock opened for injecting the cold water into the cylinder of steam, which condenses it to water again; and this making another vacuum below the piston, the atmosphere above it presses it down and raises the pump rods with another lift of water; and so on continually. This is the common principle, but there are also other modes of applying the force of steam.

It is observed in the Norfolk Report on Agriculture that "Mr. Gooch, of Quiddenham, having a water-mill which was sometimes unemployed for want of water, erected a steam-engine contiguous, at the expense of about 500*l.* and that the stove which heats the boiler, is so contrived as to burn coal to coke for his malt-house. One man attends both the engine and the cinder oven. It was, in the drought of 1800, of singular use to the whole country, for wind and water having both failed in a great measure, corn was brought from ten miles distance, to be ground by this engine: he has two pair of stones to the water-wheel, and two pair to the engine. The power, that of twelve horses."

And it is added that "the first steam-engine erected in Norfolk for merely agricultural purposes, and, for what the writer knows, in England, is one now erecting at Haydon, by Colonel Buller. He has contracted for the sum of 600*l.* It is to do the work of ten horses; to work a threshing-mill that shall thresh and dress six lasts a day: it is to grind corn also, and cut straw; to grind nine bushels of wheat with one bushel of good Newcastle coals, of 84lb. weight, and this with all the other works going on at the same time: the colonel to find timber. Last year his hay and straw cutting cost above 70*l.* therefore little doubt can be entertained of the plan answering.

There can be little doubt but that these engines may be applied to many other useful farming purposes, as draining, watering, &c.

STEAMING, the process of preparing different sorts of roots and vegetables by means of steam.

STEAMING *of cattle-food*, the process of preparing different sorts of roots by means of steam, for the feeding of cattle. This is a practice that may be highly advantageous in such situations and districts where both fuel and labour are cheap, but in others it can perhaps seldom be had recourse to with profit. It has been long known that many sorts of roots, and particularly the potatoe, become much more valuable by undergoing this sort of preparation. And it is equally well known that when thus prepared they have been employed alone as a substitute for hay, and with cut chaff both for hay and corn, in the feeding of horses, as well as other animals. It has indeed been observed that to a farmer who keeps many horses or cattle, or even swine or poultry, the practice of boiling their food in steam is so great a saving, and an advantage, that it deserves the most particular attention. It has however till lately been confined to such narrow bounds that it is known but to very few. And though potatoes have often been given raw to both horses and cattle, they are found to be infinitely preferable when boiled in steam, as they are rendered thereby much drier, and more nutritive, and better than when even boiled in water; this has been long since shown by the experiments of Mr. Wakefield, who in order to ascertain it, fed some of his horses on steamed and some on raw potatoes, and soon found the horses on the steamed potatoes had greatly the advantage in every respect. Those on the steamed potatoes looked perfectly smooth and sleek, while the others were quite rough. Mr. Eccleston also found them useful instead of corn; and the extensive accurate trials of J. C. Curwen, Esq. have placed the utility and advantage of them in this way beyond all dispute. His statements have been given in speaking of potatoes. See *Potatoe*. He has found that in their preparation in this way the waste

of the potatoe is about $\frac{1}{18}$ part, and that straw when given along with them answers equally well as hay, as the horses keep their condition and do their work equally well.

The representation of the ground plan of his washing and steaming house or apparatus is given in *Plate* XXXIV. in which,

A. Is the well. BB. The conduit which takes the water from the potatoe washing-machine.

C. The frame of the potatoe washer.

D. The circle which the crane moves in, which takes the machine out of the tub when the potatoes are washed, and will empty the potatoes into the back marked E, which is raised from the floor the height of one of the steaming tubs, or will meet the other crane, 2. 2. which will place them on the lead pots, where the potatoes are steamed.

F. The boiler seat.

G. The steam pipe which connects with the lead pots H. where the tubs stand upon whilst steaming.

I. One of the cocks which let off the condensed water.

J. The conduit which takes off the condensed water.

K. The framing and platform where the lead pots stand upon, which should be 10 inches above the floor.

L. The stone troughs in which the potatoes are bruised for use.

Reference to the Section.

No. 1. The washing-machine; the handle goes twice about for the washer's once.

2. The crane and jack which wind up the washer, which disengages from the axle by a jointed notch between the two headstocks, marked A.

3. The water back, which from the pump is supplied by a spout to fill the boiler; also a shorter spout is applied to fill the tub, which the washing machine runs in. N. B. A plug is in the bottom of the tub to let off the dirty water.

4. The boiler, which is two iron pans screwed together by two flanges; and each pan will hold 40 gallons.

5. The lead pipe leads from the boiler, and conveys the steam to the lead pots, and is one inch and a quarter diameter. N. B. The lead pots are 12 inches diameter, and 9 feet deep, marked H.

6. A brass cock, which stops the steam when the tubs are taken off: also two other cocks are applied, one to open from the water back, marked B, to fill the boiler; and the other to know when the boiler is sufficiently filled with water.

7. A steam valve fixed upon the top of the boiler, about 4lbs. to a square inch.

8. The tubs are two feet high, and 20 inches wide at the top, and 17 inches at the bottom, and will hold about eleven stone of potatoes.

N. B. The boiler will steam the four tubs from fifteen to twenty minutes. One or two tubs may be steamed at a time by plugging up the steam holes in the leaden pots. The tubs set upon the lead pots with flannel between, nailed upon the tub bottom; and each tub bottom is perforated to let the steam ascend among the potatoes; and the lids of the tubs are holden down by iron ball clevers, four to each tub. When the potatoes are steamed, the other crane removes the potatoes to the stone troughs, to be made use of; and also places the tubs.

It is observed that, "the washer should be about two thirds filled, and that it will most completely do the potatoes in two minutes. When taken out of the box, either pump or throw a pail of water over them, and let it drain through. The size of the washer must be according to the work required to be done.

But another method has been suggested by Mr. Pierrepont of preparing this root, and which, he says, is superior in respect to the goodness of the food for the use of cattle, as may be seen under the article Potatoe. See *Potatoe*.

This is by means of baking or roasting them in ovens proper for the purpose. They are constructed as shown in *Plate* XXXI. *figs.* 3 and 4, in which *fig.* 3 is the section of a oven, and *fig.* 4, section of the fire-place.

a a. Oven 3 feet 6, by 2 feet 6, and 1 foot 9 high.

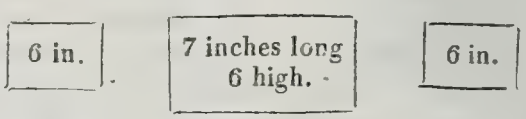
b. A cast iron plate for the bottom.

c c. The flues.

The oven will contain six digesters.

In speaking of the process of baking the potatoes in these ovens, it is observed in the fourth volume of Communications to the Board of Agriculture, that "three bushels of potatoes were weighed separately, each bushel weighing sixty pounds before they were put into six digesters. The potatoes from the two first digesters, taken out of the oven when baked, and weighed together, were fifty-five pounds; and those from the second two, were fifty-four pounds; and those from the third two, were fifty-four pounds. The carpenter measured the wood with which they were baked, and he tells him a well-stacked cord of good fuel-wood, will bake ninety sets, or ninety times six digesters, each containing half a bushel of potatoes, at the rate of wood it took to bake the above six, which was the second set baked that day."

And he adds, that "a cast-iron plate 5 feet long by 2 feet 10 inches, instead of 3 feet 10 inches by 2 feet 10 inches, which his is, will hold eight digesters, and by adding a small fire thus,



on each side the great fire place, will, in his opinion, accelerate the baking from fifteen to twenty minutes in every set, as well as save some fuel."

And in a subsequent communication it is stated that "the cord, or as it is often called, the stack of wood, mentioned in the experiment, is 24 feet long, 3 feet wide (that is, the wood is first cut into 3 feet lengths), and 1 foot 10 inches high; and

is sold for twelve shillings on the spot in his neighbourhood. Each of the six digesters holds six gallons wine measure, but in potatoe measure each will only hold half a bushel; so that one sack, or three bushels, are baked at a time with one part out of ninety of the above cord, or stack of wood. He has never had occasion for more than six bakings in a day; which six bakings, that is, six sacks, or eighteen bushels, at sixty pounds the bushel, were done within 12 hours, the wood being in a dry state. He believes that eight digesters, with the heat properly spread, would be done in somewhat less time, allowing for that of filling and emptying the two additional ones; and this should be sufficient satisfaction for any person wishing to use the method on a larger scheme. The man and his boy had twelve shillings per week for getting from the heap, washing and baking the potatoes; cleaving the wood for ditto, and feeding stock. The following account is copied from bills that he has by him, from which, and from what he shall say, the Board, and other persons will be able to make a very near calculation of the expense of the apparatus for the different places the method may be tried in, according as the articles necessary may vary in price, and according to the quantity of potatoes, which may be wanted to be baked.

6 Six gallon wine measure digesters, at 18*s.* a piece - -				£.5	8*s.*	0*d.*
A cast iron plate 3 feet 10 inches by 2 feet 10 inches, -	2	1	19	2	16	0
Two strong cast bearing bars - - -	0	1	25	0	10	0
An extra double door and frame mounted with two doors at top and two at bottom, with cranks to open together, and corkings - - -	0	3	24	4	14	6
				13	8	6"

It is observed that "the last mentioned article is not necessary, only for the greater economy of fuel. The other bars, the register, and the old iron for three sides of an eighteen inch square, with projections at the four corners to tie it in the brick work forming the mouth of the oven, he had by him; the door to which is wood faced with tin; but he is not satisfied with that, because it is so apt to burn. He could wish the door to be something similar to that of the mouth of the fire-place, which would be so much more convenient for confining the heat in the oven, and keeping out the external air, both when the digesters are taken out and filling, and when closed up at night. Perhaps an orifice just above the mouth of the oven, or in the door, with a moveable valve fixed to it, would prove useful, that the steam, which issues from those of the digesters about ten or fifteen minutes before the potatoes are done, and which steam smells like roasted ones, may escape by it, instead of by the mouth of the oven. The above steam is attended by a hissing noise, and kind of boiling commotion in the digesters, which the person attending them will very plainly hear on opening the door a little, and when he perceives that noise, &c. to intermit, the digesters must be taken out, or the potatoes will be burnt at the bottom, and that in proportion to the heat under them. A very little observation will soon make any person acquainted with the proper time of their being done. About the sixth part of an inch below the upper surface of the cast iron plate at the mouth of the oven, is a piece of sheet iron, two feet long by seven wide, to rest the digesters on, in moving them to and from the oven, that the door may be the closer at the bottom. He has been thus minute (perhaps tediously so) on his oven, that any person willing to try this method may profit, in forming his ideas on the subject, without being at the pains, &c. that he was, by the result of the many and various experiments he has made. Let the person keep in mind, 1st, that the digesters must not be in contact with the fire; 2d, that the said digesters, or other vessels, even placed on cast iron, must have legs, so that the bottoms of them do not touch the cast iron; 3d, that the vessels used must have lids steam tight, and valves similar to those of the digesters; but it is not by slow simmering that this process is performed the best; the quicker the potatoes are done in reason the better; and 4th, that the external air is to be excluded from them. With observing these four circumstances every person may exercise his own judgment, indulge his own fancy and information, relative to the management of fuel, and erecting his oven, whether it be for fewer or more digesters, according to the quantity he may wish to bake. His opinion is, that two ovens of six or eight digesters each would answer the best purpose where a great quantity of food is wanted, particularly where coals are used, or the wood is ready cut; for then the same person could attend both, and one would be baking whilst he was drawing the other. Perhaps two ovens erected together with a single brick laid flat to divide them, and the fires at the end, so that each flue would go the whole length of the plate, mounting at the other end, and so over the top; and the two doors of them at the two fronts would answer very well in point of economy." It is a matter of much consequence that cheap and convenient modes of preparing cattle food should be provided, as there can be no doubt but that many other substances beside the potatoe would be improved as cattle food by such means.

Steaming-*House*, a place properly fitted up for the purpose of preparing roots by steam for the use of cattle. See *Steaming of Cattle Food*.

STEATITES, soap-rock; a genus of the earths: it is glossy, very smooth, unctuous, and resembling hard soap, readily falling down in water, when it possesses no kind of ductility, nor any grittiness. It has not yet, we believe, been much made use of as a manure, but it seems not improbable but that it may be useful.

STEE, a provincial term applied to a ladder.

STEEL, a hard kind of iron refined by means of fire in combination with other ingredients, which ren-

ders it more compact in the grain, and of a whiter colour than common iron. It is of great use for various purposes in husbandry, as those of forming different kinds of edge tools, and it has lately been employed in forming particular parts of the coulters and shares of ploughs with great advantage. See *Share*.

Steel, a term applied to a stalk, a handle of an implement.

STEEL YARD, a well known kind of balance, by means of which the weights of different bodies are discovered by using one single weight. It is easily used, but is liable to error. See *Weighing Machine*.

Spring Steel-Yard, is a kind of portable balance serving to weigh any matters from 1 to about 40 pounds. It is composed of a brass or iron tube, into which goes a rod, and about that is wound a spring of tempered steel in a spiral form. On this rod are the divisions of pounds and parts of pounds, which are made by successively hanging on, to a hook fastened to the other end, 1, 2, 3, 4, &c. &c. pounds. And from the spring being fastened by a screw to the bottom of the rod; the greater the weight is that is hung upon the hook, the more will the spring be contracted, and consequently a greater part of the rod will come out of the tube, the proportions or quantities of which greater weights are indicated by the figures appearing against the extremity of the tube. A graduated spring steelyard may be had by applying to Mr. Salmon, Woburn Park, Bedfordshire. The price five guineas.

STEEP, a preparation for steeping grain intended to be sown as seed. See *Seed* and *Pickle*.

STEEPING *of Seed*, the practice of preparing wheat, barley, and other sort of seeds before putting them in the ground by means of steeps, in order to prevent disease. See *Pickle*.

It is observed by Mr. A. Young, who has made a great number of interesting experiments in this way, that "the modes of steeping, brining, and liming seed wheat, are innumerable, and all equally intended against the smut. From his experiments it seemed that steeping from twelve to twenty-four hours in a lye of wood ashes, in lime water, and in a solution of arsenic, gave clean crops from extremely smutty seed, but that a short time in these mixtures had a much less effect."

Experiments.

"November 9, 1786, marked twelve beds of good sandy loam, in great heart, on a clay marl bottom, and struck drills at one foot. Prepared the seed differently for each.

1. White velvet wheat a year old that was very smutty: no steep or lime.
2. Velvet wheat of this year, and very smutty, swam in brine, and limed.
3. Ditto, ditto, of this year, steeped 24 hours in a steep of lye, arsenic, &c.
   Made half a hogshead of strong lixivium of wood ashes, put it in a cast-iron boiler, with 7lb. of common salt, and 1lb. of arsenic; boiled it, and kept it in the boiler for use when cold. This is Mr. Andrews's steep, except the salt, which he does not use.
4. Velvet wheat, 14 hours in the same.
5. Ditto, ditto, swam in the same steep, and limed and sown directly.
6. Ditto, ditto, washed repeatedly in common water till clean, then swam in the steep, dried with lime, and sown directly.
7. Ditto, ditto, merely washed well in common water.
8. Ditto, ditto, dry from the barn; nothing done to it.
9. Ditto, ditto, steeped in lime water, made with hot water in the manner prescribed by Mons. Tessier, and dried with lime; then in the arsenic steep, and again dried with lime.
10. Ditto, ditto, washed in the same lime-water, and then dried with lime; as by Mons. Tessier.
11. Ditto, ditto, steeped 12 hours in a pickle made of hot lime water; to which added the vegetable powder of M. Brongniart, dried with lime.
12. Ditto, ditto, steeped four hours in the arsenic steep; dried with lime.

Sowed them November 11: the contents of each division, a rod square. All the seed was exceedingly smutty. Very little of the old seed ever vegetated."

The following are the results as stated by his neighbour Mr. Carter and his bailiff.

"*July* 26, 1787. 1. Ears fine: smut inconsiderable.

2. Very smutty: far inferior to No. 1.
3. Equal to No. 1 in smut, and to No. 2 for growth.
4. No smut: growth as No. 2 and 3.
5. 6. Growth as No. 1, but more smut.
7. Very smutty.
8. Not so bad growth as No. 7.
9. 10. Better: but some smut.
11. Ears as No. 2: nearly free from smut.
12. Ditto: but more smutty.

The bailiff's account, taken afterwards, stands thus:

"No. 1	7	smutty ears.
2	105	do. do.
3	5	do. do.
4	6	do. do.
5	35	do. do.
6	32	do. do
7	$\frac{1}{3}$	of the whole smutty,
8	$\frac{1}{2}$	smutty,
9	20	smutty ears,
10	75	do. do.
11	5	do. do.
12	10	do. do.

It is supposed that "as a great deal of the old seed never came up, the proportion of seventy smutty ears in the remainder is considerable, and should shew that sowing old seed is not a security when the wheat is so very bad." And "the first, in point of freedom from the distemper, are those steeped in arsenic 24 hours, and M. Brongniart's powder: these are equal, with this superiority, that 12 hours with the latter are equal to 24 with the former."

That "the next in freedom, and nearly equal, is that which was 14 hours in the arsenic-steep; and the next to that, No. 12, which was only four hours in the same steep. The superiority of arsenic to all the rest is decided; but it is remarkable, that the time of steeping seems of consequence. Twenty-four hours lessens, by half the quantity of smut, on comparison with four hours. In Mr. Andrews's method, the seed is not steeped at all, but only swam. No. 6 was nearly his method, but it failed here very much; yet the quantity of arsenic used was double what he prescribes. The reader is, however, to remember, that no man in his senses would sow such seed as that of this experiment. That gentleman's method is certainly sufficient, with fine clean seed, because no crops are cleaner than his; but to discover on what circumstance of the preparation the security depends, is an object certainly of consequence."

It is added, that "every operation the seed went through did good: washing in common water, lessened the smut from one-half to one-third. Swimming in brine, and limeing, appears to be utterly deficient."

It is stated, "that a striking feature in the result is, the utter failure of the method so warmly recommended by Mons. l'Abbé Tessier: yet nothing can be more decisive than the circumstances, as reported by him; and in consequence of his and M. Tillet's experiment, the king's council in France issued an edict, prohibiting the use of arsenic and other poisonous drugs. Conclusions are not to be drawn from one experiment. He shall repeat this, and with variations.

"December 7, 1787, sowed 14 beds with the same wheat-seed, as black with the smut as he ever saw any.

No. 1. Sown dry: nothing done to it.
2. Washed well in clean water.
3. Washed in lime-water,
4. Ditto in a lye of wood-ashes.
5. Ditto, in an arsenic and salt mixture; as in last year's trial.
6. Steeped in lime-water, four hours.
7. Ditto, in the lye, four hours.
8. Ditto, in the arsenic-steep, four hours.
9. Ditto, in lime-water, 12 hours.
10. Ditto, in the lye, 12 hours.
11. Ditto, in the arsenic-steep, 12 hours.
12. Ditto, in lime-water, 24 hours.
13. Ditto, in the lye, 24 hours.
14. Ditto, in the arsenic, 24 hours.

Result.

No. 1.	Had	-	377 smutty ears,
2.	-	-	325
3.	-	-	43
4.	-	-	31
5.	-	-	28
6.	-	-	12
7.	-	-	3
8.	-	-	1
9.	-		6
10.	-	-	0
11.	-	-	4
12.	-	-	0
13.	-	-	0
14.	-	-	5"

It is stated in concluding, that "the principal objects to attend to in these results, are the modes of steeping, which entirely prevented the malady, and these evidently depend on the time the wheat remains in the steeps. Nos. 10, 12, and 13, were twelve hours in it at the shortest; and lime-water not effective in 12 hours, but secure in 24, confirms this doctrine. Old wheat is, it is supposed, clearly much less exposed to the malady than new; and he has since heard of many farmers trusting with entire confidence to old wheat, and not wetting it at all: but, of course, they would not sow a sample which they knew had been smutty."

In the northern districts, the practice of steeping is almost in general use with steeps of the chamber-lye and salt kinds with lime, and the following are the practices, in two of the principal grain districts in the southern parts of the kingdom.

It is stated in the Survey of Norfolk, that "Mr. Robinson, of Watton, for many years has had no other smut on his farm, than what has been caused by accidentally sowing a head-land, or finishing a corner of a field with dry seed; but if steeped, the prevention infallible. His method is, to steep it in a brine made with common salt, of strength to bear an egg, for 12 hours, and then to dry with lime. Mr. Dover of Hockham, had great plenty of pheasants, but lost them all by using arsenic in steeping his wheat seed."

But "Mr. Salter of Winborough, dresses with salt and lime without steeping, and never has the smut: it is only to be concluded that he has always sown clean seed. And Mr. M. Hill, slakes the lime with salt, dissolved in a small quantity of water; dips the wheat in a skep in plain water only; lays it on the floor, and incorporates with salt and lime, dries with lime. Mr. Overman stirs his seed well in pump water, then lays it in a heap to drain, and adds half a pound of salt to every bushel, stirs it well together, and dries with lime; this he finds sufficient against the smut. Whence the writer concludes that his seed is always free from that distemper, or assuredly he would find the process to fail, for he does not leave it any time limed.

"The salt is dissolved in a very small quantity of water, with this salt the lime is slaked, and with this saline preparation in its hottest state the wheat becomes candied,

having previously been moistened for the purpose with pure water.

And in Hertfordshire, Mr. Byde brines his wheat; he swims it, but takes it out directly and limes it. And about Beachwood they make a brine with salt, which will swim a new-laid egg. They leave the seed from two to four hours long in this brine, and stir and skim it; they lime it over night, and then sow it next morning, but if it be kept a week it will receive no injury; they are however not free from smut, and have much this year, and over the whole country even from Watford. A steeping of one hour is trusted to at King's Waldon. If chamberley be added or thrown on the seed after brining, it kills the wheat. And Mr. Leach has bought smutty wheat to sow for curiosity, and even the worst which he could find; he steeped it six hours in a very strong brine made to swim a large egg; he dried it with hot lime and sowed it directly, and had no smut. He has tried this several times always with success. He steeps clean wheat but three hours. But Mr. Sedgwick steeps his seed in brine above six hours, then dries it with lime and sows it directly, and he never has any smut; he omitted it three or four years, and suffered severely by such omission."

STEER, a young bullock. See *Ox*.

STEERISH, a term applied to young growing oxen in contradistinction to oxey.

STEG, a provincial term applied to a gander.

STEM, that part of a plant arising from the root, and which sustains the leaves, flowers, fruits, &c. Also the handle of a fork.

STEP, in *Horsemanship*, is the walk of a horse, which when free, easy, and without shuffling, is said to be good. See *Walk*.

STEPPINGS, a word applied to large stones placed in a shallow brook for passing upon.

STEPPING *Stones*, the same.

STERCORARY, a place properly secured from the weather for containing dung.

In collecting manures from time to time, as they come to hand, farmers generally keep them together in what they call dung hills, where they remain exposed to the heat of the sun, the washing of rain, aad drying winds; by which means a great deal of their virtue is dissipated and lost.

The making of stercoraries has therefore been advised which may be done by digging a square or oblong pit, of the size suited to the quantity of compost wanted, or proportioned to the extent of the ground intended to be manured: the side next the field or place where taken away from being made sloping, so as to receive a cart to load or unload easily. The bottom should be well paved, and both the sides lined, unless it be made in a bed of clay or chalk, that it may be capable of retaining water like a cistern; as it is of great importance, for the dung to have a proper degree of moisture. And where channels or gutters can be directed to the pit, from the stables and other offices about the house, they will be of great service. Some think that they should be covered, so as at least to hinder rains from falling upon them:—but if care be taken to make the pit in a place where no running water, or springs can come to it, and if the farmer covers the dung, as it is collected, with a coat of mould, to prevent the sun's exhaling, or the rain's washing away its richness, the quantity of water which falls in rain may not be more than requisite to moisten the mixture, and bring on that putrid fermentation which is necessary for the due incorporating and perfecting of the compost. It will, however, be right to have a shed to put over it occasionally, in case the season should prove extremely wet.—It has been observed by Columella, that the Romans covered their stercoraries with hurdles; but does not speak of covering them with mould, in the manner mentioned above. See *Farm-yard*, *Manure*, and *Compost*.

STERILE, a term signifying barren, unfruitful, as applied to soils.

STERNUTATORIES, in *Farriery*, are such medicines as produce sneezing.

STEW, a kind of fish-pond, contrived for serving the daily use of a family, so that with little trouble the house may be furnished with fish at any time. It should be so situated as to be near the chief residence, and be well inclosed to defend it from depredations.

Where there are two waters of three or four acres each, it may be proper to have four stews, of two rods wide and three rods long each.

In constructing them, the sides should be cut down sloping, carrying the bottom in a continual decline from end to end, so as to have a convenient mouth, as horse-ponds have, for taking out nets in drawing for fish; and if there be room enough, a mouth may be made at both ends, and the deepest part be in the middle, by which means the net may be drawn backwards or forwards, and the fish not have such shelter as is given by a depth under a head. And besides, the fish delight to come upon the shoals, and probably thrive better.

These may chiefly be reserved for carp, but not absolutely; and where tench and perch increase and prosper, smaller stews may be made to serve them apart, and take them when wanted, without disturbing the other fish. See *Fish*.

STICKLEBACKS, a sort of small fish that are met with in large quantities in some places, and made use of as manure.

It is observed in the Norfolk Report, that these little fish, which are caught in immense quantities in the Lynn rivers about once in seven years, have been bought as high as 8*d*. a bushel. The favourite way of using them now, is by mixing with mould and carrying on for turnips. Great quantities have been carried to Marham, Shouldham, and Beachanwell. Mr. Fuller, there, is reported to have laid out 400*l*. for them in one year; they always answer exceedingly. And Mr. Rogerson, of Narborough, has gone largely into this husbandry, laying out 300*l*. in one year, at from 6*d*. to 8*d*. per bushel, besides carriage from Lynn: he formed them into composts with mould, mixed well by turning over, and carried on for turnips: the success very great. There can

be no doubt but these small fish afford a good animal manure.

STIDDY, a name commonly applied to the anvil of the blacksmith.

STIFF-LEGS, in *Farriery*, a disease in horses, under which are comprehended dry, decayed, or bruised legs.

STIFLE, in *Farriery*, the patella or knee-pan in a horse. A lameness in the stiffle is caused by those accidents that produce it in all other joints. When a horse is lame in this part, he generally treads upon his toe, and cannot set that heel to the ground. Some strains in the stiffle are violent and swell pretty much; but Gibson asserts, that he hardly ever knew any of them incurable, unless bad methods had been used in the beginning. They commonly may be cured by cooling applications, such as have been prescribed for the shoulder strains; but if the swelling be very large and puffy, which sometimes happens, recourse must be had to fomentations to take off inflammation. Sometimes, however, imposthumations follow: in such cases, and when these break and run, there is commonly an end of danger.

STIFLING, in *Farriery*, a malady that accidentally befals a horse either by a strain, by leaping, or by a slip in the stable, or on travelling, or else by a blow or stroke, which puts out the stifle-bone, or much hurts and strains the joint.

The sign of this is by the dislocated bone bearing itself out, which will make him go lame, and unwilling to touch the ground but only with his toes, till it be put in again. This should always be done as soon as possible after the accident.

STILES, a well known contrivance for the admission of foot passengers, without permitting the stock of the inclosures to get through. They are made in very different forms and manners in different districts, according to the materials, situations, and purposes for which they are intended. But they may be more clearly understood by the figures. At *fig.* 1. in *Plate* XXXIX. is shewn a stile of a very simple construction; at the bottom, A, is a thin flat stone set edge-ways, to prevent sheep getting out, and above there is a cross stone or bar, to prevent horses and cattle jumping over. *Fig.* 2. is another stile of a simple construction, and well calculated for situations where the traffick is not great. And at *fig.* 3. is the *Cornish stile*, the foundation of which is a stone wall; in which a gap is left, and stones are laid across a ditch of some depth, made lengthways in the gap; the foot passenger steps on the stones, but four-footed animals miss them, and fall into the ditch.

STITCH, a term signifying a ridge in a field. See *Ridge*.

STITCHEL, a term applied to a kind of hairy wool.

STITCHING, the forming of ridges, the same as ridging.

STIPA, feather-grass, a genus of grasses, of which there are several species, but none that are of much use to the farmer.

STIRRUP, in *Horsemanship*, a well-known iron frame, hung to a saddle by a strap of leather, for the rider to rest his foot on.

STOCK, a term signifying any sort of crop or other farm property.

Farming-Stock, that which relates to the farm, comprehending implements, produce, cattle, &c.

Live-Stock, that which comprehends all sorts of domestic animals. See *Live Stock*.

STOCKING, an improper practice with cow-jobbers, or dealers, consisting in obliging the cows to suffer the pains of retention, twenty-four or sometimes forty-eight hours, previous to sale, in order that they may have a great *shew* of milk in the udder. Such buyers however, as know any thing of cattle, are fully aware of the custom, and consequently avoid the deception. The idea of any knowledge of the animal being obtained in this way is highly ridiculous; as there are other better rules of judging, and which are familiar to every experienced stock farmer. Many cows get inflamed and even indurated udders by such means.

Stocking *up*, to grub up or eradicate any thing, as trees, hedges, &c.

STODGED, provincially filled to the stretch, as the udder of a cow by milk.

STOMBLE, provincially to trample or poach, as a wet soil.

STOMACHICS, in *Farriery*, are such medicines as are beneficial to the stomach, or act principally upon it.

STONDLE, the provincial name of a bearing tub.

STONE, a hard solid body, neither malleable, fusible by fire, or soluble in water, formed by succession of time in the bowels of the earth. It is a point not yet determined whether stones are hurtful or beneficial to arable lands. Examples are not wanting on both sides of the question; though in general, it seems rather to be carried for them. However nothing can excuse leaving a stone in any ground so large as to interrupt the plough. If they are very large, they should be blown to pieces with gun-powder, and then be carried off. Some spots very fertile in several kinds of grain, seem to consist of nothing but stones; and instances are given of fields being rendered barren by taking away the stones which covered them. Theophrastus accounted for this in a hot country, where it happened to the Corinthians, by saying that the stones sheltered the earth from the scorching heat of the sun, and thereby preserved its moisture. The same holds true even in our colder latitude, where the heat of the sun is less apt to hurt us; and Evelyn is clearly of opinion that husbandmen rather impoverish, than improve those grounds which are almost covered with stones, especially where corn is sown, if they pick them off too minutely; because they thereby expose the land too much to the effects of heat and cold. Certain it is, that a moderate mixture of small gravel preserves the earth both warm and loose, and prevents too sudden exhalations. But it seems highly probable, that there must be some farther reason, beyond what has been yet assigned, for the benefit arising from the stones.

The concealed stones should be always removed from lands that are to be kept in the state of tillage, otherwise many accidents must happen in ploughing,

by the straining and breaking of the ploughs, and the destruction of other implements. See *Clearing of Land.*

And where the lands require under-draining, it may often be proper and beneficial, as well as a cheap method, to have the stones made use of and gathered from the ground, as by such means two objects may be accomplished at once. See *Draining of Land.*

STONE-*Weight*, a term applied to a certain quantity or weight of different commodities. Thus a stone of beef or other sort of meat in the London markets, is the quantity of eight pounds; but in Herefordshire, it is twelve pounds; and in the northern districts, fourteen and sixteen pounds. And a stone of wool, according to a statute made in the eleventh year of the reign of Henry VII. is to weigh fourteen pounds, but in some places it is more, in others less; as in Gloucestershire fifteen pounds, in Herefordshire twelve pounds. But among horsemen, a stone is always the weight of fourteen pounds.

STONE-BRASH, a term sometimes applied to a shivery sort of soil.

STONE-BREAK, the name of a perennial plant of the weed kind, common in pasture grounds. The root has a sharpish and aromatic taste. The stalks are round, streaked, and reddish towards the bottom. The leaves are smooth, of a dark green, and divided twice, into long, narrow, sharp segments. The foot-stalks are membranaceous at the base. The flowers grow in loose umbels; and of a pale yellow colour. The seeds are oval, streaked, and red at the top. It is a plant of the saxifrage kind, which has been supposed beneficial in meadow lands, as improving the qualities of cheese and butter.

STONE-*Picker*, an implement used for taking the stones out of the feet of horses.

STONE-*Pickers*, persons employed in picking stones from off the ground. In order to prevent the loss of time in filling and emptying the baskets, and that of having recourse to the team, the use of one horse and a light cart is advised, which attending seven or eight women, boys and girls, may run over forty acres in about four days: four women at ten-pence is three shillings and four-pence, four boys or girls at six-pence, is two shillings. The man one shilling and eight-pence, the horse fifteen-pence, wear and tear nine-pence, together eight shillings a day; and for the four days is thirty shillings, for the forty acres, or nine-pence an acre for picking and carrying off. The pickers in this practice have nothing to do but fill their baskets; the cart and the man are always at hand to empty them, and a strong horse will draw a great many to the next hole, slough, or gate-way.

It is advised by Mr. A. Young, that "constantly in a dry season, an opportunity should be taken to stone-pick the grass and clover fields intended for mowing. In this work, no stones are, he says, however, to be taken, but such as would impede the scythe. It is often the case, he adds, that the pickers, who generally like this work, will over-pick if they are not attended to, and they will propose to pick fields which are not to be mown; but this is on no account to be permitted, if the stones be not much wanted. It has been often remarked, and is a known fact, that too much stone picking has done a very sensible mischief, in many cases where picked by authority of parliament for turnpike roads. And Mr. Macro, of Suffolk, ascertained it experimentally. "Having often thought that picking the stones off his turnip lands did more hurt than good, he tried an experiment last spring, by gathering up all the stones of one square rod, after the turnips were folded off, and laying them equally over another square rod by the side of it, then sowed them with barley, and marked them out, and at harvest time, collected them separately, as likewise another square rod at the side of them, which had only the natural quantity of stones:

	Qts.	Pints.		C.	B.	P.
Produce from the rod that had the double quantity of stones	6	1	or per acre,	8	0	2
Ditto, from that where the stones were gathered off - - -	6	0	ditto,	7	2	0
Ditto, from that in its natural state	6	½	ditto,	7		1

"From this single experiment, the result is in favour of the largest quantity of stones; and he verily believes it is quite wrong, after the sheep have trod out a great quantity of stones, in feeding off turnips, to have them raked up clean, which he has known some farmers to do, nor can the rakes be used without taking some of the tathe or dung along with them."

Observations have been made in other places, which clearly show that the stones should not be wholly picked off many sorts of land.

STONES *of a horse.* See *Testicles.*

STONE-*Wall*, a well known sort of fence. See *Fence.*

STONYHARD, the name of a plant of the weed kind, the corn grom-well.

STONY *Lands*, such as are full of flints, pebbles, or small fragments of free-stone. It is found that lands of this sort, in many places yield good crops, and the general rule is, that in stiff and cold lands the stones should be as carefully picked out as possible, but in light and dry grounds they should be left. These lands should however have the large stones removed as soon as possible. See *Clearing of Land.*

STOOK, a hattock. See *Hattock*.

STOOKING, the operation of setting up the sheaves into shocks in the field, to guard them from rain. It is sometimes written *shocking*. It was formerly the practice to set one sheaf upright, with the ears uppermost; and round that place a circle of many other sheaves, with their ears uppermost, inclining on the first sheaf, then to lay an horizontal circle of sheaves, with all the ears in the centre, and cover those ears with a loose sheaf or two. And thus placed, they are said to be protected from all wet. But a better mode is described below.

The method used in Yorkshire, as described by the Rev. Mr. Comber, is this; ten sheaves are disposed in two rows, each row leaning against the other: then two sheaves are laid on the top, so as to meet at the centre with their tails, and to slope downwards. In this mode the air has a free course, whether it bears against one or other end of the stook, or even against either side of it. Thus two weighty sheaves afford a good cover, and continue so, being hardly to be blown off by any wind, if carefully laid on: at least, not to be blown away but so as soon to be replaced. And the sloping position of the cap sheaves, neither exposes them to receive directly, nor to retain, or transmit the rain to the corn below, but to throw it off, especially as the tails of the sheaves, in which the straw is thickest and strongest, receive the most of the rain, which can do them little or no harm, and especially if they be thrust closely together. See *Harvesting*.

STOOL, provincially to ramify or tiller, as grain. It also signifies the bottom part of a tree, when the top has been cut off.

STOOMING *of Wine*, the putting of bags of herbs, or other ingredients into it to prevent fermentation. See *Wine* and *Cyder*.

STOOP, a post fixed in the earth, as a gate post, &c.

STOOR, a term signifying to rise up in clouds, as smoak, dust, fallen lime, &c.

STOPPING, in *Horsemanship*, the practice of filling the hollow of a horse's foot with poultice, cow-dung, or any other moist application. It has the effect of softening the sole, and, on some occasions, may be advantageous, though it is frequently misapplied, and of course does injury.

STOPS, a term provincially applied to small well buckets.

STORE-ROOM, a room or place for storing up different farm articles.

In some particular cases of farmers, it may be found necessary to store up some part of the produce of grain, &c. as meal roots, &c. in order to get a better price for it, or for preservation; they should therefore be provided with suitable store or meal rooms, as well as other conveniences. These rooms should be as dry as possible, and perfectly secure from vermin. An upper floor is the best for the first purpose, provided the articles can be conveniently and easily conveyed to it, which ought to be furnished with strong well-made chests, for holding the meal, or other articles, that may be put into them, and which, when meal, should be well rammed or pressed down, by means of a proper beetle, in order to make it keep sweet and well. But for the latter, vaults or cellars under ground are the most suitable, which should be provided with convenient modes of having them put in, and for protecting them against injury.

STORM, a term signifying a fall of snow.

STOT, a provincial term applied to a steer or young bullock.

STOVER, a general name for the different sorts of fodder arising from threshed grain, whether it be straw, chaff, or the short straws, such as ears and rough chaffy matter, separated by the rake or riddle from the corn in chaff after the straw has been removed by shaking from the floor.

STOVEN, a word that signifies a sapling shoot from the stool of a fallen tree.

STOUND, the name of a wooden vessel to put small beer in.

STOW, a term signifying to confine, as cattle or sheep, in a yard, fold, or pound.

STOWK, the handle of a pail: also a shock of twelve sheaves of grain.

STOWRE, a round of a ladder; a hedge stake; also the staves of the sides of a waggon, in which the eave rings are fastened. It also signifies a staff or round stick, such as a tuck or rack staff.

STRAIGHTENING *of Ridges*. See *Ridge*.

STRAIN, in *Farriery*, an over distension of the muscles, proceeding from slips, blows, or from hard riding. It may be observed that in all strains, the muscular or tendinous fibres are overstretched, and sometimes ruptured or broken. In order to form a true idea of these affections, it is necessary first to consider every muscle and tendon as composed of elastic fibres, which have a proper power of their own to contract and extend themselves; and that this function has been forcibly impaired.

It is evident that in all violent strains of either tendons or muscles, whatever opinion may have been entertained of bathing and anointing with favourite remedies, which often succeed in slight cases, where perhaps bandage alone would have answered; it is the latter, with proper resting the relaxed fibres till they have thoroughly recovered their tone, that are chiefly to be depended on; and frequently some months are necessary for effecting the cure.

All such violent strains of the ligaments, which connect the bones together, especially those of the thigh, require time, and turning out to grass, to perfect a recovery. External applications can avail but little here; the parts affected lying too deep, and so surrounded with muscles that medicine cannot penetrate to them. The sooner in these cases the horse is turned out to grass, the better, as the gentle motion in the field will prevent the ligaments from thickening, and of course the joint itself from growing stiff; nor do we believe that firing, so commonly practised in this case, is of half the consequence as rest, and turning out for a considerable time, which is indeed always advised at the time the horse is fired. Where the shoulder is over-

strained, the horse does not put out the leg as the other; but, to prevent pain, sets the sound foot hardily on the ground to save the other, even though he be turned short on the lame side, which motion tries him the most of any. When trotted in hand, instead of pulling his leg forwards in a right line, he forms a circle with the lame leg; and when he stands in the stable, that leg is advanced before the other. In order to cure this lameness, he should first be bled, and the whole shoulder be well bathed three times a-day with hot verjuice, or vinegar; but if the lameness continue without swelling or inflammation, after resting two or three days, it has been recommended that the muscles be well rubbed for some time with opodeldoc, or the embrocations mentioned below:

Take of Camphorated spirit of wine, two ounces;
Oil of turpentine, one ounce.
Mix them well together.

By giving this proportion, the hair will be prevented from coming off.

Or a better form is probably found in the following.

Take of the best vinegar, half a pint;
Spirit of vitriol,
Camphorated spirit of wine, of each two ounces.
Mix them well together.

In cases where the shoulder is very much swelled, it should be fomented with woollen cloths (large enough to cover the whole) wrung out of hot verjuice or vinegar.

And it has been found that a rowel in the point of the shoulder in this case does great service, especially if the strain has been very violent, and the swelling very large; but the *boring* up the shoulder with a hot iron, and afterwards inflating it, pegging up the sound foot, and the setting on a patten shoe, to bring the lame shoulder on a stretch, are most absurd, cruel, and preposterous practices, tending directly to render horses incurably lame; as it can only be necessary in cases the very opposite to this, where the muscles have been long contracted, and they are wanted to be stretched out. In those cases when the parts are in a state of inflammation, as where the accident is recent, poultices, if they can be applied, are very effectual, after bathing with hot vinegar, or verjuice. These are greatly preferable to cold charges, which, by drying soon on the part, keep it stiff and uneasy. They should be prepared with linseed oat-meal, rye-flour, or bran boiled up in vinegar, strong beer, or red-wine lees, with just lard enough to prevent their growing stiff. When by these means, the inflammation and swelling are brought down, the part may be bathed twice a day with either of the above mixtures, opodeldoc, or camphorated spirits of wine; and well rolled three or four inches both above and below with a strong linen roller, of about two fingers width, which will contribute not a little to the recovery, by bracing and supporting the relaxed parts.

In cases of strains of the coffin-joint, which have not been discovered in time, such a stiffness in the joint takes place that the horse only just touches the ground with his toe, the joint not being capable of being played with the hand. The only remedy here is repeated blistering, and then firing superficially. But for strains in the back-sinew, see *Back-Sinew*.

Where the knee and fetlock are affected, it is advised by Mr. Denny to "take away three or four pints of blood from the plate vein; and that for the first three or four days the only necessary application is a cold Goulard poultice, sufficiently large to cover the limb from the knee to the hoof. This may be secured by a fillet attached to the bag, and passing over the shoulder. Goulard's water may be frequently added to the poultice. Or, instead of the poultice, a flannel roller may be applied around the leg, and kept constantly moistened with the following embrocation:

Take of Crude sal ammoniac, two ounces;
Common vinegar, one pint;
Water, two quarts;
Extract of lead, two ounces;
Mix them well together.

"When the inflammation is removed," he thinks, "the parts may be strengthened with camphorated embrocation. Walking exercise should be allowed, and increased as the animal recovers. And should any swelling remain, after the lameness is removed, the cure may be completed, by applying a mild blister, and repeating it, if necessary.

"Strains of the hinder extremities are, of course, to be treated in the same manner."

STRAND, a term applied to a kennel or occasional rill caused by rain. It is a sort of shore.

STRANGLES, in *Farriery*, is a disease that chiefly affects colts and young horses, when they catch inveterate colds; as horses are seldom subject to the strangles after six years old. Gibson however speaks of horses that had this distemper at seven and eight, and sometimes at nine or ten, though these instances, he observes, are not very common. This disease is said to resemble the small-pox in this, that it never seizes horses oftener than once; whereas many other distempers, proceeding from common causes and accidents, will return as often as there are the proper causes to produce them. But however that be, it is probable that the strangles is a critical swelling, which when it suppurates and breaks, discharges something obnoxious to the constitutions of young horses, as they are usually rendered more healthy than they were before.

It begins with a swelling between the jaw-bones, sometimes pretty low among the muscles of the tongue, attended with great heat, pain, and inflammation, sometimes to such a degree, that a horse is scarcely able to swallow till the tumour suppurates. It is observed that many colts have the strangles at grass, and the tumour comes to maturity and breaks, yielding a very plentiful discharge, without any other help than what nature affords; though in some cases there is very great malignity, with a purulent running at the nose, which is often dangerous. Those

colts, however, that escape the strangles at grass, are liable, for the most part, to be seized when they are first taken up and put to business; and we often observe the change of diet, an alteration in the air, &c. bring on the strangles. Other causes may be, their catching cold, shedding their teeth, or whatever may induce pain, or bring on irritation at any critical time upon the throat and jaws. When the strangles are coming upon a horse, he feels unusually hot, and sometimes very feverish, with a painful cough; some go quite off their stomachs, others are only dainty, or eat and drink with pain in chewing and swallowing. When the swelling begins on the inside of the jaw-bone, it is much longer in coming to maturity than when it begins more towards the middle. When the skin is tight and much stretched over the swelling, and that feels unusually dry and hot, the swelling will in that case be large before it breaks, and yield a plentiful discharge. When the swelling of the strangles rises between the jaw-bones, under the middle of the tongue, it is always the most favourable; but if it rises upwards among the glands, and is divided into several little tumours, it is not so kindly, but is apt to break in several places and at different times before it sinks, which renders the case more tedious and troublesome.

In cases where the strangles begin directly in the upper part of the throat, towards the head of the wind-pipe and gullet, it hinders a horse sometimes from swallowing for several days, until the tumour grows full and large on the outside. This degree of the strangles is not altogether without danger of a suffocation. The pressure made upon the head of the wind-pipe makes the horse's eyes look fixed, as if he was convulsed, with his nose turned outwards, and his nostrils open for want of breath; which symptom continues till the tumour, growing ripe, breaks and runs off. But the worst and most dangerous kind of strangles is, when at the same time that a horse is swelled under the jaws, he runs also at the nose, which Gibson attributes either to some constitutional malignity or to bad management; and this is what some call the false or bastard strangles.

It is a disease that seldom proves dangerous, unless the efforts of nature are interrupted. It is observed by Gibson, that doing much in this case is worse than doing too little, for the strangles seldom needs any other help than to assist suppuration, by keeping the swelling always moist with camphorated hog's lard. Some however use poultices to the strangles: but besides the trouble of applying them, and renewing them often, they frequently prove hurtful, by being composed of materials that are too stimulating, as turpentine, &c. Besides, if the poultices are not kept close, they are apt to chill the part, and to repel rather than promote a discharge of the humours, and this often leaves a dry and obstinate cough, or endangers the horse's eyes. Another error in the cure of the strangles, is opening the tumour before it comes to maturity, which defeats the purpose of nature, for there are found, in that case, callous swellings under the throat, with a gleeting ulcer, sometimes followed by a plentiful running at the nose, which, without very great care, will end in the glanders. Of this Gibson says he has seen several instances. Therefore if the strangles proves kindly, and without uncommon symptoms, he insists there is no need of any other application, besides keeping the part continually moist with some lenient ointment till the tumour breaks and discharges itself, which for the most part happens in about five or six days. Some farriers are apt to open the tumours, or widen the orifice with tents; but this is altogether unnecessary, and often injurious, for nature does the business here effectually, unless the formation of matter has been hindered by some improper application.

When the disease begins with great pain and inflammation, as sometimes happens; if the horse's eyes are fixed, and he look convulsed; his neck much swoln, and his jaws stiff, with his nose turned outwards; it is necessary to take away a sufficient quantity of blood, to foment and apply a bran poultice to the part, covering it with a thin woollen cloth; and this should be persevered in till it comes to maturity and breaks. Sometimes the inflammation is so great as to destroy the skin that incloses the matter, by which means it falls off in pieces, like an eschar made by a caustic, and exposes the interstices of the muscles, and contiguous glands. But here also nature will effect a cure, without any other help, besides what has been already recommended; for the cavity is soon filled by a new growth of flesh, and covered with skin and hair, as perfect as at first. Sometimes the strangles break inwardly, and the matter is discharged chiefly by the mouth; and when it is so, the horse's mouth may be washed once or twice a-day, with equal parts of brandy and vinegar, with a spoonful of honey to each pint. This, with warm soft diet, will perfect the cure without any other help, and the swelling on the outside will soon wear off. But in particular cases, where there is little swelling and inflammation, the horse will eat and drink without pain; and though there be a collection of matter, yet when it is small, it sometimes continues long without breaking. When matter is formed in this way, and felt by gentle pressure with the finger, it is recommended by Mr. Denny to open the tumour with a lancet in the most depending part, as this prevents any ulceration of the skin. If the tumour has been very large, he advises that a seton should be introduced, to support the discharge till the cavity be filled up, after which it is to be withdrawn. And where the animal does not recover his strength, but becomes weaker, with the continuance of a fetid discharge from the nose, accompanied with a cough and difficult respiration, the following mixture should, he says, be given every four hours, until an alteration takes place:

Take of Peruvian bark, in powder, half an ounce;
Liquorice root, sliced,

Aniseeds,
Coriander seeds, bruised, of each one ounce;
Water, two quarts.

Boil them for ten minutes; then strain, and add, of
Tincture of opium, two drachms;
Honey, two ounces. Mix.

And as soon as the danger is removed, to discontinue the mixture, and give the following ball every morning and night, with mashes of malt or oatmeal, and bran, to recruit the strength:

Take of Peruvian bark, half an ounce;
Myrrh, in powder, two drachms;
Gentian,
Aniseeds, of each half an ounce;
Honey, enough to make them into a ball.

Also, that the horse must have gentle walking exercise, and good grooming, daily; and after his strength is returned, a dose of mild mercurial physic will be proper.

When the discharge is very large, thin and watery, with considerable emaciation, advantage is said to have been derived from the use of decoctions of guaiacum.

STRANGURY, in *Farriery*, a disease consisting of a partial suppression of urine, but at the same time unaccompanied by fever, or other general symptoms. It is the effect of irritation, occasioning a spasmodic contraction about the neck of the bladder. According to Mr. Denny the following treatment is proper in this case.

In the first place "if much irritation prevails, he advises to take away four or five pints of blood, and then to give the following ball and mixture:

Take of Camphor, in powder, two drachms;
Nitre, in powder,
Common soap, of each half an ounce;
Balsam of capivi, enough to make a ball.

Take of Gum arabic, in powder, two ounces;
Tincture of opium, half an ounce;
Simple peppermint water, two pints.

Dissolve the gum first in the mint water, and then add the tincture of opium.

It is further, advised to repeat this in the course of six or eight hours, if necessary; taking the precaution of clearing the bowels with the following clyster:

Take of Tincture of opium, two drachms;
Oatmeal gruel, three quarts;
Common salt, four ounces;
Olive oil, half a pint. Mix.

And, that the horse's food should consist of bran mashes, warm water, or gruel. The cure may also be promoted by applying fomentations of chamomile flowers to the perinæum."

It is recommended by Gibson, where the stoppage of urine proceeds from matter in the bladder, derived from the kidneys, which happens in some colds, or after some kinds of fevers, to give a decoction made with the roots of marsh-mallows, to which he adds nitre, gum arabic, &c. He adds that he never observed any stoppages that were insurmountable, either in the neck of the bladder or urethra in horses, as is usual in men, from gritty matter, stones, or ulcers, which last, he says, very rarely happens.

STRAPS *of a Saddle*, in *Horsemanship*, are small leather straps, nailed to the bows of it, by which the girths are made fast to the saddle.

STRAW, the stalk or stem on which grain grows, and from which it is threshed.

This is an article of cattle food, which requires some management in order to consume it to the greatest advantage, and with the most economy. In employing it for store cattle or other stock, it should constantly be made use of when threshed out, as by keeping it gets musty, and not by any means eaten so well or completely by cattle; in this view the threshing out large quantities at a time by the threshing machine, and stacking, or putting it up in other ways, is unfavourable to the perfect consumption of the fodder, and the thriving of the farm-stock. There is likewise another point necessary to be regarded in respect to the consumption of this article as fodder, which is that the inferior sorts should be first had recourse to, and afterwards those of the better kind. And in giving it, too much should not be placed before the animals at once.

It has been observed by Mr. Marshall in his Rural Economy of Yorkshire, that straw, of every kind, is bound upon the threshing floor. This when, straw is not used at the time of threshing, would, he says, in any country be good economy. Straw in trusses is much better to move, lies in less room, and retains its flavour longer, than loose straw does. In a country where cattle in winter are universally kept in the house and foddered at stated meal times, the binding of straw becomes, he thinks, essential to good management. Each truss, provincially, "—*fold*,"—contains an armful, as much as the arms can conveniently "*fold*;" and this is the usual meal for a pair of cattle. Thus the business of "foddering" is facilitated, and a waste of straw avoided.

And it has been remarked by Mr. Young, "that if the cattle are fed with straw, it should be done with attention. The best farmers in Norfolk are generally agreed, he says, that cattle should eat no straw, unless it be cut into chaff mixed with hay; but on the contrary, that they should be fed with something better, and have the straw thrown under them, to be trodden into dung: and he is much inclined to believe, that in most, if not in all cases, this maxim will prove a just one. The common cases of straw-feeding are, of cows, young cattle, or black cattle just brought in, and not yet put to fatting. With regard to cows, the food is certainly, he thinks, insufficient, and lets them down so much in flesh, that when they calve, and are expected to yield productively, they lose a considerable time, and that, perhaps, the most valuable, in getting again into flesh, before they give their usual quantity of milk; but if

they have been well and sufficiently wintered, they are half summered, and yield at once adequately." And that "for young cattle, it is still worse management; for their growth is stunted, and they never recover it." It is his opinion, that "black cattle from poor mountains had better be put to straw than any other stock; but here again care must be taken that the system be not deranged by it. If well fed, and the beasts be not large, they may be cleared off between harvest and the end of November; but if they are wintered on straw, this may not be effected, and the farmer may be forced to put himself to the expense of corn or oil-cake, to feed beasts not of a size to pay well enough for those articles. The evil is less if he has plenty of turnip or cabbage, but for these he may have other applications. In so far as regards the quality of the farm-yard dung, all this reasoning becomes still more forcible; for from straw-fed cattle, the farmer will, at the end of winter, find perhaps a large heap, of so poor a quality, that it will go but a little way in manuring his fields; whereas, one load of dung made by fat or well fed cattle, will be equal to two or three" of such as have been fed poorly.

But cut chaff, one half hay and the other half straw, answers very well, especially with some sort of succulent food.

And it has been stated by the author of the Synopsis of Husbandry, that "bean-straw, if well harvested, forms a very hearty and nutritious diet for cattle in the winter time, and both oxen and horses, when not worked, will thrive upon it: sheep also are very fond of browzing upon the pods, and the caving is a very nutritious manger meat." And Mr. Young suggests the great importance of putting beans in early and reaping soon enough, as the straw, well harvested, is worth from 2 to 3*l.* per acre; and that Mr. Arbuthnot's teams, which were always hard worked, never had a truss of hay while the bean-straw lasted.

It has been stated by Mr. Marshall, that he "met with an idea that cattle may be satiated with straw; or, in other words, may be served with it in too great plenty. It has been observed, that after a dry summer, when straw is scarce and the cattle have it dealt out to them regularly, they do better than when, after a plentiful year, it is thrown before them in profusion from the thrashing floor, not through the superior quality of the straw in a scarce year; as these effects have been observed to be produced from the same straw. This subject is by no means uninteresting to those who winter large quantities of cattle: he has observed in Yorkshire, where cattle are kept tied up and of course are regularly fed, that they in general do better at straw, than cattle in the south of England, where they go loose among a much greater plenty; but, whether it proceed from the warmth, from their resting better, from the breed of cattle, or from their being regularly fed and *eating with an appetite*, he will not pretend to decide."

Where this sort of fodder can be wholly consumed by the store stock, it is probably a better method to make use of it in that way, than by littering the yards with it, as the manure is without doubt much superior, and other articles, such as fern, &c. may in many cases be provided as litter.

The quantity of manure where an abundance of straw is at command, that may be raised by littering animals that are feeding and fattening in the stalls or yards, especially where much green food is used, is however very great, and often of vast importance to the farmer, as has been stated in considering the means of stall-fattening animals. See *Stall-Feeding*.

STRAWBERRY-*Trefoil*. See *Trefoil*.

STRAW-*Cutter*, the person or implement by which straw is cut into chaff. See *Chaff-cutter*.

STRAW-*House*, the place for piling up straw. These are very convenient in most situations, but where the practice of stacking straw prevails, not so essentially necessary as under other circumstances; but to have some place or other in which a small quantity can be deposited for the daily supply of different animals, is useful, as by this means, much time, as well as straw, will be saved, and there will be much less dirt and litter about the yard. Where the custom of stacking is in use, these houses may be applied to the purpose of store rooms for roots and other vegetables used as cattle food.

STRAW-*Twisting-Machine*, a contrivance for twisting straw into ropes for the purpose of underdraining. It is seen at *fig.* 12 in *Plate* XXII. in Vol. I. See *Draining Straw-Twisting Machine*.

STRAW-*Yard*, the yard into which straw is thrown in threshing. Also the yard in which cattle are fed, with straw or other similar matters.

STRAWT, a term signifying the dock of a horse without the hair; also the tail of slaughtered cattle or sheep where the skin is removed.

STREET *Dung*, the mixture of animal and vegetable matters sweeped up from the streets of large towns, which is found to be excellent as a manure. See *Manure*.

STREWING *of Peas*, a method of sowing, in which furrows are made to strew the peas by hand, and the usual measure is about three bushels to an acre. They should be strewn about six weeks after Christmas, and the furrows be made about sixteen inches apart; but this must be regulated according to the soil. See *Peas*.

STRICKLE, a provincial term applied to the wooden contrivance placed upon the extremity of the shaft of the scythe for whetting it with.

STRICKLESS, the tool by which the bushel is stricken.

STRIKE, a bushel or four pecks of grain.

STRING-HALT, in *Farriery*, an involuntary and convulsive motion of the muscles, which extend or bend the hough. When it seizes the outside muscles, the horse straddles, and throws his legs outwards; but when the inside muscles are affected, his legs are twitched up to his belly. Sometimes, it is only in one leg; sometimes in both. It generally proceeds from some strain or blow, and the cure is difficult, and seldom attended with success; though, in the beginning, a string-halt may be removed with good rubbing and the use of fomentations, with daily

but moderate exercise. The last refuge is usually the fire, which Gibson says has been known to answer at least so far as to prevent absolute lameness in some cases.

STRIP, a term signifying to drain the last milk from cows.

STRIPPINGS, a word made use of to signify the last milk of cows, or the strokings.

STROLL, provincially a narrow slip of land.

STRONG-*Room*, a secure small room fitted up about the farm-house for the purpose of laying up various farm articles in. See *Store Room*.

STROYL, couch, or other weeds; or the roots of weeds either harrowed or raked up on the land.

STRUM, a term signifying the hose used in brewing, &c. to keep the tap free.

STUB, a term signifying to grub up the stumps of trees, shrubs, brushwood, &c.

Stub. in *Farriery*, a splinter of fresh cut underwood, that gets into a horse's foot, as he goes, and, piercing the sole through the quick, becomes more or less dangerous, according as it sinks more or less into the sensible parts.

STUBBLE, the cut stalks or stems of grain left in the field after reaping. The stubble should in all cases be collected either for the purpose of thatch or as litter. The proper time for cutting the wheat and rye stubbles, is September, when Mr. Young advises "their being raked into heaps, for carting home to the farm-yard for litter, upon the same principle as fern is carted there. This is a business strangely neglected in most parts of the kingdom; but is nevertheless of great importance: the stubble left on the land is not of much advantage as a manure; it prevents the plough from turning in the land with neatness, and a crop does not succeed soon enough to feed upon it; but, carted into the farm-yard, it becomes an excellent manure. Any sort of litter there is valuable, and serves for the cattle treading into dung. In those parts of the kingdom where this use of stubble is common, the price for cutting and raking into heaps is from 2*s*. 6*d*. to 3*s*. 6*d*. per acre; a very small expense, compared with the great advantages that undoubtedly result from it."

Stubble-*Rake*. See *Rake*.

Stubble-*Turnips*. See *Turnip*.

STUBWOOD, such wood as grows in hedge-rows, and does not properly come under the names of timbers, pollards or thorns, or the young wood that is cut from stubs or stools. It is observed by Mr. Marshall that the harvesting of this, as of timber, depends on situation and other circumstances. And that the age or size of cutting must ever be guided by the demand in a given district;—whether it be for *cord wood*, *hop poles*, *hoops*, *stakes*, *faggot-wood*, or other ware. And further, that the mode of disposal is to be determined upon by the succeeding crop. If the land be intended to be appropriated wholly to coppice woods, it is generally the most eligible to dispose of the crop as it stands;—by one of the modes enumerated for selling timber. But if seedling plants are to be set out for timber stands, or the young shoots from the stubs to be trained up in the grove manner, it is requisite that a proprietor should employ his own people, in reaping the crop and making it up into such wares as are most saleable and profitable in the particular situations. In regard to the cutting down coppice woods, the main observances are, to cut them in season, to take off the stems clean and smooth, with upward strokes of the axe, that the stubs may shoot with the greater certainty; and to cut them off as low as conveniency will allow, in order that the shoots may be few and vigorous in their growth.

STUD, in *Horsemanship*, the place where stallions and mares are kept to propagate, &c. It signifies the stallions and breeding mares themselves. Also the horses kept in a stable. See *Stallion*, &c.

STULP, a provincial word, signifying a post of any kind.

STUM, must, whose fermentation has been prevented or prematurely suppressed by fumigation with sulphur or other similar substance.

STUMBLING, in *Horsemanship*, is the fault of tripping in horses, which occurs either naturally or accidentally. The fore-legs of a stumbling horse are too straight, so that he is not able to use them with proper freedom. To shoe a horse which stumbles is a nice point, as he must be shod quite contrary to those which tread only upon the toes of their hind-feet; for his toe must be taken down very much, and also shortened it, that he may not meet so easily with impediments and stones upon the roads. This is, however, far from affording any certain relief.

STUMMING, a provincial term signifying the *fuming* a cask with burning sulphur, and is thus performed.

According to Mr. Croker, take a strip of canvas cloth, about 12 inches long and two broad, let it be dipped into melted brimstone; when this match is dry, let it be lighted and suspended from the bung of a cask, in which there are a few gallons of liquor, until it be burnt out: the cask must remain stopped for an hour or more, and then rolled to and fro, to incorporate the fumes of the match with the liquor, after which it may be filled. When stumming is designed only to surpress some slight, improper fermentation, the brimstone match is quite sufficient. See *Cyder*.

STUMP, provincially a post, as a gate stump.

Stump, the root part of any solid body, particularly of trees, &c. remaining after the rest are taken away.

Where the roots are very large, and obstinately tenacious, it has been advised to blow them up with gunpowder. See *Blasting*.

STUMPY, full of stumps; hard, stiff.

STUNTED, a term signifying set in the growth; as by bad keep, &c.

STUPE, in *Farriery*, a hot decoction of herbs; the same as fomentation.

STURDY, in *Farriery*, a name for the staggers, especially in sheep. See *Staggers*.

STURK, a young bullock, an heifer.

STURKS, yearling cattle.

STYPTICS, in *Farriery*, such remedies as by their astringent qualities, stop hæmorrhages and violent bleedings. There are several medicines applied with this intention, but one of the most celebrated preparations for this purpose, is that sold under the name of Colebatch's styptic powder, which is thus prepared:

Take any quantity of the filings of iron;
Pour upon them spirit of salt, to the height of three or four fingers.
Let them stand until the fermentation is over, and the spirit of salt is become sweet; then pour off what is liquid, and evaporate in an iron or glass vessel, until half is consumed; at which time put to it an equal quantity of saccharum saturni (*cerussa acetata*), and evaporate to a dry powder, which is to be close kept from the air.

It is found to have great power in stopping hæmorrhages of blood, from wounds or ruptured vessels, by applying it only to the part, and keeping it afterwards covered. There are other styptics of inferior power, such as alum, vitriolated metals, as iron, copper, zinc, &c. and some gums, as kino, &c.

SUB-PLOUGH, the practice of running a share through or below the soil without turning it.

SUB-DRAINING. See *Under-draining*.

SUBETING, the letting to an under tenant.

SUB-SOIL, the under stratum of earth or other materials on which the cultivated soil is deposited. See *Soil*.

SUCCESSION, the order in which crops or what occupies the soils, whether arable lays or fallows succeed each other in.

Succession-*Crops*, such as are put in so as to come in succession.

SUCCORY, a term applied to wild endive. It is recommended as a fodder plant for cattle, but more particularly for sheep and cows, being equal if not superior to many others. See *Chicory*.

SUCCULENT, a term signifying juicy, moist.

SUCKER, a term signifying a young twig, or shoot from the root of a plant.

SUCKLING, the art of fattening by means of milk. It also signifies a sort of white clover. See *Suckling of Lambs*.

Suckling-*Calves*. See *Calf-suckling*.

SUDORIFICS, in *Farriery*, such remedies as excite sweating.

SUFFLATION. See *Blown* and *Hoved*.

SUFFOLK-GRASS, a name given to meadow-grass. See *Poa*.

SUIT and SERVICE, a sort of ancient feudal custom of freehold and copyhold courts, formerly in general performed in kind, and which were of two kinds, viz. *free* or *military*, and other services appendant to the tenant in *free socage*; or, in other words, the holder or owner of lands in *fee simple* of inheritance, anciently *bokland*, or *bookland*, that is lands held by written charter or deed, now called freehold. These services being considered as in some degree honorary and certain, were commuted by an easy payment, under various denominations, such as *quit-rents*, *fee-farm rents*, *castle-guard rents*, &c. &c. which it is not in the power of the lord of the manor to increase. The other kind, viz. mean or base services appendant to the tenant in *villain socage*, or the holder or owner of lands, by copy of the *court roll*, at the will of the lord of the manor, and, according to the custom of the same, anciently called folkland, now copyhold. According to a writer in the Farmer's Magazine, "these services consisted in cultivating the domain of the lord of the manor, and many other laborious operations, which being more important and substantial, were of greater value, and of course commuted, by payment of annual-rents of much greater amount, and by fines, certain and uncertain, to be paid by the vassal or copyholder, who consequently is in a situation at this day much inferior to that of the freeholder, whose payments are small and certain. These annual-rents, or payments, are in some copyhold manors doubtfully imposed, and fines are levied at the end of a term of years, which, in certain situations, are so high, as to render the security of property expended in improvement of various kind, very dubious. These fines have an indefinite prospect on any future value the estate may possibly arrive to, by improvements, however extensive or lucrative, to the great discouragement of such improvements: in short, they are such as, with the suit and service, &c. usually exacted, leave the copyholder in circumstances little removed from the state of absolute vassalage. The heritors of Durham, and some other parts of the country, are, in some sort, of this description; where the lord of the manor seizes, for his own use, the best horse, bull, or cow, or other beast, which he can find on the premises at the demise of the holder. Under this disagreeable tenure, are also levied fines on death, or alienation, of various kinds and degrees; all which, with the burdensome forms of some of the courts, the incidental expences of various kinds, and the extortions of the attorney stewards, who are continually racking their brains to invent pretences for increasing their fees, &c. together with the very galling idea and sense, in the mind of the holder, of the debasing nature of this species of dependence,—form a burden and grievance on the subject, loudly calling for the interference of any legislature which has a sincere intention of acting on principles indissolubly connected with the public welfare. It were idle to insist on any objection to a general alienation, by law, of all rights or claims of this nature, by which every body would be gainers, and nobody losers: for it is the duty of individuals to do this voluntarily, as much as in them lies: and if individuals refuse, it is the bounden duty of the legislature, on a general scale, to do any thing, and every thing in its power, towards the removal of grievances which may and ought to be removed, and to which nothing can be objected, but the pride and caprice of a few individuals; justice being no further concerned than in pecuniary compensation. The Crown has lately set a high

example, by the sale of many, if not most of its claims of this nature, at a fixed and moderate rate; an example which it is very desirable may be enforced on all inferior lords, who indeed themselves, it must be presumed, in fact and law, hold only of the crown."

SULL, a term applied to a plough. See *Plough.*

SULLAGE, a term applied to a drain of filth, or the dirt cleaned up from the streets.

SULLPADDLE, a term applied to a plough-paddle.

SULPHATE, a salt formed by the combination of the sulphuric acid with different alkaline, earthy, and metallic bases. There are several; some of which are found useful in promoting vegetation.

SULPHATE *of Ammoniac*, the saline substance termed vitriolic ammoniac, and which is very soluble, and promotes vegetation; but it is not to be had in such quantities as to render it an article of importance to agriculture, according to lord Dundonald.

SULPHATE *of Iron*, is a saline substance, formed naturally in many places in great abundance, according to lord Dundonald, by the process of oxygenation, from sulphureous or pyriteous substances. "These matters are generally found accompanying the coal strata, as well as in coal itself; particularly in such coals as are sulphureous. This salt is very soluble in water, and is in a high degree injurious to vegetation, when it abounds in soils consisting of poor clay and siliceous matter, without any admixture of vegetable or calcareous substances.—It is decomposed by alkaline salts, forming therewith vitriolated tartar, Glauber salts, vitriolic ammoniac, gypsum, and Epsom salt. When added to soils containing calcareous matter, and a due proportion of animal and vegetable substances, it has been found, when not used in too great quantities, to have produced beneficial effects in promoting the growth of grass; but experiments have not as yet been made fully to ascertain its effects on arable land."

Some very interesting observations have been lately made on this substance, as contained in peat of Tingrith moor, Bedfordshire, by Dr. George Pearson, in a communication presented to the Board of Agriculture. It is stated in answer to several queries put by him, to J. W. Willaume, Esq. that "in answering them, he shall divide the subject into three articles, 1st, the peat considered as an object of fuel; 2d, the ashes; 3d, the salt of peat, or dust; the two last as objects of manure.

"1. *Peat.* The peat which is found after the removal of the turf or exterior surface, to about a spade's depth, has long been known as an article of fuel. It is, however, used only by cottagers, who burn it on a brick hearth; it has been rejected from the parlour, the kitchen, the brewhouse, &c. as being injurious to grates, and to all sorts of vessels put on it; it cannot be employed in the roasting of meat, as it will impart a disagreeable taste, and it is destructive of all sorts of furniture by the effluvia which it emits, or by the dust or ashes which may chance to be blown from it. If these disagreeable consequences could be obviated, it might be made an article of general consumption as a substitute for coal, much to the advantage of the seller and consumer; it is dug out in the form of a brick to a certain depth, well known to the common labourer. This depth must be carefully attended to, lest you should cut out the staple, in which case it could never be retrieved; but this circumstance attended to, it will grow again to its former state in the space of fifteen years. Thus the whole moor is divided into proper portions and periodically cut once in fifteen years.

"2. *Ashes.* The turf or surface, and such parts of the peat as do not appear to be of the best quality, are laid up in considerable heaps, and reduced to ashes by the action of fire. *The ashes are red.*

"*Answer to Queries.* 1. The ashes have been long known as a manure, and the demand is on the increase.

"2. The quantity usually laid on an acre, by spreading or sowing it, is fifty bushels, either on grass or arable land.

"3. It is laid on hot land. By hot land, we understand sandy, gravelly, chalky soils of a dry nature, such as are burnt up on the long continuance of hot weather. It is most commonly used for grasses; but is in considerable esteem as a manure, for oats or barley on land of the nature abovementioned.

"4. The vegetable effect is surprising, inasmuch as it will double or treble a crop of any new sown grass, such as trefoil, &c. He has seen the benefits arising from it on old pasture land much overgrown with moss, which it effectually destroys, and produces in its stead white or Dutch clover. You may trace to an inch the cessation and recommencement of this manure. It is observable, that near the fire heaps, as far as the wind can carry the lighter parts of the ashes, the production of clover is sure to be abundant; it is equally favourable to the growth of barley or oats.

"5. It is not mixed with lime or any other manure.

"6. These ashes are bought by a set of higlers, who carry them in bags loaded on asses to a considerable distance, where they are known to be in great repute; they must come excessively dear to the consumer by this mode of conveyance. The farmers in the vicinity send for them in waggons, particularly Mr. Brumiger, near Sundon in Bedfordshire, a considerable and intelligent farmer, who increases his consumption every year, both for his grass and arable land."

3. *The Salt of Peat, or Dust.*—"1. The dust or gray saline substance is produced by beating the earth containing this salt, to a powder; it is found in particular spots, not universally, the earth not being equally impregnated with it in all places; it has not been known as a manure above six years; but on trial greatly increases in reputation and demand.

"2. Fifty bushels are the proper quantity per acre. This should not be exceeded, for if it be laid on in too great abundance, it may prove extremely deleterious.

"3. It is used for cold lands. By cold lands we understand clayey, or any wet grounds.

"4. It will much improve the vegetation of sowed grasses, and old pasture, and is equally favourable to the production of corn; the ground, whether grass or arable, being of a cold nature.

"5. It is not mixed with lime, or any other substance.

"6. The dust is likewise bought by the higlers, and carried to great distances. The nearer farmers likewise send for the dust in waggons, particularly Mr. Anstie, of Dunstable Houghton, and Mr. Smith, of Sundon, who hold this manure in great esteem."

The following are the experiments, observations, and remarks, of Dr. Pearson on the substance called *Salt of Peat*, or *Dust*,

"1. It is a blackish gray, coarse, and rather heavy powder. Has no smell; taste strongly styptic; readily dissolves in the mouth; did not deliquesce on exposure to the air.

"2. Dissolves in four times its weight of water of the temperature of sixty degrees of Fahrenheit, and in twice its weight of boiling hot water, giving a pale green coloured solution, with a trifling sediment, which is insoluble in muriatic acid.

"3. To the solution (2) he added a little liquid prussiate of vegetable alkali in a perfectly neutral state, which occasioned immediately a most abundant precipitation of prussiate of iron; and this test was added gradually, till no further precipitation took place.

"4. Into the decanted and filtrated fluid (3) was poured liquid caustic volatile alkali, but without inducing any change.

"5. Into the same fluid (3) was poured liquid carbonate of vegetable alkali, which produced a scarcely perceivable cloudy appearance.

"6. Into the solution (3) was dropped the aqueous solution of muriate of baryt, which occasioned immediately a milky appearance.

"7. To the solution (3) he added the oxalic acid, and turbidness ensued.

"8. A little of the powdery substance, called the salt of peat, with concentrated sulphuric acid, produced no emissions of fumes, nor smell.

"9. The solution (2) with muriate of baryt, immediately grew thick and white as cream.

"10. The solution (2) with carbonate of potash, deposited a very copious greenish sediment; and the same effect ensued with caustic volatile alkali.

"11. The solution (2) with oxalic acid, gave instantly a very turbid bluish green precipitation.

"The preceding experiments, he says, manifest that the peat salt consists of sulphate of iron, vulgarly called green vitriol of iron, mixed with a very minute proportion of siliceous earth, and of lime united either to sulphuric acid, or to carbonate acid. But the presence of the earths, magnesia and argil; the uncombined alkalies; the uncombined acids; are by these experiments excluded. In short, the salt of peat is almost pure sulphate of iron.

"*Remarks.* 1. The salt of peat is, he apprehends, deposited by evaporations which run over the moors, where it is found; and hence he should expect many of such waters to be strongly impregnated with it, and in many parts the soil to be tinged red and yellow by ochre. Very likely on enquiry much iron pyrites will be found on, or near the moors."

"This is," says Mr. Willaume, "exactly the fact. This sulphate of iron, the salt of peat, during the heat of the summer is frequently found in a crystalized state, very white, and crackling under the feet; but is deliquescent in that form, and turns to its former dark colour when the air become moist." —Note by Mr. J. W. Willaume.

"2. The quantity spread on land is said to be fifty bushels per acre, which he estimates at 2,250 pounds avoirdupoise: this will give near seven ounces and a half per square yard. If a larger quantity be applied, it is observed it will prove extremely deleterious. This is true also of every other manure, such as lime, alkaline salts, marine salts, nay, of the dung of animals: for if they be used in certain quantities, they poison plants, instead of promoting their growth. This is equally true in the animal kingdom; for there is not an article taken as food, or as seasoning, which is not a poison, if taken in certain quantities. A human creature may be poisoned or alimented by beef or pudding, according to the quantity of them taken into the stomach. He may be poisoned, or have digestion greatly assisted by salt, or pepper, according to their quantity. In brief, the vulgar notion of the term poison is erroneous: for by it is conceived that substances so called are in their nature positively destructive of life; but the truth is, that the most virulent poisons are, in all reason and fact, only deleterious according to the quantity applied. White arsenic swallowed in the quantity of ten grains or less, will destroy life; but in the quantity of one-sixteenth of a grain, it is as harmless as a glass of wine; and further, in that dose is a remedy for inveterate agues." It is concluded from these considerations, "that there is no admissible contradictory evidence to the testimonies for the fertilizing effect of sulphate of iron, unless by such contravening evidence the quantity stated to be used exceed fifty bushels per acre; it being an established fact that in certain proportions this metallic salt is a poison to plants."

It is supposed that "this discovery will give new light so as to explain fully the *rationale* of the improvement of land by the burnt earth and ashes from paring and burning. It is usual to account for the effects of this process, by referring to supposed alkaline or other salts; but of these there is no evidence, nay, on trial he has not detected them, or at least not in any efficient quantity; but this he knows that such earth and ashes contain oxide of iron, and as he suspects of manganese; which from the analysis, and the effect of salt of peat, must now be admitted into the class of manures. This communication of

Mr. Willaume, affords evidence, he says, of the truth of this conjecture, for the ashes of the peat which affords the salt "have been long known as a manure, and the demand is on the increase:" of course, these ashes contain an unusual quantity of oxide of iron. A consequence of this reasoning is, that the burnt earth of soils will, he supposes, *cæteris paribus*, fertilize in proportion to the oxide of iron it contains. Accordingly the ashes of the peat, says Mr. Willaume, have a surprising effect, they "will double or treble a crop of any new-sown grass, such as trefoil, &c.;" they are so beneficial, that in spite of the expence they are carried in bags by higlers to great distances. The doctor concludes by "asserting, that the more he contemplates the facts in Mr. Willaume's letter, the more evidence he perceives for the truth, that metallic salts, and metallic oxides in general, and salts and oxides of iron in particular, are manures, if applied in proper doses." He is desirous that it may be understood, that he considers the *salt of peat*, and the *ashes of peat*, as operating in promoting vegetation analogous to seasoning, or condiments, taken with the food of animals; that is, analogous to mustard, cinnamon, ginger, &c. which are not of themselves at all or necessarily nutritious, but contribute to render other things nutritious, by exciting the action of the stomach and other organs of digestion and assimilation. He has no doubt of the truth of the proposition, that no living thing, neither plant nor animal, can grow and live in a state of visible action without constant supplies of matter which has been alive; in other words, living animals and vegetables can only live on dead animals and dead vegetables. No plant, nor animal has ever been known by experience, nor in the nature of things does it seem reasonable, that they can be nourished by mere water and pure air, as some persons have asserted."

On the other two substances the doctor thus remarks: "2. *The Peat.* It is a dense mass of vegetable matter for a certain depth, partly in a dead and partly in a living state, with which is mixed more or less earth, and in burning it affords so much empyreumatic oil, as to give a disagreeable taste to roasted provisions; hence, as we are told, it has been rejected from the kitchen. This fuel affords a vast quantity of what the chemists call lignic acid; hence it is rejected also from the parlour, as very destructive to the grates. He begs to suggest that this lignic acid might be saved in burning the peat as fuel, and be used for various purposes in manufactures; and the charred peat may be used in place of charcoal of wood. Probably too other useful products will be found, on examining the matters more accurately which are afforded by distillation.

"3. *Ashes.* If the peat were mere vegetable matter, the ashes afforded by it would be as trifling as those of wood; but some parts of the moor contain so much earth and oxide of iron, as to leave behind, on burning, a considerable quantity of incombustible matter; and such kind of peat, we are told, is not used as fuel; but, after burning, the residuary matter is an efficacous manure, much more so than is commonly afforded by paring and burning. The ashes are more red and more fertilizing than ashes of common turf, because they contain more iron.

"The spontaneous springing up of white clover, in land manured with these ashes, is similar to the spontaneous growth of this plant on heath land, which has been covered with lime to destroy all its present vegetation; and this fact shows that probably these are seeds buried in the earth for many ages, which yet remain alive, but do not grow until exposed to the stimuli of air, water, caloric, and lifeless animal, or vegetable matter."

And other facts discovered by respectable chemists are added which "serve to shew that other salts, besides sulphate of iron and certain earths, may be employed advantageously as manures, although like iron they have been esteemed deleterious to plants.

"1. Ashes of pit coal are a good manure for grass. It is stated in the fifth volume of Nicholson's Journal, that "his much valued friend, the Rev. Wm. Gregor of Grampound, on examination of the ashes of coal from Liverpool, found them to contain both sulphate of magnesia and sulphate of lime, especially the former, salt. He apprehends that these ashes also contain oxide of iron, or perhaps sulphate of iron. These ashes, says Mr. Gregor, '*skeaded*' over grass apparently produced good effects, notwithstanding the sulphate of magnesia, which he was well assured they contained."

On this it is remarked, that "from this observation of Mr. Gregor, it seems he is aware of the prevailing popular opinion, that sulphate of magnesia is not favourable to vegetation; and to reconcile his fact with the unfriendly nature of magnesia to plants, as discovered by Mr. Tennant, he observes that the effects of sulphate of magnesia may be very different from those of magnesia and carbonate of magnesia. He apprehends it is the magnesia (calcined magnesia) only which this learned chemist found hurtful to vegetables, as the discovery was made on the examination of Nottingly lime, which the farmers near Doncaster employ as a manure, while they reject the lime of their own neighbourhood. In the latter Mr. Tennant met with magnesia, and in the former none. See *Lime.*

"2. The earth from ashes called cinis, is a durable and efficacious manure. It is observed that Professor Mitchill, of New York, in a letter addressed to Dr. Pearson on cinis, or earth found in the ashes of wood, has remarked that the "ashes of wood contain very commonly sulphate of potash, also phosphoric acid, besides other well known salts; but after these salts are separated by lixiviation, there remains a peculiar earth, and a small proportion of iron. This earth differs from lime, baryt, magnesia, strontian, or any other known species of earth. He would call it cinis, for plentiful, common and important as it is, science has not dignified it with a name. To judge of the excellence of this earth as a manure,

after all the salts are extracted from soap boilers' ashes, the earth sells for ten cents the bushel, and notwithstanding this high price, it is not unusual for the farmer to pay for the article twelve months beforehand. When ploughed into sterile ground, at twelve loads per acre, it produces great crops of wheat, clover, and other sorts of grass and grain, and its fertilizing operation will last twenty years. Although some of the other ingredients of the ashes left after lixiviation may prove beneficial, yet the effects are chiefly from the cinis, or new named earth.

"This earth, which is so prized in America as a manure, was esteemed of old in Asia, as an ingredient in a cement: among the ancient Syrians, it was one of the materials forming the plaster of their walls; and as it holds an intermediate place between lime and potash, it can easily be conceived how it may act both as a cement and a manure. It is to be hoped chemists will turn their attention to this important subject." See Tilloch's Philos. Magazine, Vol. VII. p. 273.

"4. Sulphate of iron in the peat of Russia. This was found by Professor Robinson. And it is observed that "something else besides vegetable matter is necessary to form peat or black moss of the moors. The smell of burning peat is different from that of vegetable matter. Peat ashes, says the Professor, always contain a very great proportion of iron; he has seen three places in Russia where there is superficial peat moss, and in all of them *the vitriol is so abundant as to effloresce.* In particular, on a moor near St. Petersburgh, the clods shew the vitriol (sulphate of iron) every morning when the dew has evaporated. According to this learned Professor's observations, the sulphate of iron in pit coal may be accounted for in the following manner: "peat mosses form very regular strata, lying indeed on the surface; but if any operation of nature should cover this with a deep load of other matter, it would be compressed and rendered very solid: and remaining for ages in that situation, might ripen into a substance very like pit coal. See the Medical and Chirurgical Review for November 1803."

5. Use of peat dust and peat ashes. In answer to a letter from Dr. Pearson requesting to know what experiments Mr. Anstey had made "from the turf dust, taken from Tingrith Moor; he affords the testimony of having made use of the ashes and dust near thirty years, and frequently laying on from eighty to a hundred bushels per acre. Our land, says he, is dry and very thin stapled, owing to the chalk rock lying so very near the surface; it encourages vegetation in moist warm weather; but when hot and dry, the reverse. We never mix any other manure with it. It costs about four-pence per bushel, including all expenses. We chiefly spread it over seed, grass, clover, &c."

Sulphate *of Lime*, a term employed by modern chemists to signify gypsum; which, according to Lord Dundonald, "exists in great abundance, in many soils. It is produced by the decomposition of aluminous schyst, containing a due proportion of calcareous matter; with which the sulphuric acid will join, as it is formed in preference to the earth of alum or clay. It is likewise formed by the decomposition of pyrites, in such soils as contain a sufficiency of calcareous matter for the sulphuric acid to combine with, in preference to the earth of iron, the other constituent part of pyrites: and it is found in immense quantities, constituting not only the soil, but the substratum, of some countries, to a great depth. It is to be decomposed by alkaline salts; the sulphuric acid forming with them sulphate of potash and sulphate of soda, according to the alkali used. It is a salt very insoluble, requiring upwards of five hundred times its weight of water to dissolve it: hence supposing it equally deleterious to vegetation, as alum hath been considered, which is soluble in only fifteen times its weight of water, it must, he says, prove less injurious, from its greater degree of insolubility: but gypsum, far from being hurtful to vegetation, when applied to certain soils, promotes vegetation in a very high degree, as is evinced by the use of it in some parts of the continent of Europe and of America; and is further proved by the chemical analysis of vegetables, whose ashes are found to contain a certain portion of the component parts of gypsum." The particular explanation of its mode of acting on soils suited to it may be seen under the heads Gypsum and Vitriolic Acid. See *Vitriolic Acid* and *Gypsum*.

Sulphate *of Magnesia*: this is a saline substance usually known by the name of Epsom salt: according to Lord Dundonald, it is not to be found in such abundance as alum or gypsum: it is contained in sea water, and is to be procured in great quantities by decomposing the muriat of magnesia, or the bitter refuse liquor of salt works, by the means of the vitriolic acid. Native Epsom salt is sometimes to be met with in the mineral strata, mixed with clay and siliceous matter. It is formed in soils containing aluminous schyst, or pyrites, and a due proportion of the earth of magnesia: in which case, on the decomposition of the schyst, or pyrites, the vitriolic acid so formed, will, by superior affinity, join with the magnesia, and form Epsom salt, in preference to the argillaceous or ferruginous matter of the above-mentioned substances. It is very soluble, dissolivng in in about twice its weight of cold water. It is decomposed by lime and alkalis, forming therewith gypsum, vitriolated tartar, Glauber salt, or vitriolic ammoniac. By Dr. Home's experiments, it has been found in a very high degree to promote vegetation. He states, that it made the garden mould he used for his experiments produce one fourth more grain."

Sulphate *of Potash*, the saline substance usually known by the title of *vitriolated tartar*; which, according to Lord Dundonald, "is soluble in fifteen times its weight of cold water, and has been found by Dr. Home to promote vegetation in an extraordinary manner. The garden mould on which his experiments were made produced an increase of one-fourth more grain, in consequence of the application of this salt. It is to be had from most vegetable matters by com-

bustion; it forms at least one-third of the saline matter obtained by the lixiviation of their ashes. This is sufficient, *a priori*, to prove, (independently of Dr. Home's very satisfactory experiments) that vitriolated tartar is beneficial to vegetation. This substance is a refuse article in some branches of manufacture; but the quantity produced is a mere trifle, in comparison to the quantity that might advantageously be applied to the purposes of agriculture."

SULPHATE *of Soda*, the saline substance known by the title of Glauber's salt, and which is soluble in about two and one half times its weight of cold water, according to Lord Dundonald. "From experiments, it has been proved to promote vegetation in a very high degree. It is procured in small quantities, in the processes for making the muriatic acid, and muriat of ammoniac, or sal ammoniac. The high price at present of this article precludes the use of it; but could it be made and sold at a cheap rate, it would, he thinks, prove a most valuable acquisition to agriculture."

SUMMER, the season in which the sun arises at the northern solstice, and when the days are at the greatest length.

SUMMER, the name of the large piece of timber, or principal beam of a floor.

SUMMER-*Colt*, a provincial term applied to the undulating state of the air seen in a hot calm day near the surface of the ground, appearing to rise as from hot embers, in which case it is said the *summer colt* rides.

SUMMER-*Eat*, a provincial word signifying to make use of as a pasture.

SUMMER-*Fallow*, a naked fallow. See *Fallowing of Land.*

SUMMER-*Land*, the fallowing of land in the summer.

SUMMER-*Stir*, another word applied to the same.

SUMMILY, a term provincially signifying a turnip fallow, autumn or naked fallow.

SUN-SCORCHED, a term applied to plants or trees injured by the sun.

SUNDER, a provincial term signifying to air and expose to the sun and wind, as hay that has been cocked up without being fully dry, and is respread out.

SUPPRESSION *of Urine*, in *Farriery*, a term used for the stoppage of the urine, or any other discharge. See *Strangury.*

SUPPURATION, in *Farriery*, a term signifying the ripening or change of the matter of a tumour into pus, which may be effected either by natural means, or the use of artificial compositions, by way of plasters, cataplasms, or the like. See *Abscess.*

SURBATING, in *Farriery*, is a term used to signify when the sole is worn out, bruised, or spoiled by any accident, as by bad shoeing, especially when the shoes lie flat on the feet; or when the horse goes too long bare-foot; as also, by travelling on hard roads, or among dry hot sand in hot weather, which dries the hoof, whereby the sole, becoming hard, presses upon the soft parts beneath it. If a horse be surbated by bad shoeing, the part that is affected, may be known by the thinness of the shoe, where it presses most; and therefore it ought to be pared deepest in that part, before another is put on: but if the shoe is not in the fault, it may be known that he is surbated by his continual hitching and moving; but by feeling his hoofs, you may observe them both very hot and dry. According to Gibson, the cure is very easy, before it becomes attended with other accidents, and may be performed only by stopping up the feet with cows' dung and vinegar. Some use only hogs' grease, hot, thickened with bran; and others make use of vinegar and soot boiled together: but nothing will be more efficacious, in case it be troublesome, than first softening the sole with the application of unctuous things, and after that pouring a mixture of warm pitch and tar upon the sole of the foot.

SURFACE, the superficial parts of the ground.

SURFACE-*Drain.* See *Drain.*

SURFEIT, in *Farriery*, a disease incident to horses and other cattle. It arises from various causes; but is commonly the effect of some disease not attended to, or ill cured.

It is a term almost unknown to the modern farrier. Bracken says, "a surfeit is principally understood to be all such maladies or distempers as proceed from excessive and immoderate feeding, but especially upon unwholesome food, from cold and hard riding, &c. whereby a horse forsakes his meat, and is infected with hard swellings, which, if they happen to fall upon the joints, will in process of time occasion lameness and many other disorders. Surfeits arise, he says, from various causes, but are commonly the effects of some diseases not attended to; or that have been ill cured. A horse is said to be surfeited, when his coat stares and looks rusty and dirty, though proper means have not been wanting to keep him clean. The skin is full of scales and dander, that lie thick and mealy among the hair, and is constantly supplied with a fresh succession of the same, for want of due transpiration. Some horses have hurdles of various sizes, like peas or tares. Some have dry fixed scabs all over their limbs and bodies; others a moisture attended with heat and inflammation; the humours being so sharp, and violently itching, that the horses rub so incessantly, as to make themselves raw. Some have no eruption at all, but an unwholesome look, and are dull, sluggish, and lazy. Some appear only lean and hide-bound, others have flying pains and lameness, resembling a rheumatism; so that, in the surfeits of horses, we have almost all the different species of scurvy, and other chronical distempers."

In the dry species, Gibson advises "first to take away about three or four pounds of blood; and then to give the following mild purge, which will work as an alterative, and should be repeated once a-week or ten days, for some time:

Take of Succotrine aloes, six drachms, or one ounce;
Gum-guaiacum, half an ounce;
Diaphoretic antimony,
Myrrh, of each two drachms;
Make into a ball with syrup of buckthorn.

"And in the intermediate days, an ounce of the following powder should be given morning and evening in the feeds:

Take of Cinnabar of antimony, finely powdered, half a pound;
Crude antimony, in fine powder, four ounces;
Gum-guaiacum, also in powder, four ounces;
Make into sixteen doses, for eight days.

"It should be repeated till the horse's coat is well, and all the symptoms of surfeit disappear. If the horse is of small value, two or three common purges should be given; and half an ounce of antimony, with the same quantity of sulphur, twice a day; or alterative balls, with camphire and nitre." And where the little scabs on the skin do not peel off they should be anointed with mercurial ointment.

In regard to "the *wet surfeit*, it is a moist running eruption, appearing on different parts of the body of the horse, attended sometimes with great heat and inflammation; the neck sometimes swelling so in one night's time, that great quantities of hot briny humour issue forth, which if not allayed, will be apt to collect on the poll or withers, and produce the poll-evil or fistula. The disease also frequently attacks the limbs, where it proves obstinate and hard to cure, and in some horses shews itself in the spring and fall."

The cure may be attempted by bleeding, and the use of cooling laxative remedies, with an opening mild diet.

SURVEY, a peculiar sort of auction.

SURVEYING, the art, or act, of measuring land. This is a business of considerable importance to be well understood by the farmer and land owner, as it may save them much trouble and expense. The principles and practice of it have been laid down with much clearness and precision by Dr. Hutton in his valuable Mathematical and Philosophical Dictionary, by whose permission we are enabled to introduce it here.

He begins by observing that it "comprises the three following parts: viz. taking the dimensions of any tract or piece of ground; the delineating or laying the same down in a map or draught; and finding the superficial content or area of the same; beside the dividing and laying out of lands.

"The first of these is what is properly called *Surveying*; the second is called *plotting*, or *protracting*, or *mapping*; and the third *casting up*, or *computing the contents*."

And that "the first again consists of two parts, the making of observations for the angles, and the taking of lineal measures for the distances.

"The former of these is, he says, performed by some of the following instruments; the *theodolite*, *circumferentor*, *semicircle*, *plain-table*, or *compass*, or even by the *chain* itself: the latter is performed by means either of the *chain* or the *perambulator*."

"It is useful in surveying, he says, to take the angles which the bounding lines form with the magnetic needle, in order to check the angles of the figure, and to plot them conveniently afterwards. But, as the difference between the true and magnetic meridian perpetually varies in all places, and at all times; it is impossible to compare two surveys of the same place, taken at distant times, by magnetic instruments, without making due allowance for this variation."

"The second branch of surveying is performed by means of the protractor and plotting scale," as already suggested.

"If the lands in the survey are hilly and not in any one plane, the measured lines cannot be truly laid down on paper, till they are reduced to one plane, which must be the horizontal one, because angles are taken in that plane. And in this case, when observing distant objects, for their elevation or depression, the following table shows the links or parts to be subtracted from each chain in the hypothenusal line, when the angle is the corresponding number of degrees.

A TABLE *of the links to be subtracted out of every chain in hypothenusal lines, of several degrees of altitude or depression, for reducing them to horizontal.*

	links.		links.
4° 3′	¼	19° 57′	6
5 44	½	21 34	7
7 1	¾	23 4	8
8 7	1	24 30	9
11 29	2	24 50	10
14 4	3	27 8	11
16 16	4	28 22	12
18 12	5	29 32	13

"For example, if a station line measure 1250 links or 12½ chains, on an ascent, or a descent, of 11°; here it is after the rate of almost two links per chain, and it will be exact enough to take only the 12 chains at that rate, which make 24 links in all, to be deducted from 1250, which leaves 1226 links, for the length to be laid down."

It is observed that "practical surveyors say, it is best to make this deduction at the end of every chain-length while measuring, by drawing the chain forward every time as much as the deduction is; viz. in the present instance, drawing the chain on 2 links at each chain-length.

"The third branch of surveying, namely, computing or casting-up, is performed by reducing the several inclosures and divisions into triangles, trapeziums, and parallelograms, but especially the two former; then finding the areas or contents of these several figures, and adding them all together.

" *The Practice of Surveying.* 1. Land is measured with a chain called Gunter's chain, of 4 poles or 22 yards in length, which consists of 100 equal links, each link being $\frac{22}{100}$ of a yard, or $\frac{66}{100}$ of a foot, or 7·92 inches long, that is nearly 8 inches or $\frac{2}{3}$ of a foot.

" An acre of land is equal to 10 square chains, that is, 10 chains in length and 1 chain in breadth.

Or it is 40 × 4 or 160 square poles.
Or it is 220 × 22 or 4840 square yards.
Or it is 1000 × 100 or 100000 square links.

These being all the same quantity.

" Also an acre is divided into 4 parts called roods, and a rood into 40 parts called perches, which are square poles, or the square of a pole of $5\frac{1}{2}$ yards long, or the square of $\frac{1}{4}$ of a chain, or of 25 links, which is 625 square links. So that the divisions of land measure will be thus:

625 sq. links = 1 pole or perch
40 perches = 1 rood
4 roods = 1 acre

" The length of lines, measured with a chain, are set down in links as integers, every chain in length being 100 links; and not in chains and decimals. Therefore, after the content is found, it will be in square links; then cut off five of the figures on the right hand for decimals, and the rest will be acres. Those decimals are then multiplied by 4 for roods, and the decimals of these again by 40 for perches.

" *Ex.* Suppose the length of a rectangular piece of ground be 792 links, and its breadth 385: to find the area in acres, roods and perches.

```
  792
  385
 ----
 3960
6336
2376
 ----          ac. ro. p.
3,04920 Ans.   3   0  7
    4
 ----
 19680
    40
 ----
7·87200
 ----
```

" 2. Among the various instruments for surveying, the plain-table is the easiest and most generally useful, especially in crooked difficult places, as in a town among houses, &c. But although the plain-table be the most generally useful instrument, it is not *always* so; there being many cases in which sometimes one instrument is the properest, and sometimes another; nor is that surveyor master of his business who cannot in any case distinguish which is the fittest instrument or method, and use it accordingly: nay, sometimes no instrument at all, but barely the chain itself, is the best method, particularly in regular open fields lying together; and even when you are using the plain-table, it is often of advantage to measure such large open parts with the chain only, and from those measures lay them down upon the table.

" The perambulator is used for measuring roads, and other great distances on level ground, and by the sides of rivers. It has a wheel of $8\frac{1}{4}$ feet, or half a pole, in circumference, upon which the machine turns; and the distance measured is pointed out by an index, which is moved round by clock work.

" Levels, with telescopic or other sights, are used to find the level between place and place, or how much one place is higher or lower than another.

" An offset-staff is a very useful and necessary instrument, for measuring the offsets and other short distances. It is 10 links in length, being divided and marked at each of the 10 links.

" Ten small arrows, or rods of iron or wood, are used to mark the end of every chain-length, in measuring lines. And sometimes pickets, or staves with flags, are set up as marks or objects of direction.

" Various scales are also used in protracting and measuring on the plan or paper; such as plane scales, line of chords, protractor, compasses, reducing scales, parallel and perpendicular rulers, &c. Of plane scales, there should be several sizes, as a chain in 1 inch, a chain in $\frac{1}{4}$ of an inch, a chain in $\frac{1}{8}$ of an inch, &c. And of these, the best for use are those that are laid on the very edges of the ivory scale, to prick off distances by, without compasses.

" 3. *The Field Book.* In surveying with the plain-table, a field-book is not used, as every thing is drawn on the table immediately when it is measured. But in surveying with the theodolite, or any other instrument, some sort of a field-book must be used, to write down in it a register or account of all that is done and occurs relative to the survey in hand.

" This book every one contrives and rules as he thinks fittest for himself. The following is a specimen of a form that has formerly been much used. It is ruled into 3 columns: the middle, or principal column, is for the stations, angles, bearings, distances measured, &c.; and those on the right and left are for the offsets on the right and left, which are set against their corresponding distances in the middle column; as also for such remarks as may occur, and be proper to note for drawing the plan, &c.

" Here ⊙ is the first station, where the angle or bearing is 105 25'. On the left, at 73 links in the distance or principal line, is an offset of 92; and at 610 an offset of 24 to a cross hedge. On the right, at o, or the beginning, an offset 25 to the corner of the field; at 248 Brown's boundary hedge commences; at 610 an offset 35; and at 954, the end of the first line, the o denotes its terminating in the hedge. And so on for the other stations.

" Draw a line under the work, at the end of every station line, to prevent confusion.

Offsets and Remarks on the left.	Stations, Bearings, and Distances.	Offsets and Remarks on the right.
	⊙1	
	105°25′	
	00	25 corner
92	73	
	248	Brown's hedge
cross a hedge 24	610	35
	954	00
	⊙2	
–	53°10′	
	00	00
house corner 51	25	21
	120	29 a tree
34	734	40 a stile
	⊙ 3	
	67°20	
	61	35
a brook 30	248	
	639	16 a spring
foot path 16	810	
cross hedge 18	973	20 a pond

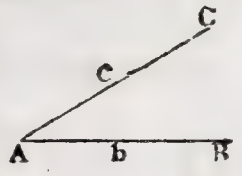
"But a few skilful surveyors now make use of a different method for the field book, namely, beginning at the bottom of the page and writing upwards, by which they sketch a neat boundary on either hand, as they pass it; an example of which will be given below, with the plan of the ground to accompany it.

"In smaller surveys and measurements, a very good way of setting down the work, is, to draw, by the eye, on a piece of paper, a figure resembling that which is to be measured; and so write the dimensions as they are found, against the corresponding parts of the figure. And this method may be practised to a considerable extent, even in the larger surveys.

"4. To measure a line on the ground with the chain: having provided a chain, with 10 small arrows, or rods, to stick one into the ground, as a mark, at the end of every chain: two persons take hold of the chain, one at each end of it, and all the ten arrows are taken by one of them who goes foremost, and is called the leader; the other being called the follower, for distinction's sake.

"A picket, or station staff, being set up in the direction of the line to be measured, if there do not appear some marks naturally in that direction; the follower stands at the beginning of the line, holding the ring at the end of the chain in his hand, while the leader drags forward the chain by the other end of it till it is stretched straight, and laid or held level, and the leader directed by the follower waving his hand to the right or left, till the follower see him exactly in a line with the mark or direction to be measured to; then both of them stretching the chain straight, and stooping and holding it level, the leader having the head of one of his arrows in the same hand by which he holds the end of the chain, he there sticks one of them down with it, while he holds the chain stretched. This done, he leaves the arrow in the ground, as a mark for the follower to come to, and advances another chain forward, being directed in his position by the follower standing at the arrow, as before; as also by himself now, and at every succeeding chain's length, by moving himself from side to side, till he brings the follower and the back mark into a line. Having then stretched the chain, and stuck down an arrow, as before, the follower takes up his arrow, and they advance again in the same manner another chain length. And thus they proceed till all the ten arrows are employed, and are in the hands of the follower; and the leader without an arrow, is arrived at the end of the 11th chain length. The follower then sends or brings the 10 arrows to the leader, who puts one of them down at the end of his chain, and advances with the chain as before. And thus the arrows are changed from the one to the other at every 10 chains length, till the whole line is finished; the number of changes of arrows shews the number of tens, to which the follower adds the arrows he holds in his hand, and the number of links of another chain over to the mark or end of the line. So if there have been 3 changes of the arrows, and the follower hold 6 arrows, and the end of the line cut off 45 links more, the whole length of the line is set down in links thus, 3645.

"5. *To take Angles and Bearings.* Let B and C be two objects, or two pickets set up perpendicular; and let it be required to take their bearings, or the angle formed between them at any station A.



"1*st. With the plain-table.* The table being covered with a paper, and fixed on its stand; plant it at the station A, and fix a fine pin, or a point of the compasses, in a proper part of the paper, to represent the point A: close by the side of this pin lay the fiducial edge of the index, and turn it about, still touching the pin, till one object B, can be seen through the sights: then by the fiducial edge of the index draw a line. In the very same manner draw another line in the direction of the other object C. And it is done.

"2*d. With the Theodolite, &c.* Direct the fixed sights along one of the lines, as A,B, by turning the instrument about till you see the mark B, through these sights; and there screw the instrument fast. Then turn the moveable index about till, through its sights, you see the other mark C. Then the degrees cut by the index, upon the graduated limb or

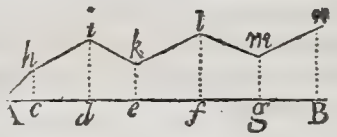
ring of the instrument, shew the quantity of the angle.

"*3d. With the Magnetic Needle and Compass.* Turn the instrument, or compass so, that the north end of the needle point to the fleur-de-luce. Then direct the sights to one mark, as B, and note the degrees cut by the needle. Then direct the sights to the other mark C, and note again the degrees cut by the needle. Then their sum or difference, as the case is, will give the quantity of the angle BAC.

"*4th. By measurement with the chain, &c.* Measure one chain length, or any other length, along both directions, as to b and c. Then measure the distance b c, and it is done.—This is easily transferred to paper, by making a triangle A b c with these three lengths, and then measuring the angle A as in Practical Geometry.

"6. *To measure the Offsets.* A h i k l m n being a crooked hedge, or river, &c. From A measure in a straight direction along the side of it to B. And in measuring along this line AB observe when you are directly opposite any bends or corners of the hedge, as at c, d, e, &c; and from thence measure the perpendicular offsets, ch, di, &c. with the offset-staff, if they are not very large, otherwise with the chain itself and the work is done. And the register, or field book, may be as follows:

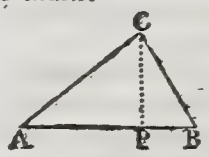
Offs. left.		Base line AB	
	o	⊙	A
c h	62	45	A c
d i	84	220	A d
e k	70	340	A e
f l	98	510	A f
g m	57	634	A g
B n	91	785	AB



"7. *To survey a triangular Field* ABC.

1st. By the chain.

AP	794
AB	1321
PC	826



"Having set up marks at the corners, which is to be done in all cases where there are not marks naturally; measure with the chain from A to P, where a perpendicular would fall from the angle C, and there measure from P to C; then complete the distance AB by measuring from P to B; setting down each of these measured distances. And thus having the base and perpendicular, the area from them is easily found. Or having the place P of the perpendicular, the triangle is easily constructed.

"Or, measure all the three sides with the chain, and note them down. From which the content is easily found, or the figure constructed.

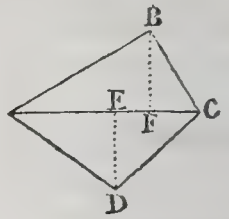
"*2d. By taking one or more of the Angles.*

"Measure two sides AB, AC, and the angle A between them. Or measure one side AB, and the two adjacent angles A and B. From either of these ways the figure is easily planned: then by measuring the perpendicular CP on the plan, and multiplying it by half AB, you have the content.

8. *To measure a Four-sided Field.*

1st. By the chain.

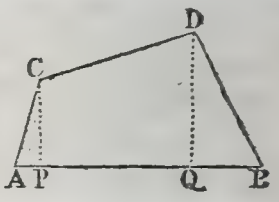
AE	214	210	DE
AF	362	306	BF
AC	592		



"Measure along either of the diagonals, as AC; and either the two perpendiculars, DE, BF, as in the last problem; or else the sides AB, BC, CD, DA. From either of which the figure may be planned and computed as before directed.

Otherwise by the chain.

AP	110	352	PC
AQ	74	595	QD
AB	1110		



"Measure on the longest side, the distances AP, AQ, AB; and the perpendiculars PC, QD.

"*2d. By taking one or more of the Angles.*

"Measure the diagonal AC (see the first fig. above), and the angles CAB, CAD, ACB, ACD.—Or measure the four sides, and any one of the angles, as BAD.

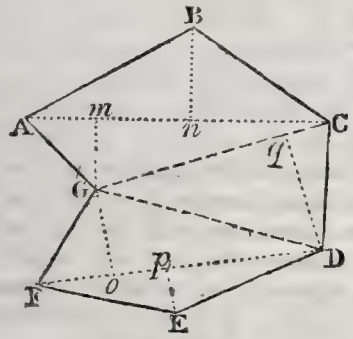
Thus			Or thus	
AC	591		AB	486
CAB	37°	20′	BC	394
CAD	41	15	CD	410
ACB	72	25	DA	462
ACD	54	40	BAD	78°35′

"9. *To survey any Field by the Chain only.*

"Having set up marks at the corners where necessary, of the proposed field ABCDEFG. Walk over the ground, and consider how it can best be di-

vided into triangles and trapeziums; and measure them separately as in the last two problems. And in this way it will be proper to divide it into as few separate triangles, and as many trapeziums as may be, by drawing diagonals from corner to corner: and so as that all the perpendiculars may fall within the figure. Thus the following figure is divided into the two trapeziums ABCG, GDEF, and the triangles GCD. Then, in the first, beginning at A, measure the diagonal AC, and the two perpendiculars Gm, Bn. Then the base GC and the perpendicular Dq. Lastly the diagonal DF, and the two perpendiculars pE, oG. All which measures write against the corresponding parts of a rough figure, drawn to resemble the figure to be surveyed, or set them down in any other form you choose.

Am 135	130	mG
An 410	180	nB
Ac 550		
Cq 152	230	qD
CG 440		
FO 206	120	oG
FP 288	80	pE
FD 520		



Or thus:

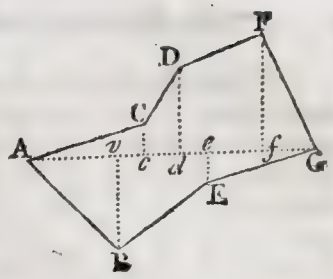
"Measure all the sides AB, BC, CD, DE, EF, FG, and GA; and the diagonals AC, CG, GD, DF.

"*Otherwise.* Many pieces of land may be very well surveyed, by measuring any base line, either within or without them, together with the perpendiculars let fall upon it from every corner of them. For they are by these means divided into several triangles and trapezoids, all whose parallel sides are perpendicular to the base line; and the sum of these triangles and trapeziums will be equal to the figure proposed if the base line fall within it; if not, the sum of the parts which are without being taken from the sum of the whole, which are both within and without, will leave the area of the figure proposed.

"In pieces that are not very large, it will be sufficiently exact to find the points, in the base line, where the several perpendiculars will fall, by means of the cross, and from thence measuring to the corners for the lengths of the perpendiculars.—And it will be most convenient to draw the line so as that all the perpendiculars may fall within the figure.

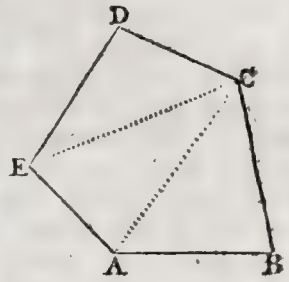
"Thus in the following figure, beginning at A, and measuring along the line AG, the distances and perpendiculars, on the right and left, are as below.

Ab	315	350	bB
Ac	440	70	cC
Ad	585	320	dD
Ae	610	50	eE
Af	990	470	fF
AG	1020	0	



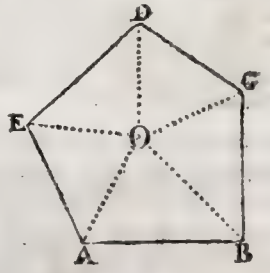
"10. *To survey any Field with the Plain Table.*

"1*st. From one Station.*



"Plant the table at any angle, as C, from whence all the other angles, or marks set up, can be seen; and turn the table about till the needle point to the flower-de-luce, and there screw it fast. Make a point for C on the paper on the table, and lay the edge of the index to C, turning it about there till through the sights you see the mark D; and by the edge of the index draw a dry or obscure line: then measure the distance CD, and lay that distance down on the line CD. Then turn the index about the point C, till the mark E be seen through the sights, by which draw a line; and measure the distance to E, laying it on the line from C to E. In like manner determine the positions of C A and CB, by turning the sights successively to A and B; and lay the lengths of those lines down. Then connect the points with the boundaries of the field, by drawing the black lines CD, DE, EA, AB, BC.

"2*d. From a Station within the Field.*



"When all the other parts cannot be seen from one angle, choose some place O within; or even without, if more convenient, from whence the other parts can be seen. plant the table at O, then fix it with the needle north, and mark the point O upon it. Apply the index successively to O, turning it round with the sights to each angle A, B, C, D, E, drawing dry lines to them by the edge of the index, measuring the distances OA, OB, &c, and laying them down upon those lines. Lastly draw the boundaries AB, BC, CD, DE, EA.

"3d. *By going round the Figure.*

"When the figure is a wood or water, or from some other obstruction you cannot measure lines across it; begin at any point A, and measure round it, either within or without the figure, and draw the directions of all the sides thus: Plant the table at A, turn it with the needle to the north or flower-de-luce, fix it and mark the point A. Apply the index to A, turning it till you can see the point E, there draw a line; and then the point B, and there draw a line: then measure these lines, and lay them down from A to E and B. Next move the table to B, lay the index along the line A B, and turn the table about till you can see the mark A and screw fast the table; in which position also the needle will again point to the flower-de-luce, as it will do indeed at every station when the table is in the right position. Here turn the index about B till through the sights you see the mark C; there draw a line, measure BC, and lay the distance upon that line after you have set down the table at C. Turn it then again into its proper position, and in like manner find the next line CD. And so on quite round by E to A again. Then the proof of the work will be the joining at A: for if the work is all right, the last direction EA on the ground, will pass exactly through the point A on the paper; and the measured distance will also reach exactly to A. If these do not coincide, or nearly so, some error has been committed, and the work must be examined over again.

"11. *To surrvey a Field with the Theodolite, &c.*

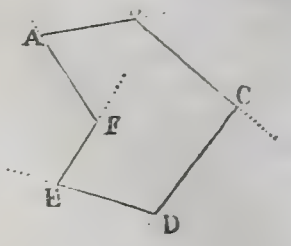
1*st. From one Point or Station.*

"When all the angles can be seen from one point, as the angle C (last fig. but one), place the instrument at C, and turn it about till, through the fixed sights, you see the mark B, and there fix it. Then turn the moveable index about till the mark A is seen through the sights, and note the degrees cut on the instrument. Next turn the index successively to E and D, noting the degrees cut off at each; which gives all the angles BCA, BCE, BCD. Lastly, measure the lines CB, CA, CE, CD; and enter the measures in a field-book, or rather against the corresponding parts of a rough figure drawn by guess to resemble the field.

"2d. *From a Point within or without.*

"Plant the instrument at O, (last fig.) and turn it about till the fixed sights point to any object, as A; and there screw it fast. Then turn the moveable index round till the sights point successively to the other points E, D, C, B, noting the degrees cut off at each of them; which gives all the angles round the point O. Lastly, measure the distances OA, OB, OC, OD, OE, noting them down as before, and the work is done.

3d. *By going round the Field.*



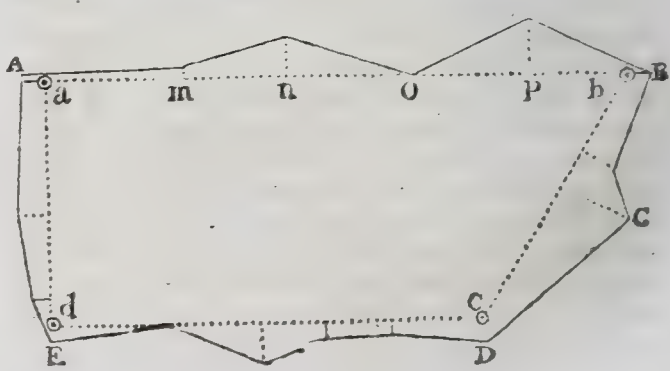
"By measuring round, either within or without the field, proceed thus. Having set up marks at B, C, &c. near the corners as usual, plant the instrument at any point A, and turn it till the fixed index be in the direction A B, and there screw it fast: then turn the moveable index to the direction A F, and the degrees cut off will be the angle A. Measure the line A B, and plant the instrument at B, and there in the same manner observe the angle A. Then measure B C, and observe the angle C. Then measure the distance C D, and take the angle D. Then measure D E, and take the angle E. Then measure E F, and take the angle F. And lastly measure the distance F A.

"To prove the work; add all the inward angles, A, B, C, &c. together, and when the work is right, their sum will be equal to twice as many right angles as the figure has sides, wanting 4 right angles. And when there is an angle, as F, that bends inwards, and you measure the external angle, which is less than two right angles, subtract it from 4 right angles, or 360 degrees, to give the internal angle greater than a semi-circle or 180 degrees.

"*Otherwise*, Instead of observing the internal angles, you may take the external angles, formed without the figure by producing the sides further out. And in this case, when the work is right, their sum all together will be equal to 360 degrees. But when one of them, as F, runs inwards, subtract it from the sum of the rest, to leave 360 degrees.

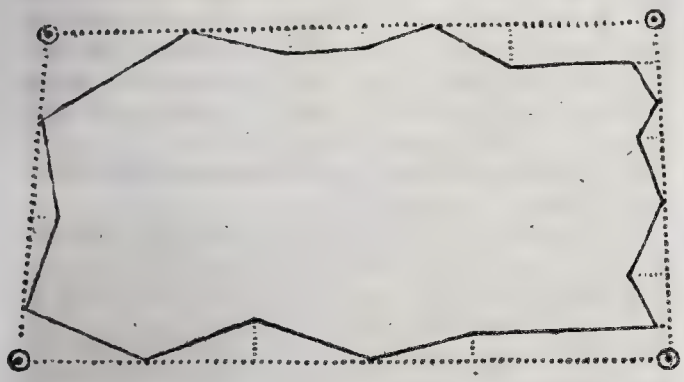
"12. *To survey a Field with crooked Hedges, &c.*

"With any of the instruments measure the lengths and positions of imaginary lines running as near the sides of the field as you can; and in going along them measure the offsets in the manner before taught; and you will have the plan on the paper in using the plain table, drawing the crooked hedges through the ends of the offsets: but in surveying with the theodolite, or other instrument, set down the measures properly in a field book, or memorandum-book, and plan them after returning from the field, by laying down all the lines and angles.



"So, in surveying the piece ABCDE, set up marks, *a*, *b*, *c*, *d*, dividing it into as few sides as may be. Then begin at any station *a*, and measure the lines *ab*, *bc*, *cd*, *da*, and take their positions, or the angles *a*, *b*, *c*, *d*; and in going along the lines measure all the offsets, as at *m*, *n*, *o*, *p*, &c. along every station line.

"And this is done either within the field, or without, as may be most convenient. When there are obstructions within, as wood, water, hills, &c; then measure without, as in the figure here below.

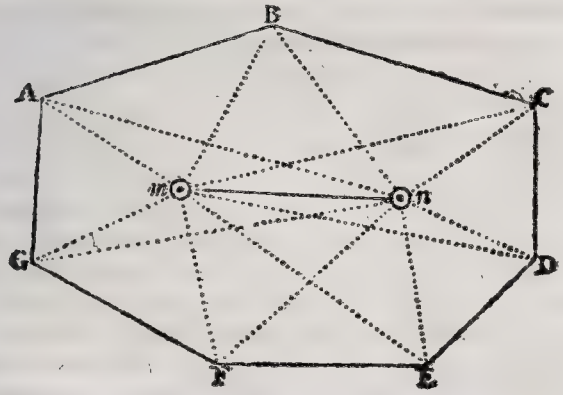


"13. *To Survey a Field or any other Thing by Two Stations.*

"This is performed by choosing two stations, from whence all the marks and objects can be seen, then measuring the distance between the stations, and at each station taking the angles formed by every object from the station line or distance.

"The two stations may be taken either within the bounds, or in one of the sides, or in the direction of two of the objects, or quite at a distance, and without the bounds of the objects, or part to be surveyed.

"In this manner, not only grounds may be surveyed without even entering them, but a map may be taken of the principal parts of a country, or the chief places of a town, or any part of a river or coast surveyed, or any other inaccessible objects; by taking two stations, on two towers, or two hills, or such like.



"When the plain table is used; plant it at one station *m*, draw a line *m n* on it, along which lay the edge of the index, and turn the table about till the sights point directly to the other station; and there screw it fast. Then turn the sights round *m* successively to all the objects ABC, &c, drawing a dry line by the edge of the index at each, as *m*A, *m*B, *m*C, &c. Then measure the distance to the other station, there plant the table, and lay that distance down on the station line from m to n. Next lay the index by the line *nm*, and turn the table about till the sights point to the other station *m*, and there screw it fast. Then direct the sights successively to all the objects A, B, C, &c. as before, drawing lines each time, as nA, *n*B, *n*C, &c: and their intersection with the former lines will give the places of all the objects, or corners, A, B, C, &c.

"When the theodolite, or any other instrument for taking angles, is used; proceed in the same way, measuring the station distance *mn*, planting the instrument first at one station, and then at another; then placing the fixed sights in the direction *mn*, and directing the moveable sights to every object, noting the degrees cut off each time. Then, these observations being planned, the intersections of the lines will give the objects as before.

"When all the objects, to be surveyed, cannot be seen from two stations; then three stations may be used, or four, or as many as is necessary; measuring always the distance from one station to another; placing the instrument in the same position at every station, by means described before; and from each station observing or setting every object that can be seen from it, by taking its direction or angular position, till every object be determined by the intersection of two or more lines of direction, the more the better. And thus may very extensive surveys be taken, as of large commons, rivers, coasts, countries, hilly grounds, and such like.

"14. *To Survey a Large Estate.*

"If the estate be very large, and contain a great number of fields, it cannot well be done by surveying all the fields singly, and then putting them together; nor can it be done by taking all the angles and boundaries that inclose it. For in these cases, any small errors will be so multiplied, as to render it very much distorted.

"1st. Walk over the estate two or three times, in order to get a perfect idea of it, and till you can carry the map of it tolerably in your head. And to help your memory, draw an eye draught of it on paper, or at least of the principal parts of it, to guide you.

"2d. Choose two or more eminent places in the estate, for your stations, from whence you can see all the principal parts of it: and let these stations be as far distant from one another as possible; as the fewer stations you have to command the whole, the more exact your work will be; and they will be fitter for your purpose, if these station lines be in or

near the boundaries of the ground, and especially if two or more lines proceed from one station.

" 3d. Take angles, between the stations, such as you think necessary, and measure the distances from station to station always in a right line; these things must be done, till you get as many angles and lines as are sufficient for determining all your points of station. And in measuring any of these station distances, mark accurately where these lines meet with any hedges, ditches, roads, lanes, paths, rivulets, &c. and where any remarkable object is placed, by measuring its distance from the station line; and where a perpendicular from it cuts that line; and always mind, in any of these observations, that you be in a right line, which you will know by taking backsight and foresight along your station line. And thus as you go along any main station line, take offsets to the ends of all hedges, and to any pond, house, mill, bridge, &c. omitting nothing that is remarkable. And all these things must be noted down; for these are your data, by which the places of such objects are to be determined upon your plan. And be sure to set marks up at the intersections of all hedges with the station line, that you may know where to measure from, when you come to survey these particular fields, which must immediately be done, as soon as you have measured that station line, whilst they are fresh in memory. In this way all your station lines are to be measured, and the situation of all places adjoining to them determined, which is the first grand point to be obtained. It will be proper for you to lay down your work upon paper every night, when you go home, that you may see how you go on.

" 4th. As to the inner parts of the estate, they must be determined in like manner, by new station lines: for, after the main stations are determined, and every thing adjoining to them, then the estate must be subdivided into two or three parts by new station lines: taking inner stations at proper places, where you can have the best view. Measure these station lines as you did the first, and all their intersections with hedges, and all offsets to such objects as appear. Then you may proceed to survey the adjoining fields by taking the angles that the sides make with the station line, at the intersections, and measuring the distances to each corner, from the intersections. For every station line will be a basis to all the future operations; the situation of all parts being entirely dependant upon them: and therefore they should be taken of as great a length as possible; and it is best for them to run along some of the hedges or boundaries of one or more fields, or to pass through some of their angles. All things being determined for these stations, you must take more inner ones, and so continue to divide and subdivide, till at last you come to single fields; repeating the same work for the inner stations, as for the outer ones, till all be done; and close the work as often as you can, and in as few lines as possible. And that you may choose stations the most conveniently, so as to cause the least labour, let the station lines run as far as you can along some hedges, and through as many corners of the fields, and other remarkable points, as you can. And take notice how one field lies by another; that you may not misplace them in the draught.

" 5th. An estate may be so situated, that the whole cannot be surveyed together; because one part of the estate cannot be seen from another. In this case, you may divide it into three or four parts, and survey the parts separately, as if they were lands belonging to different persons; and at last join them together.

" 6th. As it is necessary to protract or lay down your work as you proceed in it, you must have a scale of a due length to do it by. To get such a scale, you must measure the whole length of the estate in chains; then you must consider how many inches in length the map is to be; and from these you will know how many chains you must have in an inch; then make your scale, or choose one already made, accordingly.

" 7th. The trees in every hedge row must be placed in their proper situation, which is soon done by the plain table; but may be done by the eye without an instrument; and being thus taken by guess, in a rough draught, they will be exact enough, being only to look at; except it be such as are at any remarkable places, as at the ends of hedges, at stiles, gates, &c. and these must be measured. But all this need not be done till the draught is finished. And observe in all the hedges, what side the gutter or ditch is on, and consequently to whom the fences belong.

" 8th. When you have long stations, you ought to have a good instrument to take angles with; and the plain table may very properly be made use of, to take the several small internal parts, and such as cannot be taken from the main stations, as it is a very quick and ready instrument.

" 15 Instead of the foregoing method, an ingenious friend (Mr. Abraham Crocker,) after mentioning the new and improved method of keeping the field book by writing from bottom to top of the pages, observes, the Doctor says, that " in the former method of measuring a large estate, the accuracy of it depends on the correctness of the instruments used in taking the angles. To avoid the errors incident to such a multitude of angles, other methods have of late years been used by some few skilful surveyors; the most practical, expeditious, and correct, seems to be the following.

" As was advised in the foregoing method, so in this, choose two or more eminences, as grand stations, and measure a principal base line from one station to the other, noting every hedge, brook, or other remarkable object as you pass by it; measuring also such short perpendicular lines to such bends of hedges as may be near at hand. From the extremities of this base line, or from any convenient parts of the same, go off with other lines to some remarkable object situated towards the sides of the estate, without regarding the angles they make with the base line or with one another; still remembering to note every hedge, brook or other object that you pass by.

These lines, when laid down by intersections, will with the base line form a grand triangle upon the estate; several of which, if need be, being thus laid down, you may proceed to form other smaller triangles and trapezoids on the sides of the former: and so on, until you finish with the enclosures individually.

"To illustrate this excellent method, let us take A B (in the plan of an estate *fig.* 1, pl. XXXV.) for the principal base line. From B go off to the tree at C; noting down in the field book, every cross hedge as you measure on; and from C measure back to the first station at A, noting down every thing as before directed.

"This grand triangle being completed, and laid down on the rough plan paper, the parts, exterior as well as interior, are to be completed by smaller triangles and trapezoids.

"When the whole plan is laid down on paper, the contents of each field might be calculated by the methods laid down below, at article 20.

"In countries where the lands are enclosed with high hedges, and where many lanes pass through an estate, a theodolite may be used to advantage, in measuring the angles of such lands; by which means, a kind of skeleton of the estate may be obtained, and the lane-lines serve as the bases of such triangles and trapezoids as are necessary to fill up the interior parts."

"The method of measuring the other cross lines, offsets and interior parts and enclosures, appears, Dr. Hutton says, in the plan, *fig.* 1, last referred to.

16 "Another ingenious correspondent, he adds, (Mr. John Rodham of Richmond, Yorkshire) has also communicated the following example of the new method of surveying, accompanied by the field book, and its corresponding plan. His account of the method is as follows:

"The field book is ruled into three columns. In the middle one are set down the distances on the chain line, at which any mark, offset, or other observation is made; and in the right and left hand columns are entered the offsets and observations, made on the right and left hand respectively of the chain line.

"It is of great advantage, both for brevity and perspicuity, to begin at the bottom of the leaf and write upwards; denoting the crossing of fences, by lines drawn across the middle column, or only a part of such a line on the right and left opposite the figures, to avoid confusion, and the corners of fields, and other remarkable turns in the fences where offsets are taken to, by lines joining in the manner the fences do, as will be best seen by comparing the book with the plan annexed, *fig.* 2, pl. XXXV.

"The marks called *a*, *b*, *c*, &c. are best made in the fields, by making a small hole with a spade, and a chip or small bit of wood, with the particular letter upon it, may be put in, to prevent one mark being taken for another, on any return to it. But in general the name of a mark is very easily had by referring in the book to the line it was made in. After the small alphabet is gone through, the capitals may be next, the print letters afterwards, and so on, which answer the purpose of so many different letters; or the marks may be numbered.

"The letter in the left hand corner at the beginning of every line, is the mark or place measured from; and that at the right hand corner at the end, is the mark measured to: but when it is not convenient to go exactly from a mark, the place measured from, is described such a distance from one mark towards another; and where a mark is not measured to, the exact place is ascertained by saying, turn to the right or left hand, such a distance to such a mark, it being always understood that those distances are taken in the chain line.

The characters used, are, ⌐ for turn to the right hand, ¬ for turn to the left hand, and ∧ placed over an offset, to show that it is not taken at right angles with the chain line, but in the line with some straight fence; being chiefly used when crossing their directions, and is a better way of obtaining their true places than by offsets at right angles.

"When a line is measured, whose position is determined, either by former work (as in the case of producing a given line or measuring from one known place or mark to another) or by itself (as in the third side of a triangle) it is called a fast line, and a double line across the book is drawn at the conclusion of it; but if its position is not determined (as in the second side of a triangle) it is called a loose line, and a single line is drawn across the book. When a line becomes determined in position, and is afterwards continued, a double line half through the book is drawn.

"When a loose line is measured, it becomes absolutely necessary to measure some line that will determine its position. Thus, the first line *ah*, being the base of a triangle, is always determined; but the position of the second side *hj*, does not become determined, till the third side *jb* is measured; then the triangle may be constructed, and the position of both is determined.

"At the beginning of a line, to fix a loose line to the mark or place measured from, the sign of turning to the right or left hand must be added (as at *j* in the third line); otherwise a stranger, when laying down the work may as easily construct the triangle hjb on the wrong side of the line *ah*, as on the right one: but this error cannot be fallen into, if the sign above named be carefully observed.

"In choosing a line to fix a loose one, care must be taken that it does not make a very acute or obtuse angle; as in the triangle *p*B*r*, by the angle at B being very obtuse, a small deviation from truth, even the breadth of a point at *p* or *r*, would make the error at B when constructed very considerable; but by constructing the triangle *p*B*q*, such a deviation is of no consequence.

"Where the words *leave off* are written in the field book, it is to signify that the taking of offsets is from thence discontinued, and of course something is wanting between that and the next offset.

"The field-book above referred to, is engraved on plate XXXVI. in parts, representing so many pages, each of which is supposed to begin at the bottom and end at top. And the map or plan belonging to it, in fig. 2, pl. XXXV.

"17. *To Survey a County or large Tract of Land.*

"1st. Choose two, three, or four eminent places for stations: such as the tops of high hills or mountain, towers, or church steeples, which may be seen from one another; and from which most of the towns, and other places of note, may also be seen. And let them be as far distant from one another as possible. Upon these places raise beacons, or long poles, with flags of different colours flying at them; so as to be visible from all the other stations.

"2d. At all the places, which you would set down in the map, plant long poles with flags at them of several colours, to distinguish the places from one another; fixing them upon the tops of church steeples, or the tops of houses, or in centres of lesser towns.

"But you need not have these marks at many places at once, as suppose half a score at a time. For when the angles have been taken, at the two stations, to all these places, the marks may be moved to new ones; and so successively to all the places you want. These marks then being set up at a convenient number of places, and such as may be seen from both stations; go to one of these stations, and with an instrument to take angles, standing at that station, take all the angles between the other station, and each of these marks, observing which is blue, which red, &c, and which hand they lie on; and set all down with their colours. Then go to the other station, and take all the angles between the first station, and each of the former marks, and set them down with the others each against his fellow with the same colour. You may, if you can, also take the angles at some third station, which may serve to prove the work, if the three lines intersect in that point, where any mark stands. The marks must stand till the observations are finished at both stations, and then they must be taken down, and set up at fresh places. And the same operations must be performed, at both stations, for these fresh places; and the like for others. Your instrument for taking angles must be an exceeding good one, made on purpose with telescopic sights; and of three, four, or five feet radius. A circumferentor is reckoned a good instrument for this purpose.

"3d. And though it is not absolutely necessary to measure any distance, because a stationary line being laid down from any scale, all the other lines will be proportional to it; yet it is better to measure some of the lines, to ascertain the distances of places in miles; and to know how many geometrical miles there are in any length; and from thence to make a scale to measure any distance in miles. In measuring any distance, it will not be exact enough to go along the high roads; by reason of their turnings and windings, and hardly ever lying in a right line between the stations, which would cause endless reductions, and create trouble to make it a right line; for which reason it can never be exact. But a better way is to measure in right line with a chain, between station and station, over hills and dales or level fields, and all obstacles. Only in case of water, woods, towns, rocks, banks, &c. where one cannot pass, such parts of the line must be measured by the methods of inaccessible distances; and besides, allowing for ascents and descents, when we meet with them. And a good compass that shews the bearing of the two stations, will always direct you to go straight, when you do not see the two stations; and in your progress, if you can go straight, you may take offsets to any remarkable places, likewise noting the intersection of the stationary line, with all roads, rivers, &c.

"4th. And from all the stations, and in the whole progress, be very particular in observing sea coasts, river mouths, towns, castles, houses, churches, windmills, watermills, trees, rocks, sands, roads, bridges, fords, ferries, woods, hills, mountains, rills, brooks, parks, beacons, sluices, floodgates, locks, &c.; and in general all things that are remarkable.

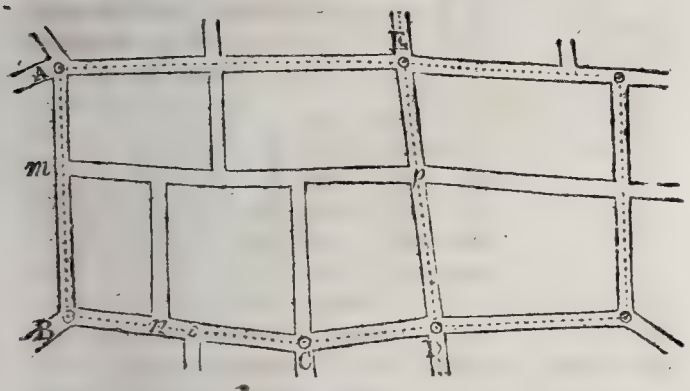
"5th. After you have done with the first and main station lines, which command the whole county; you must then take inner stations at some places already determined; which will divide the whole into several partitions: and from these stations you must determine the places of as many of the remaining towns as you can. And if any remain in that part, you must take more stations, at some places already determined; from which you may determine the rest. And thus proceed through all the parts of the country, taking station after station, till we have determined all we want. And in general the station distances must always pass through such remarkable points as have been determined before, by the former sations.

"6th. Lastly, the position of the station line you measure, or the point of the compass it lies on, must be determined by astronomical observation. Hang up a thread and plummet in the sun, over some part of the station line, and observe when the shadow runs along that line, and at that moment take the sun's altitude; then having his declination, and the latitude, the azimuth will be found by spherical trigonometry. And the azimuth is the angle the station line makes with the meridian; and therefore a meridian may easily be drawn through the map: or a meridian may be drawn through it by hanging up two threads in a line with the pole star, when he is just north, which may be known from astronomical tables. Or thus; observe the star Alioth, or that in the rump of the great bear, being that next the square; or else Cassiopeia's hip; he says, observe by a line and plummet when either of these stars and the pole star come into a perpendicular; and at that time they are due north. Therefore two perpendicular lines being fixed at that moment, towards these two stars, will give the position of the meridian.

"18. *To Survey a Town or City.*

"This may be done with any of the instruments for taking angles, but best of all with the plain table, where every minute part is drawn while in sight. It is proper also to have a chain of 50 feet long, divided into 50 links, and an offset-staff of 10 feet long.

"Begin at the meeting of two or more of the principal streets, through which you can have the longest prospects, to get the longest station lines. There having fixed the instrument, draw lines of direction along those streets, using two men as marks or poles set in wooden pedestals, or perhaps some remarkable places in the houses at the farther ends, as windows, doors, corners, &c. Measure these lines with the chain, taking offsets with the staff at all corners of streets, bendings, or windings, and to all remarkable things, as churches, markets, halls, colleges, eminent houses, &c. Then remove the instrument to another station along one of these lines; and there repeat the same process as before. And so on till the whole is finished.



"Thus, fix the instrument at A, and draw lines in the direction of all the streets meeting there; and measure AB, noting the street on the left at *m*. At the second station B, draw the directions of the streets meeting there; measure from B to C, noting the places of the streets at *n* and *o* as you pass by them. At the 3d station C, take the direction of all the streets meeting there, and measure C D. At D do the same, and measure DE, noting the place of the cross streets at *p*. And in this manner go through all the principal streets. This done, proceed to the smaller and intermediate streets; and lastly to the lanes, alleys, courts, yards, and every part that it may be thought proper to represent.

"*Of Planting, Computing, and Dividing.*

"19. *To lay down the Plan of any Survey.*

"If the survey was taken with a plain table, you have a rough plan of it already on the paper which covered the table. But if the survey was with any other instrument, a plan of it is to be drawn from the measures that were taken in the survey, and first of all a rough plan upon paper.

"To do this, you must have a set of proper instruments, for laying down both lines and angles, as scales of various sizes, the more of them, and the more accurate, the better; scales of chords, protractors, perpendicular and parallel rulers, &c. Diagonal scales are best for the lines, because they extend to three figures, or chains and links, which are hundredth parts of chains. And in using the diagonal scale a pair of compasses must be employed to take off the lengths of the principal lines very accurately. But a scale with a thin edge divided is much readier for laying down the perpendicular offsets to crooked hedges, and for marking the places of those offsets upon the station line; which is done at only one application of the edge of the scale to that line, and then pricking off all at once the distances along it. Angles are to be laid down either with a good scale of chords, which is perhaps the most accurate way; or with a large protractor, which is much readier when many angles are to be laid down at one point, as they are pricked off all at once round the edge of the protractor.

"Very particular directions for laying down all sorts of figures cannot be necessary in this place, to any person who has learned practical geometry, or the construction of figures, and the use of his instruments. It may therefore be sufficient to observe, that all lines and angles must be laid down on the plan in the same order in which they were measured in the field, and in which they are written in the field-book; laying down first the angles for the position of lines, then the lengths of the lines, with the places of the offsets, and then the lengths of the offsets themselves, all with dry or obscure lines; then a black line drawn through the extremities of all the offsets, will be the hedge or bounding line of the field, &c. after the principal bounds and lines are laid down, and made to fit or close properly, proceed next to the smaller objects, till you have entered every thing that ought to appear in the plan, as houses, brooks, trees, hills, gates, stiles, roads, lanes, mills, bridges, woodlands, &c. &c.

"The north side of a map or plan is commonly placed uppermost, and a meridian somewhere drawn, with the compass or flower de-luce pointing north. Also in a vacant place a scale of equal parts or chains is drawn, and the title of the map in conspicuous characters, and embellished with a compartment. All hills must be shadowed, to distinguish them in the map. Colour the hedges with different colours; represent hilly grounds by broken hills and valleys; draw single dotted lines for foot-paths, and double ones for horse or carriage roads. Write the name of each field and remarkable place within it, and, if you choose, its contents in acres, roods, and perches.

"In a very large estate, or a county, draw vertical and horizontal lines through the map, denoting the spaces between them by letters, placed at the top, and bottom, and sides, for readily finding any field or other object, mentioned in a table.

"In mapping counties, and estates that have uneven grounds of hills and valleys, reduce all oblique

lines, measured up hill and down hill, to horizontal straight lines, if that was not done during the survey, before they were entered in the field-book, by making a proper allowance to shorten them. For which purpose, there is commonly a small table engraven on some of the instruments for surveying.

"20. *To compute the Contents of Fields.*

"1st. Compute the contents of the figures, whether triangles, or trapeziums, &c. by the proper rules for the several figures laid down in measuring; multiplying the lengths by the breadths both in links; the product is acres after you have cut off five figures on the right, for decimals; then bring these decimals to roods, and perches, by multiplying first by 4, and then by 40. An example of which was given in the description of the chain, art. 1.

"2d. In small and separate pieces, it is usual to cast up their contents from the measures of the lines taken in surveying them, without making a correct plan of them.

"Thus in the triangle in art. 7, where we had AP = 794, and AB = 1321
PC = 826

7926
2642
10568

2) 10·91146
5·45573 ac r p
4 Ans. 32 1 33 nearly

1·82292
40

32·91680

"Or the first example to art. 8, thus;

AE 214 | 210 ED
AF 362 | 306 FB
AC 592 |

516 sum of perp.
592 AC

1032
4644
2580

3·05472 ac r p
4 Ans. 3 0 8

·21888
40

8·75520

Or the 2d example to the same article, thus:

AP 110 | 352 PC
AQ 745 | 595 QD
AB 1110 |

PC	352	PC	352	QD	595
AP	110	QD	595	QB	365
2 APC	38720	sum	947		2975
		PQ	635		3570
					1785
			4735		
			2841		217175 = 2QDB
			5682		601345 = 2PCDQ
		2PCDQ	601345		38720 = 2APC
					) 8·57240 = double the whole.
					4·2862
					4
ac r p					
Ans. 4 1 5					1·1448
					40
					5·7920

"3d. In pieces bounded by very crooked and winding hedges, measured by offsets, all the parts between the offsets are most accurately measured separately as small trapezioids. Thus, for the example to art. 6, where

Ac 45 | 62 *ch*
Ad 220 | 84 *di*
Ae 340 | 70 *ek*
Af 510 | 98 *fl*
Ag 34 | 57 *gm*
AB 785 | 91 Bn

Then

Ac	45	ch	62	di	84	ek	70	fl	98	gm	57
ch	62	di	84	ek	70	fl	98	gm	57	Bn	91
	90		146		154		168		145		148
	270	cd	175	de	120	ef	170	fg	124	gB	151
	2790		730		18480		11760		580		148
			1022				168		290		740
			146						145		148
							28560				
			25550						17980		22348

2790
25550
18480
28560
17980
22348

2) 1·15708 ac r p
·57854 Content 0 2 12
4
2·31416
40

12·56640

"4th. Sometimes such pieces as that above, are computed by finding a mean breadth, by dividing the sum of the offsets by the number of them, accounting that for one of them where the boundary meets the station line, as at A; then multiply the length A B by that mean breadth.

"Thus:

00	785	A B
62	66	mean breadth
84		
70	4710	ac r p
98	4710	Content o 2 2 by this method,
57		which is 10 perches too little.
91	51810	
	4	
7) 462		
66	2·07240	
	40	
	2·89600	

"But this method is, he says, always erroneous, except when the offsets stand at equal distances from one another.

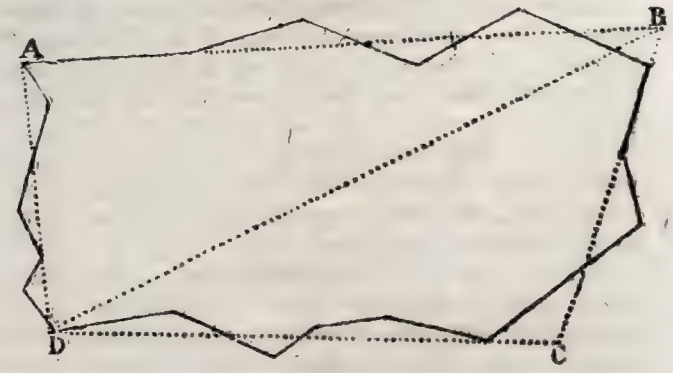
"5th. But in larger pieces, and whole estates, consisting of many fields, it is the common practice to make a rough plan of the whole, and from it compute the contents quite independent of the measures of the lines and angles that were taken in surveying. For then new lines are drawn in the fields in the plan, so as to divide them into trapeziums and triangles, the bases and perpendiculars of which are measured on the plan by means of the scale from which it was drawn, and so multiplied together for the contents. In this way the work is very expeditiously done, and sufficiently correct; for such dimensions are taken, as afford the most easy method of calculation; and, among a number of parts, thus taken and applied to a scale, it is likely that some of the parts will be taken a small matter too little, and others too great; so that they will, upon the whole, in all probability, very nearly balance one another. After all the fields, and particular parts, are thus computed separately, and added altogether into one sum, calculate the whole estate independent of the fields, by dividing it into large and arbitrary triangles and trapeziums, and add these also together. Then if this sum be equal to the mer, or nearly so, the work is right; but if the sums have any considerable difference, it is wrong, and they must be examined, and recomputed, till they nearly agree.

A specimen of dividing into one triangle, or one trapezium, which will do for most single fields, may be seen in the examples to the last article; and a specimen of dividing a large tract into several such trapeziums and triangles, in article 9, where a piece is so divided, and its dimensions taken and set down; and again in articles 15, 16.

"6th. But the chief secret in casting up consists in finding the contents of pieces bounded by curved, or very irregular lines, or in reducing such crooked sides of fields or boundaries to straight lines, that shall inclose the same or equal area with those crooked sides, and so obtain the area of the curved figure by means of the right-lined one, which will commonly be a trapezium. Now this reducing the crooked sides to straight ones, is very easily and accurately performed thus: Apply the straight edge of a thin, clear piece of lanthorn-horn to the crooked line, which is to be reduced, in such a manner, that the small parts cut off from the crooked figure by it, may be equal to those which are taken in: which equality of the parts included and excluded, you will presently be able to judge of very nicely by a little practice: then with a pencil draw a line by the straight edge of the horn. Do the same by the other sides of the field or figure. So shall you have a straight sided figure equal to the curved one; the contents of which being computed as before directed, will be the content of the curved figure proposed.

"Or instead of the straight edge of the horn, a horse hair may be applied across the crooked sides in the same manner; and the easiest way of using the hair, is to string a small slender bow with it, either of wire, or cane, or whale bone, or such like slender springy matter; for the bow keeping it always stretched, it can be easily and neatly applied with one hand, while the other is at liberty to make two marks by the side of it, to draw the straight line by.

"*Ex.* Thus let it be required to find the contents of the same figure as in art. 12, to a scale of 4 chains to an inch.



"Draw the four dotted straight lines AB, BC. CD, DA cutting off equal quantities on both sides of them, which they do as near as the eye can judge: so is the crooked figure reduced to an equivalent right-lined one of four sides ABCD. Then draw the diagonal BD, which, by applying a proper scale to it, measures 1256. Also the perpendicular, or nearest

distance, from A to this diagonal, measures 466; and the distance of C from it, is 428. Then

466	2) 11·10304
428	5·55152
	4
884	
1256	2 20608
	40
5024	
10048	8·24320
10048	
1110304	

"And thus the content of the trapezium, and consequently of the irregular figure, to which it is equal, is easily found to be 5 acres, 2 roods, 8 perches.

"21. *To Transfer a Plan to another Paper, &c.*

"After the rough plan is completed, and a fair one is wanted; this may be done, either on paper or vellum, by any of the following methods:

"*First method.*—Lay the rough plan upon the clean paper, and keep them always pressed flat and close together, by weights laid upon them. Then, with the point of a fine pin or pricker, prick through all the corners of the plan to be copied. Take them asunder, and connect the pricked points on the clean paper, with lines; and it is done. This method is only to be practised in plans of such figures as are small and tolerably regular, or bounded by right lines.

"*Second method.*—Rub the back of the rough plan over with black lead powder; and lay the said black part upon the clean paper, upon which the plan is to be copied, and in the proper position. Then, with the blunt point of some hard substance, as brass, or such like, trace over the lines of the whole plan; pressing the tracer so much as that the black lead under the lines may be transferred to the clean paper; after which take off the rough plan, and trace over the leaden marks with common ink, or with Indian ink, &c.—Or, instead of blacking the rough plan, you may keep constantly a black paper to lay between the plans.

"*Third method.*—Another way of copying plans, is by means of squares. This is performed by dividing both ends and sides of the plan, which is to be copied, into any convenient number of equal parts, and connecting the corresponding points of division with lines; which will divide the plan into a number of small squares. Then divide the paper, upon which the plan is to be copied, into the same number of squares, each equal to the former when the plan is to be copied of the same size, but greater or less than the others, in the proportion in which the plan is to be increased or diminished, when of a different size. Lastly, copy into the clean squares, the parts contained in the corresponding squares of the old plan; and you will have the copy either of the same size, or greater or less in any proportion.

"*Fourth method.*—A fourth way is by the instrument called a pentagraph, which also copies the plan in any size required.

"*Fifth method.*—But the neatest method of any is this: procure a copying frame or glass, made in this manner; namely, a large square of the best window glass, set in a broad frame of wood, which can be raised up to any angle, when the lower side of it rests on a table. Set this frame up to any angle before you, facing a strong light; fix the old plan and clean paper together with several pins quite around, to keep them together, the clean paper being laid uppermost, and upon the face of the plan to be copied. Lay them, with the back of the old plan, upon the glass, namely, that part which you intend to begin at to copy first; and, by means of the light shining through the papers, you will very distinctly perceive every line of the plan through the clean paper. In this state then trace all the lines on the paper with a pencil. Having drawn that part which covers the glass, slide another part over the glass, and copy it in the same manner. And then another part. And so on till the whole be copied.

"Then, take them asunder, and trace all the pencil-lines over with a fine pen and Indian ink, or with common ink.

"And thus you may copy the finest plan, without injuring it in the least.

"When the lines, &c. are copied upon the clean paper or vellum, the next business is to write such names, remarks, or explanations as may be judged necessary; laying down the scale for taking the lengths of any parts, a flower-de-luce to point out the direction, and the proper title ornamented with a compartment: and illustrating or colouring every part in such manner as shall seem most natural, such as shading rivers or brooks with crooked lines, drawing the representations of trees, bushes, hills, woods, hedges, houses, gates, roads, &c. in their proper places; running a single dotted line for a foot path, and a double one for a carriage road; and either representing the bases or the elevations of buildings, &c.

"22. *Of the Division of Lands.*

"In the division of commons, after the whole is surveyed and cast up, and the proper quantities to be allowed for roads, &c. deducted, divide the net quantity remaining among the several proprietors, by the rule of fellowship, in proportion to the real value of their estates, and you will thereby obtain their proportional quantities of the land. But as this division supposes the land, which is to be divided, to be all of an equal goodness, you must observe that if the part in which any one's share is to be marked off, be better or worse than the general mean quality of the land, then

you must diminish or augment the quantity of his share in the same proportion.

"Or, which comes to the same thing, divide the ground among the claimants in the direct ratio of the value of their claims, and the inverse ratio of the quality of the ground allotted to each; that is, in proportion to the quotients arising from the division of the value of each person's estate, by the number which expresses the quality of the ground in his share.

"But these regular methods cannot always be put in practice; so that, in the division of commons, the usual way is, to measure separately all the land that is of different values, and add into two sums the contents and the values; then the value of every claimant's share is found by dividing the whole value among them in proportion to their estates; and lastly, by the 24th article, a quantity is laid out for each person, that shall be of the value of his share before found.

23. It is required to divide any given Quantity of Ground or its Value, into any given Number of Parts, and in proportion to any given Number.

"Divide the given piece, or its value, as in the rule of Fellowship, by dividing the whole content or value by the sum of the numbers expressing the proportions of the several shares, and multiplying the quotient severally by the said proportional numbers for the respective shares required, when the land is all of the same quality. But if the shares be of different qualities, then divide the numbers expressing the proportions or values of the shares, by the numbers which express the qualities of the land in each share; and use the quotients instead of the former proportional numbers.

"Ex. 1. If the total value of a common be 2500 pounds, it is required to determine the values of the shares of the three claimants A, B, C, whose estates are of these values, 10000, and 15000, and 25000 pounds.

"The estates being in proportion as the numbers 2, 3, 5, whose sum is 10, we shall have 2500 ÷ 10 =250; which being severally multiplied by 2, 3, 5, the products 500, 750, 1250, are the values of the shares required.

"Ex. 2. It is required to divide 300 acres of land among A, B, C, D, E, F, G, and H, whose claims upon it are respectively in proportion as the numbers 1, 2, 3, 5, 8, 10, 15, 20.

"The sum of these proportional numbers is 64, by which dividing 300, the quotient is 4 ac. 2 r. 30 p. which being multiplied by each of the numbers, 1, 2, 3, 5, &c. we obtain for the several shares as below:

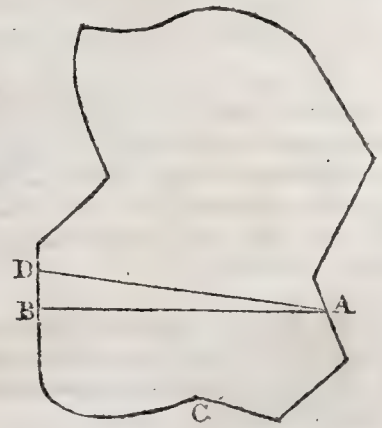
	Ac.	R.	P.
A =	4	2	30
B =	9	1	20
C =	14	0	10
D =	23	1	30
E =	37	2	00
F =	46	3	20
G =	70	1	10
H =	93	3	00
Sum =	300	0	00

"Ex. 3. It is required to divide 780 acres among A, B, and C, whose estates are 1000, 3000, and 4000 pounds a year; the ground in their shares being worth 5, 8, and 10 shillings the acre respectively.

"Here their claims are as 1, 3, 4; and the qualities of their land are as 5, 8, 10; therefore their quantities must be as $\frac{1}{5}$, $\frac{3}{8}$, $\frac{2}{5}$, or, by reduction, as 8, 15, 16. Now the sum of these numbers is 39; by which dividing the 780 acres, the quotient is 20; which being multiplied severally by the three numbers 8, 15, 16, the three products are 160, 300, 320, for the shares of A, B, C, respectively.

"24. To cut off from a Plan a given Number of Acres, &c. by a Line drawn from any Point in the Side of it.

"Let A be the given point in the annexed plan, from which a line is to be drawn cutting off suppose 5 ac. 2 r. 14 p.



"Draw AB cutting off the part ABC as near as can be judged equal to the quantity proposed; and let the true quantity of ABC, when calculated, be only 4 ac. 3 r. 20 p. which is less than 5 ac. 2r. 14 p. the true quantity, by 0 ac. 2 r. 34 p. or 71250 square links. Then measure A B, which suppose = 1234 links, and divide 71250, by 617 the half of it, and the quotient 115 links will be the altitude of the

triangle to be added, and whose base is AB. Therefore if upon the centre B, with the radius 115, an arc be described; and a line be drawn parallel to A B, touching the arc, and cutting BD in D; and if A D be drawn, it will be the line cutting off the required quantity ADCA.

"Note. If the first piece had been too much, then D must have been set below B.

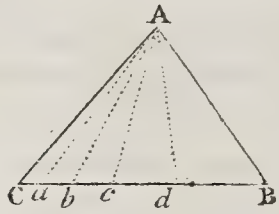
"In this manner the several shares of commons, to be divided, may be laid down upon the plan, and transferred from thence to the ground itself.

"Also for the greater ease and perfection in this business, the following problems may be added.

"25. From an Angle in a given Triangle, to draw Lines to the opposite Side, dividing the Triangle into any Number of Parts, which shall be in any assigned Proportion to each other.

"Divide the base into the same number of parts, and in the same proportion, by article 22; then from the several points of division draw lines to the proposed angle, and they will divide the triangle as required.—For, the several parts are triangles of the same altitude, and which therefore are as their bases, which bases are taken in the assigned proportion.

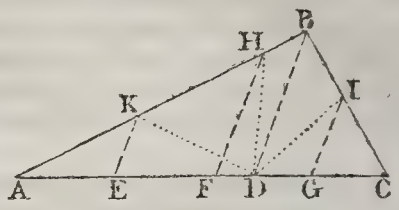
"Ex. Let the triangle A B C, of 20 acres, be divided into five parts, which shall be in proportion to the numbers 1, 2, 3, 5, 9; the lines of division to be drawn from A to CB, whose length is 1600 links.



"Here $1 + 2 + 3 + 5 + 9 = 20$, and $1600 \div 20 = 80$; which being multiplied by each of the proportional numbers, we have 80, 160, 240, 400, and 720. Therefore make $Ca = 80$, $ab = 160$, $bc = 240$, $cd = 400$, and $dB = 720$; then by drawing the lines Aa, Ab, Ac, Ad, the triangle is divided as required.

"26. From any Point in one side of a given Triangle, to draw Lines to the other two Sides, dividing the Triangle into any Number of Parts which shall be in any assigned Ratio.

"From the given point D, draw D B to the angle opposite the side A C in which the point is taken; then divide the same side A C into as many parts A E, E F, F G, G C, and in the same proportion with the required parts of the triangle, like as was done in the last problem; and from the points of division draw lines E K, F I, G H, parallel to the line BD, and meeting the other sides of the triangle in K, I, H; lastly, draw KD, ID, HD, so shall ADK, KDI, IDHB, HDC be the parts required.—The example to this will be done exactly as the last.



"For, the triangles ADK, KDI, IDB, being of he same height, are as their bases AK, KI, IB; which, by means of the parallels EK, FI, DB, are as AE, EF, FD; in like manner, the triangles CDH, HDB, are to each other as CG, GD: but the two triangles JDB, BDH, having the same base BD, are to each other as the distances of I and H from BD, or as FD to DG; consequently the parts DAK, DKI, DIBH, DHC, are to each other as AE, EF, FG, GC."

Surveying of Harbours.

It is remarked by the above able writer, that "the method of surveying harbours, and of forming maps of them, as also of the adjacent coasts, sands, &c, depends on the same principles, and is chiefly conducted like that of common surveying. The operation is indeed more complicated and laborious; as it is necessary to erect a number of signals, and to mark a variety of objects along the coast, with different bearings from one another, and the several parts of the harbour; and likewise to measure a great number of angles at different stations, whether on the land or the water. For this purpose, the best instrument is Hadley's quadrant, as all these operations may be performed by it, not only with greater ease, but also with much more precision, than can be hoped for by any other means, as it is the only instrument in use, in which neither the exactness of the observations, nor the ease with which they may be made, are sensibly affected by the motion of a vessel: and hence a single observer, in a boat, may generally determine the situation of any place at pleasure, with a sufficient degree of exactness, by taking the angles subtended by several pairs of objects properly chosen upon shores round about him; but it will be still better to have two observers, or the same observer at different stations, to take the like angles to the several objects, and also to the stations. By this means, two angles and one side are given, in every triangle, from whence the situation of every part of them will be known. By such observations, when carefully made with good instruments, the situation of places may be easily determined to 20 or 30 feet, or less, upon every 3 or 4 miles."

On this subject more full information may be met with by consulting the Philos. Trans. vol. 55, pa. 70, and Mackenzie's Maritime Surveying.

SURVEYOR, a person whose business is that of surveying. He should be a careful steady man, and perfectly acquainted with his art as well as that of country business in general. All large estates require a proper person of this sort.

SURVEYS *of the Board of Agriculture*, those reports of the state of agriculture made of different counties under the direction of the Board of Agriculture, in which the facts and particular practices of the different districts are recorded and brought to notice. A great part of the kingdom has now been surveyed in this way, and much useful information brought to the attention of the farmer.

The following is the model or plan on which the re-printed reports are conducted upon, one uniform model being adopted for the whole: and which after fully considering the subject, "was pitched upon, as one that would include in it all the particulars which it was necessary to notice in an Agricultural Survey."

Plan of the re-printed Reports.

Preliminary Observations.

CHAP. I. *Geographical State and Circumstances.*

SECT. 1. Situation and Extent.
2. Divisions.
3. Climate.
4. Soil and Surface.
5. Minerals.
6. Water.

CHAP. II. *State of Property.*

SECT. 1. Estates, and their Management.
2. Tenures.

CHAP. III. *Buildings.*

SECT. 1. Houses of Proprietors.
2. Farm Houses and Offices, and Repairs.
3. Cottages.

CHAP. IV. *Mode of Occupation.*

SECT. 1. Size of Farms. Character of the Farmers.
2. Rent—in Money—in Kind—in Personal Services.
3. Tithes.
4. Poor Rates.
5. Leases.
6. Expense and profit.

CHAP. V. *Implements.*

CHAP. VI. *Enclosing—Fences—Gates.*

CHAP. VII. *Arable Land.*

SECT. 1. Tillage.
2. Fallowing.
3. Rotation of Crops.
4. Crops commonly cultivated, such as Corn, Pulse, Artificial Grasses; their Seed, Culture, Produce, &c.
5. Crops not commonly cultivated.

Where the quantity is considerable, the information respecting the crops commonly cultivated may be arranged under the following heads—for example, WHEAT.

1. Preparation { tillage, manure,	{ hoeing, weeding, feeding. }
2. Sort	
3. Steeping.	7. Harvest.
4. Seed (quantity sown),	8. Threshing.
5. Time of sowing.	9 Produce.
6. Culture whilst growing.	10. Manufacture of bread

In general, the same heads will suit the following grains:

Barley. Oats. Beans. Rye. Pease. Buckwheat. Vetches — Application.
Cole-seed — { Feeding, Seed. }
Turnips — { Drawn, Fed, Fed on grass, —in houses. }

CHAP. VIII. *Grass.*

SECT. 1. Natural Meadows and Pastures.
2. Hay Harvest.
3. Feeding.

CHAP. IX. *Gardens and Orchards.*

CHAP. X. *Woods and Plantations.*

CHAP. XI. *Wastes.*

CHAP. XII. *Improvements.*

SECT. 1. Draining.
2. Paring.
3. Manuring.
4. Weeding.
5. Watering.

CHAP. XIII. *Live Stock.*

SECT. 1. Cattle.
2. Sheep.
3. Horses, and their Use in Husbandry, compared to Oxen.
4. Hogs.
5. Rabbits.
6. Poultry.
7. Pigeons.
8. Bees.

CHAP. XIV. *Rural Economy.*

SECT. 1. Labour—Servants — Labourers — Hours of Labour.
2. Provisions.
3. Fuel.

CHAP. XV. *Political Economy, as connected with or affecting Agriculture.*

SECT. 1. Roads.
2. Canals.
3. Fairs.
4. Weekly Markets.
5. Commerce.
6. Manufactures.
7. Poor.
8. Population.

CHAP. XVI. *Obstacles to Improvement; including General Observations on Agricultural Legislation and Police.*

CHAP. XVII. *Miscellaneous Observations.*

SECT. 1. Agricultural Societies.
2. Weights and Measures.
3. Supply of London.
4. Experimental Farm.

CONCLUSION. *Means of Improvement, and the Measures calculated for that Purpose.*

Under these different heads, all the various facts and processes, relating to, or connected with the business of husbandry, are comprehended.

SURSINGLE, the girt which comes over the saddle, and binds it firmly to the horse.

SWAD, a provincial word signifying a pod, as of peas, beans, &c.

SWALE, a term signifying shade.

SWALLOWING, the act by which food is passed into the stomach of an animal.

It has been observed by Mr. J. Lawrence that the swallowing of leeches or hens dung, is an "accident that frequently happens to country cart-horses, passing off with a slight sickness, and without notice. Whilst the horses are absent, the poultry will always watch the opportunity of examining the mangers, where they leave both dung and feathers, which ought ever to be carefully swept away, previous to feeding the horses. Horses drinking at ponds will also often suck in a variety of filth and vermin. The signs of having swallowed leeches, or other vermin, are hanging the head to the ground, and a discharge of impure saliva, sometimes mixed with blood." To remove which he advises giving a pint of sweet oil warmed, with a glass of brandy, and a dram of ground ginger. Scalded bran and gruel, should likewise be plentifully given; and the oil may be repeated, if needful. A mild dose of aloes and rhubarb, with one ounce of diapente, may likewise often be given in warm ale with advantage.

SWAMP, a hollow, morass, bog, or watery place, in any part of a field or other place. See *Bog*.

SWAMPY *Land*, such as is of a boggy or morassy nature. Under this title are also sometimes included, according to Mr. Marshall, "*inland fens*,—*low marshy grounds*,—*wet meadows*,—and *flat pasture lands*,—which lie out of the way of floods; yet are liable to be chilled by surface waters, and poached by cattle, in wet seasons; by reason of the natural water-courses, below them, being in a state of neglect; or for the want of artificial courses being opened; to relieve them from surface waters, as they collect."

And he adds, that "lands of this description are now more particularly seen, in forests or other unappropriated and unreclaimed wastes. Where the appropriation of lands has taken place, they are less conspicuous. But even there, in a wet season, we too frequently see, he says, water loitering on the surface,—to the great injury of existing crops, as well as of the future productiveness of the soil. And a still greater extent of appropriated lands are injured by water lodging in furrows and ditches, for want of sufficient shores, or public drains, to draw it off, and of public laws to enforce the re-opening, and the cleansing, from time to time, of those which the wisdom of our ancestors formed."

The nature of this sort of lands must of course vary greatly, according to the circumstances and situations in which they are placed.

It is sufficiently evident, however, that all lands of the swampy kind, whatever their situation may be, must require to be first drained before any other improvement can be effected. When this has been well accomplished by proper feeding and managing, they may in most instances be brought into a good state of sward, which is in general the best application of them, as they are seldom fit for the purposes of tillage. See *Draining of Land* and *Bog*.

SWANG, a grassy or other piece of green sward lying low or in a bottom covered or liable to be covered with water.

SWAPE, a provincial term signifying a long pole, turning upon a fulcrum, for raising water out of a shallow well or other similar purposes.

SWARD, the green or grassy surface of the ground.

In some cases it is extremely easy to have a good sward, while in others it requires much art and trouble to obtain it, even in a tolerable degree. In order to have a fine sward, much attention is necessary to feeding down the grass, as well as the keeping it free from all sorts of rubbish of the weed kind. See *Laying down to Grass* and *Grass-Land*.

SWARD-*Cutter*, an implement invented by Mr. Sandilands, and described in the sixth volume of the Bath Papers, for the purpose originally of preparing old grass ground for the plough, by cutting it across the ridges, in the beginning of, or during winter, when the land is soft, in order to answer all the intentions proposed by Mr. Tull, with the four-coulter plough, for bringing grass ground that has been long rested into tilth. "This the sward-cutter has been found to do, the inventor says, much more effectually and expeditiously; as Mr. Tull's plough, with four coulters, cuts the sward in the same direction with the plough, and is liable from every stone, or other obstruction any of the coulters meets with, to be thrown out of its work altogether, or the instrument broke, to which the sward cutter, consisting of four, six, or more cutting wheels, is never liable, from their being entirely independent of one another, cutting the ground across the ridges before ploughing, and rendering that operation easier to two horses than it would be to three without its being cut. The furrow being cut across, falls finely from the plough in squares of any size required, not under six inches, in place of long slips of tough sward, seldom and imperfectly broken by the four-coultered plough."

It is supposed that "any person who reads Mr. Tull's description of his four coultered plough, and what he proposed by it, will soon see the great advantage the sward-cutter has over it, in producing the desired effect of bringing old rested grass-ground into tilth; an object universally allowed to be of no small importance to agriculture."

And it is an implement which is supposed "very fit for preparing ground for burnbating, as it will save much hand-labour. It may also be properly used in cross-cutting clover, of one or two years standing, to prepare the ground for wheat, if the land be stiff and moist enough. It may also be applied to cutting and cross-cutting pasture-ground, intended to have manure of any kind put upon it to meliorate the grass. In this it will far exceed the scarificator, as that instrument is liable, as well as the four-coultered plough, to be thrown out of its work when meeting with a stone or other interruption. This the sward-cutter is proof against, which is looked on as its greatest excellence."

And "in preparing for barley, the sward-cutter, it is said, excels a roller of any kind, in reducing the large hard clods in clay land, occasioned by a sudden drought, after its being ploughed too wet; and it is likewise very proper for reducing such clay land, when under a summer fallow. In this operation the sward-cutter is greatly to be preferred to the cutting roller, from its wheels being all dependant one on another, so that when one is thrown out by a stone, three or four must share the same fate: besides, the cutting roller has but seven wheels in six feet, and the sward-cutter has six in four feet three inches, at nine inches distant; and, if necessary, may have them so near as six inches." It is added that "after old grass-ground is cut across with the sward-cutter, and ploughed, it has a very uncommon and worklike appearance, from each square turned over by the plough, being raised up an inch or two at the side last moved by the earth-board; so that the field when finished, is all prettily waved, and resembles a piece of water when blown on by a gentle breeze. By this means a very great deal of the land's surface is exposed to the frost, and other influences of the air, which cannot fail to have a good effect on it." And it is found that "two horses are sufficient for the draught of a double-horse sward-cutter, and one horse for a single-horse one; one man manages the machine, and drives the horses. The workman begins his operation by first measuring off twenty or thirty paces from the machine, less or more, as he inclines, and there fixes a pole. He then cuts the field cross, as near at right angles with the ridges as he can. When the cutting wheels are past the last furrow about a yard, and the machine is upon the outmost ridge of the field on which it must turn, he must stop the horses, then take hold of the lever, and by pulling it to him raise the cutting wheels out of the ground, which are kept so by the loop of the rope being put over a pin for the purpose in the lever till the machine is turned and brought to its proper place, which is done by measuring off the same distance formerly done on the opposite side of the field. When the cutting wheels are exactly over the outmost furrow, then, on the horses being stopped, slip off the pin and the lever returns to its former place, which allows the weights to force the cutting wheels into the ground again. He then goes on till the interval betwixt the first and second stroke of the machine is all cut. In this manner the field is to be finished, after which you may begin to plough when you please." It is remarked that there must be a pole at each side of the field. "But it is of no consequence whether the land to be sward-cut is in crooked ridges, or straight, in flat ridges, or in very high-raised ridges, such as are frequently met with in Scotland. Be the surface ever so uneven, it does not signify, as the cutting wheels being all independent of one another, are forced by their weights into every furrow or hollow.

"One sward-cutter, it is said, will cut as much in one day as six ploughs will plough." And that "the land may lie several months in winter after being sward-cut, when there is no vegetation to make the cuts grow together again before it is ploughed; but the sooner it is ploughed after cutting, the better, that it may have the benefit of all the winter's frost, which makes it harrow better and easier at seed time. When the ground is harrowed, the harrows ought to go with the waves that appear after ploughing, not against them, as by that means they are less apt to tear up the furrows all cut into squares. This need only be attended to respecting the first two tines, as they are called, or the harrowing."

It is observed that any "common wright and smith may make the instrument. It is very strong, very simple, and easily managed, and moved from place to place; and if put under cover, will last many years." A representation of it may be seen in the work noticed above.

SWARD-*Dresser*, an implement contrived for the

purpose of dressing and improving the sward of lands in the state of grass.

An useful tool of this sort has been described by Mr. Amos in his Minutes on Agriculture and Planting, where he has advised the use of it for scarifying and dressing grass land, whether it is to be mown or depastured with animals. And that the best time of performing the operation with it is from the middle of February to the middle of April. And that in general, dressing the land one way may be sufficient; but if the sward be very mossy or adhesive, it should, he thinks, be dressed length and cross ways, cleaned and rolled; the implement being occasionally cleared from rubbish.

It is also suggested, that if the sward be thin, it may be thickened very much, by laying eight or ten tons of rotten dung on, and sowing seven pounds of white clover, four pounds of wild or cow clover, four pounds of trefoil, four pounds of ribb grass, and one peck of best rye-grass seeds, per acre, previous to its being dressed in this way, bush-harrowed, cleaned, and rolled. He thinks that by dressing land in this way by this tool, *moss* is torn up, *ant* and *mole hills* levelled and destroyed, the roots of the grass cut, and horse hoed, which causes them to throw out fresh lateral *shoots* or *stems*, the *sward* thickened, and the *surface* made so clean, as to put on the finest appearance, when kept close fed down. And that by such management and grazing as much stock as will keep the grass in a young succulent state, and *hobbing* or mowing all the tufts and weeds three times in the course of the summer, the grazier will be enabled to receive every benefit from his land, and likewise prevent the stems of several grasses from running to seed, and being thereby injured as well as the land.

The tool is represented in perspective in *Plate* XXXV. *fig.* 3, in which AA is the outer side frames, six feet long, and twelve by three inches square, shaped as in the figure; B the coulter bar, five feet eight inches long, and four by three and a half inches square outside measure. Set off one and a half inches from each side frame, and divide the remainder (which is 57 inches) into nineteen equal parts, in which fix nineteen coulters for scarifying the sward of the ground. CCCC are four bars, five feet eight inches long, and three and a half by two inches square for bracing the side frames together, and for fixing the thorns which brush the sward after it has been scarified, as in the figure. DD are two pieces of ash wood, three inches square, and about forty inches long, for sledging the machine from one field to another. E the chain by which the whole machine is drawn with two horses abreast. And at *fig.* 4. is represented one of the coulters which is ten inches long (but here only eight inches) one and one-fourth inch broad, and three-eighths of an inch thick for three and a half inches within the wood of the coulter bar, below which the fore-edge is made sharp for cutting the sward or turf off the ground. By *fig.* 5 is represented the screw bolt which regulates the depth at which the coulters scarify and cut the land; in which *aa* are iron plates twelve inches long and three by one-fourth of an inch square.

bb two iron bolts, twelve and a half inches long, and half an inch diameter, for fastening the iron plates to the upper and under sides of *fig.* 3, at 1,1, 2,2.

c is an iron bolt, twelve and three-fourth inches long, half an inch diameter at top and bottom, and three quarters of an inch diameter where the screw is made.

d is a nut screw, three inches long, three-fourths of an inch by one and a half inches square, fixed in the coulter bar for regulating the depth of the coulters.

m the screw key, which being turned right or left hand about, raises or drops the coulters at pleasure.

In using it, the hinder part of the machine must be drawn well with long black thorns as shewn in the figure, when it will be ready for being made use of.

SWARM, a large number of bees, seeking a proper settlement. It also signifies to climb the naked stem of a tree by the naked arms and knees only. See *Bee*.

SWARTH, a provincial term signifying the sward of grass land; and also the rind of bacon.

SWASH-OVER, a term provincially applied to the spilling of milk or any other fluid over in waves.

SWATH, the line of grass, &c. cut down by the mower at one operation.

SWATH-*Bulk*, the ridge or line under new mown grass. Also the small ridge of stubble or short grass left between two swaths in mowing. This should always be clean cut out.

SWATH-*Rake*, a rake about two yards long, with iron teeth, and a bearer in the middle, to which a man fixes himself with a belt, and when he has gathered as much corn, &c. as his rake will hold, he raises it and begins again. This instrument is in some counties called a dew rake, and much used in Essex for gathering barley after mowing.

SWATTER, a provincial word signifying to spill or splatter water about, as by geese and ducks.

SWAUF, provincially a cart cover.

SWAYING *of the Back*, in *Farriery*, a kind of lumbago known by a pain and weakness in the loins of the horse. It may be caused by a fall, the carrying of some heavy burden, or some other violent accident; or a relaxation or spasm of the muscles of the back. The first thing to be done in this case, is to take away blood; after which a blister is to be applied, and those things given inwardly that promote sweat. The diet must be opening, and all imaginable care taken to keep down a fever. The horse ought to be girt pretty firm over his loins, but not so as to hinder the motions of his flanks.

SWEAL, to singe, or burn off the hair, as in hogs, &c.

SWEAT, in *Farriery*, the transudation of perspirable matter through the skin. The following drink has been recommended for sweating horses.

Take of Venice-treacle, half an ounce;

Contrayerva, in powder, two drachms;

Camphire, powdered, a scruple.
Mix all these with a pint of small white wine; or, for want of that, in a quart of stale beer; and give it the horse milk warm.

And he should then be covered with a hood, a blanket, and a rug, and be well bedded, and not have any hay or corn for twelve hours.

SWEATH, a provincial term applied to a swath of mown grass.

SWEATING-*Iron*, in *Horsemanship*, a term applied to a piece of a scythe about a foot long, and of the breadth of about three or four fingers, very thin, and which cuts only with one side. When the horse is very hot, and the grooms have a mind to take off the sweat, they take this in their two hands, and gently run the edge along the horse's skin, commonly with the grain, or as the hair lies, with intent to scrape off the sweat and dry the horse.

SWEDISH *Turnip*. See *Ruta Baga*.

SWELLED *Legs of a Horse*, in *Farriery*, an infirmity he is sometimes subject to, by hard riding or much labour, when he is too gross, or carelessly put to grass, or put up in the stable too hot, whereby he takes cold, which causes his legs to swell. But sometimes it comes by long standing in the stable, especially when the planks where his fore-feet stand, are higher than where his hinder legs are. The remedies must be applied according to the nature of the disease. See *Grease*.

SWELLED-*Vein*, in *Farriery*, enlarged or very coarse veins.

SWELLING, in *Farriery*, a term applied to the enlargement of a part by the occurrence of inflammation. See *Tumour*.

SWIDDEN, a provincial word signifying to singe or burn off as heath.

SWILL, the wash used for swine; it is also applied to a vessel to wash in, standing on three feet, a sort of shallow tub.

SWILL-TUB, a term applied to a sort of *hog tub*.

SWILLINGS, hog's wash.

SWINE, a well known animal of the quadruped kind, which is of much importance to the farmer in many situations; and which, under proper modes of management in respect to breeding, rearing, feeding and fattening, often affords a good profit.

The characteristic distinctions of the animal, are thus given by Dr. Shaw in the second volume of his General Zoology. Four *front teeth* in the upper jaw, converging. In the lower jaw six projecting. *Two canine teeth or tusks* in the upper jaw, rather short: in the lower jaw two long, exserted. The *snout truncated*, prominent, moveable. The *feet* cloven. It is a sort of animal "in some points of an ambiguous nature, being allied to the *pecora* or cattle by its cloven hoofs, and to the *feræ*, or wild beasts, in some degree by its teeth, yet differing widely from both in many respects." It is consequently supposed, "to form at once, a link between the cloven-footed, the whole footed, and the digitated quadrupeds."

Swine are capable of living to a considerable age, as twenty or thirty years; but they are mostly killed while young, which is a circumstance that renders any marks for ascertaining their ages unnecessary.

It is well known that the hog is a native of all the temperate climates of the old world, but was not found in America, until introduced by the first discoverers, the Spaniards, whose black breed has had a wonderful increase, both on the American continent and in the islands.

It has been asserted by naturalists, that swine are not indigenous to these islands; but probably without any sufficient authority. They are, however, no longer found wild either here or in France.

But the European wild-boar, the original stock of our domestic breed, is still to be found in the forests of Germany, and other countries on the continent, being generally preserved as a beast of chase. According to Mr. Lawrence, he has "a dark brinded, grey colour, sometimes nearly black, or of a dusky yellow, with longitudinal stripes, like those of the domestic kind, called *corderoy* pigs. He is smaller than the tame hog, with upright, wide ears, long powerful snout, large head and shoulders, high crest, deep short body, and thin hinder-quarters, and endowed with considerable activity." It is also stated by the same writer that "the African hog is red, or sandy in colour, with a small head, long, slender pricked ears, soft and short hair, and a long tail touching the ground." But he is not informed "whether this be the same variety used in this country as a cross, under the name of the African." He states that "the Æthiopian hog has wattles under the eyes, is large, and in a wild state." And that "the Cape Verd hog, another African variety, is also large, with more length than the former."

It is added that the "small, almost naked, short, large-bellied black pig of China, with the white, have been long well-known in this country, as a cross for fineness of bone and quickness of proof." But whether the Portugal, of nearly similar form with the last, be only a variety of that species, he is not informed, or whence we derive the large, thick-hided *tonky*." In Batavia, he says, they have long used the tonky, or short cross. And he has heard that our sandy, or rufous pigs, are of Italian origin, and that the neighbourhood of Turin is celebrated for its excellent breed. The Bosnian and Servian pigs, with which the markets of Vienna are supplied, if we may credit travellers, have the character, he says, of being at once the hardiest, and the handsomest in the world, and such as will stand travelling with the least waste."

In regard to the "native pigs of Ireland, France, and Germany, at least such of them as he has seen, they are of the large flat-hided, heavy-eared breed, with longer legs, and of still worse form, but resembling our old breeds of York and Shropshire."

It is further stated that "the hogs of Curdistan, in Asia, are of the largest size and weight." And that "Aristotle and other ancient writers mention a peculiar variety of swine in Illyria, which do not divide the hoof. Mascal says, this whole-footed breed existed in his days, in the neighbourhood of Windsor,

and that they were a large and superior species: and on inquiry, Mr. Lawrence finds some remains of this variety have been found in Berkshire, of late years, but they have now ceased to be a distinct variety, and a few individuals only of them are occasionally met with."

There is evidently much diversity in these animals, in different situations and circumstances, which require to be particularly noticed by the farmer, as it is a point of much advantage, in this as well as all other sorts of live stock, to have a good breed, for it will constantly pay better than those of the more inferior kinds. But like most other descriptions of farm animals, they should probably in some measure be adapted to the nature of the keep, and the circumstances of the management under which the farm is conducted. They should possess as much as possible the points and properties mentioned below; which the farmer should never neglect in selecting them for his different uses. The chief marks made use of in distinguishing the breeds of this animal, are those of the form or shape of the ear, and the quality of the hair. The pendulous hanging down, or lop ear, and the coarse harsh hair are commonly asserted to indicate largeness of size, and thickness of skin: while erect or prick ears show the size to be more small, but the animals more quick in feeding. And it has been observed by some of the older writers that the smooth soft haired pigs are most suitable for warm climates.

The hog or swine, to be well formed, should not be too long, but full in the head and cheek, thick and rather short in the neck; fine in the bone; thick, plump, full and compact in the carcase; full in the quarters, fine and thin in the hide; and of a full size according to the sort whatever it may be; having a disposition to fatten well and expeditiously at an early age.

Varro as well as Columella, however, describes what was considered in their time as the marks of a good hog, to be "a small head, short legs, long bodies, large thighs and neck, and the bristles, particularly on the neck, thick set, erect and strong."

It is observed by the author of the General Treatise on Cattle, that "depth of carcase, lateral extension, breadth of the loin and breast, proportional length, moderate shortness of the legs, and substance of the gammons and fore-arms are great essentials. These are qualities, says he, to produce a favourable balance in the account of keep, and a mass of weight which will pull the scale down. In proportion too, as the animal is capacious in the loin and breast, will be generally the vigour of his constitution; his legs will be thence properly extended, and he will have a bold and firm footing on the ground, to which, however, it is farther necessary that his claws be upright, even and sound."

He adds, however that "a good hog may have a coarse, long, ugly head and ear; and the thing may be safely classed among the non-essentials; yet a short, handsome, sprightly head, with light pointed pendulous ears, of moderate size, are pleasing to the view, and may sometimes have a favourable effect in the market. For head and ears the Oxford or rather smaller Berkshire pigs are good models, and for true shape the improved Shropshire, Hereford, and Gloucester. If colour deserve any consideration, he should prefer the light and sandy and yellow-spotted, at least such skins appear far the most delicate when dead. In respect to the skin of pork, he gives a preference to the thick over the thin skin."

And he remarks, that "our best-bred pigs are often thick-skinned, but such skin is tender, gelatinous, shining, easy to masticate, even in the shape of roasted crackling, and very nutritious; whereas to eat the crackling of thin-skinned pork, case-hardened by the action of fire, requires teeth equal to the division of block-tin. The health of swine is to be estimated by their cheerfulness, by the gloss upon their coats, and their skin being whole and free from eruption: it is an extremely unfavourable indication when the head is hung down, the snout approaching the earth like a fifth leg, and when the flanks heave and are hollow. If pigs *bark* (snort) on being alarmed, it is an excellent sign of sound health and good keep."

The breeds of these animals are so extremely numerous, that almost every county or district is in possession of a particular kind. But they may be distinguished into the large and small sorts, of the former which the following are the most valuable breeds.

The principal districts for the breeding and rearing these animals, at present, are, *Berkshire—Hampshire—Shropshire—Gloucestershire—Herefordshire—Wiltshire—Northamptonshire—Leicestershire—Lincolnshire—Yorkshire—Norfolk—Suffolk & Essex.*

Berkshire breed. This is a breed which is distinguished by being in general of a tawny, white, or reddish colour; spotted with black; large ears hanging over the eyes; thick, close, and well made in the body; legs short; small in the bone; having a disposition to fatten quickly; when well fed the flesh is fine.

The above county has been long famous for its breed of swine. But according to Mr. Lawrence, "the old breed is now so totally worn out, that he believes for many years past, no possibility has existed of obtaining a living model. They were thus described to him, "long and rather crooked-snouted, large heavy ears, body long and thick, but not very deep, legs short with much bone. They formerly made great weights."

But the new or present breed is, he says, lighter in the head and ear, shorter in the carcase, with somewhat less bone, and higher in the leg, in colour generally dark spotted. He supposes, that "the Berkshire breeders have made a very judicious use of the pug-cross, by not repeating it to the degree of taking away all shape and power of growing flesh, in their stock; and he is informed they now mean to discontinue any farther mixture. The breed, as it now stands, is, he says, about in the third class, in point of size, excellent in all respects, but particularly as a cross for heavy, slow-feeding sorts. The small porking variety of Berks, and those of

Oxfordshire, with round carcases, short and handsome heads, appear to him to have descended from the Axford breed."

It is an useful breed that has extended itself from the district from which it takes its name, over most parts of the island. It is the sort mostly fattened at the distilleries; it feeds to a great weight, and is good for either pork or bacon. This sort is supposed by many as the most hardy, both in respect to their nature and the food on which they are fed. A sow and boar of this breed is shown at *figs.* 3 and 4 in *Plate* XXXVII. The Berkshire is, however, a sort of hog that requires constant good keep, declining fast under other circumstances.

Hampshire breed. This is a breed of large hogs, which is longer in the body and neck, but not of so compact a form as the Berkshire; they are mostly of a white colour, or spotted, and are well disposed to fatten, coming up to a great weight when properly managed in respect to food.

But Mr. Lawrence says they "are generally dark spotted, some black, of a longer and flatter make than those of Berks, ears more pointed, head long and sharp, resembling the Essex." But "he speaks of them as they are found in the range of Basingstoke and Andover. They are generally, he says, bought up with the Berks stock, the dealers themselves being unattentive to any distinction between the two varieties. The goodness of the Hampshire hog is proverbial, and he has never observed in any breed, greater or quicker proof."

Shropshire breed. This is another large breed of hogs, which are found valuable where the keep is in sufficient abundance for their support. They are not so well formed as those of the Berkshire kind, or equal to them in their disposition to fatten, or to be supported on such cheap food.

The standard colour of this breed, according to Mr. Lawrence, is white, or brinded; and that anterior to the late improvement, they might be looked upon as nearly as possible, the original large breed of England.

They are a breed "of the largest size, flat bone, deep and flat-sided, harsh or rather wiry-haired, the ear large, head long, sharp and coarse, leg too long, loin, although very substantial, yet not sufficiently wide, considering the great extent of the whole frame. With all their defects, they were, he says, ever excellent stock, and have been improved within the last fifteen years by the Berkshire cross, which has reduced the length both of their legs and carcase, and rendered their heads lighter: in consequence the new variety, shewing the Berkshire spots and form, feeds quicker than the old" sort of these animals.

Shropshire has long bred stores for the supply of the London feeders, and of the Essex farmers, who thus turn their clovers to the most profitable account.

Gloucestershire breed. It is likewise a large breed, but inferior to either of the above, being tall and long in shape, and by no means so well formed. The colour is in general white. It has two wattles hanging from the throat. Mr. Marshall supposes this to have been the prevailing breed of the island. It is said to be thinner in the skin than the Berkshire breed, and to require better sorts of food.

According to Mr. Lawrence, this breed is a "size under the Hereford sort, and a shorter and more truss pig; there is also, he thinks, a handsome roundness of the bone and frame, which distinguishes this breed." Formerly he used to see many sandy pigs among them, and some with very heavy, thick ears. They are not now so heavy-eared." They are, he says, good stock for any purpose.

Herefordshire breed. This is also a large useful breed, but perhaps without possessing any advantage over those that have been described above. Mr. Lawrence thinks it "a variety of the Shropshire, or an intermixture, which cannot now be traced. He says they are shorter, have less bone, and lighter heads, ears smaller, thinner, and more pointed, coats somewhat less harsh than those of Shropshire, and are quicker feeders, colour originally light. There may be found in this breed many individuals of the truest form; they are generally good, sound stock, full of growth, and assuredly among the most profitable bacon-hogs we have." They have been of late crossed with the Berkshire boars, of which the best of them did not, he thinks, stand in any great need.

Rudgwick breed. This is a large kind of swine, which the author of the Survey of Middlesex says, is the largest in the island, met with at the village of that name, on the borders of Sussex and Surrey. They feed to an extraordinary size, and weigh, at two years old, nearly double or triple the usual weight of other sorts of hogs of that age. As large breeds pay the farmer the best in many cases, such a breed deserves to be attended to in the system of hog management.

Large spotted Woburn breed. It is a breed introduced by the late Duke of Bedford, being large in size and of various colours. It is a hard well formed prolific sort, rising quickly to a large weight.

Wiltshire breed. This is a long-bodied, low hog, hollow about the shoulder, and high on the rump, middling large pointed ears, round bone, light in colour. It is stated by Mr. Lawrence, that "of late years this breed has been crossed with the pug, and with the Berkshire sorts, and that the new variety appeared to him smaller than the old breed, and darker in colour, spotted, with round carcase, handsome pug face, and some with prick-ears." It is added, that this cross is by no means a new thing. The boars originally made use of, were of the wild breed from Barbadoes, in colour red, or red spotted with black, which were sent from that island, more than fifty years since, by a gentleman to his relation at Axford, near Marlborough, and thence the variety produced, were long called the Axford breed. Without doubt, he says, the Axford smaller variety, and part of the new Berkshires, originated in the same source."

Yorkshire breed. This in the old breed, was Mr. Lawrence says, probably the worst large variety we had; extremely long-legged and weak-loined,

their constitution not of the soundest; and bad stye-pigs in the winter-season; they were yet quicker feeders than some of the superior breeds. They have been improving, he says, some years from the Berkshire cross, but are still inferior to the north-western stock, rendering a less price at market. Probably short-legged Gloucestershire boars might succeed with this breed, or the entire adoption of Hereford stock might be attended with still more profit."

There are other breeds in different counties of a middle size.

Northamptonshire breed. This was formerly, according to the above writer, a handsome, light-eared, white, deep-sided pig, with middling bone, and quick of proof: the breeders have since, he says, tried the new Leicester, and, if he is rightly informed, without success. They have again, it seems, returned to their old breed, adopted some improving cross, and at present, breed middle-sized well-shaped pigs, both for their own and the Buckinghamshire dairy farmers.

Leicestershire breed. In the original stock, large, deep, and flat-sided, light-spotted, with rather handsome head and ear. Mr. Lawrence is not informed whether the Bakewell variety has much merit in its own county.

Lincolnshire breed. This is a breed that was formerly, according to the above author, "light-coloured and white, like those of Northamptonshire, many of them having curled and woolly coats. They are still, he says, middle-sized, quick-proving pigs."

Norfolk breed. This is a small, short, up-eared porking sort, various in colour, white, bluish, striated; generally an inferior kind, which, Mr. Lawrence says, it would be to the interest of that great corn county to improve; they are, however, of a thin-skinned, quick-proving kind. But in the vicinity of Lynn, and generally on the Lincoln side of the county, there is a larger-spotted variety of very good form and quality, which should be encouraged."

Suffolk breed. This is a small delicate white pig, which, the same writer says, "has for many years, had great reputation, and at this time, there is not only a strong prejudice in their favour, in their own county, but they have many advocates out of it. They are shorter, and more pug-formed than the Norfolks, and by their dish-face, and pendent belly, it may be supposed, that the variety proceeded originally from the white Chinese. Some of the Suffolks are very handsome, and very regularly shaped; their defects are, he thinks, that they are great consumers in proportion to their small bulk, and that they produce little flesh. He supposes that the small Hampshire boar, would be a profitable cross for sows of this breed."

Essex breed. These are "up-eared, with long sharp heads, roach-backed, carcases flat, long; and generally high upon the leg, bone not large, colour white, or black and white, bare of hair, quick feeders, but great consumers, and of an unquiet disposition. A mixture of the tonky with this old breed produced an improved and shorter variety called the *half-blacks*, a very useful kind of pig."

In other counties, there are many other varieties, which it is unnecessary to notice here.

Mr. Donaldson remarks, that "the Berkshire and Hampshire hogs are the largest; but that it is most probably from the Berkshire stock, that the greatest number of the varieties of the country have sprung. And that they are of a very large size, the four quarters frequently weighing when fat, not less than from six to eight hundred weight; the medium weight of the hogs fattened for hams and bacon, do not, however, exceed from three to four hundred weight. The above writer speaks of a breed in the northern parts of Scotland, whose appearance, being very different from that of any other sort in the island, denotes them to have been the original breed of the country. They are small, ill-formed, bristly, wild looking animals, and are very probably the remains of that breed, which we may suppose to have ranged through the forests and woody parts of the kingdom for ages in a state of nature.

In the smaller breeds of these animals there is likewise much diversity or difference in regard to size, as well as other qualities.

Chinese breed. It is a breed which is distinguished by the neck being thick; the body very close, compact, and well formed; the legs very short, and the size small; the flesh delicate; the colour various, as black, white, brown, and tawny. This breed is particularly disposed to fatten in an expeditious manner, and has, in consequence, spread over a great part of the kingdom. It is most adapted for being used as pork, but is much too small for being cured as bacon. It is mischievous when not well rung. A sow and boar of this breed are seen at *figures* 1 and 2, in *Plate* XXXVII.

Small white English breed. This is another breed of the small kind of hogs, that is met with in many districts; it is of a white colour, thick, compact, and well made in the body; short in the leg; the head and neck well formed, and the ears slouching a little downwards. It is well disposed to fatten, and perfectly hardy. It prevails much in the northern districts.

Swing-tailed breed. This is an useful sort of the smaller kind of hogs, that is hardy in its nature, and of considerable weight in proportion to its size.

But some farmers prefer mixed breeds, as being more beneficial than either of the large or small perfect breeds. Where this is the case, the Berkshire with a cross of the Chinese, has been found a very profitable sort, as being capable of feeding to a considerable weight with a moderate proportion of food, and in a short time.

It is well remarked by the author of the "General Treatise on Cattle," that "nothing can be more groundless than the common assertion, that there is no such thing as breed in pigs, the only meaning of which is, he thinks, that the assertors have not taken the pains to seek it. The number of regular breeding counties of this article of stock is considerable, and the peculiar characteristics of form, in each variety, as distinctly marked as in any other class of animals. That there are numberless intermixtures; that radical

changes are introduced in the course of time, even in those districts most prejudiced in favour of their own peculiar variety, and that in many counties where a few only are bred for home use, they have no settled breed, is a common case with every other species of cattle." There can be no doubt but that the difference of breed in this sort of live-stock, is as obvious as in that of most other kinds; and that in order to have good pigs it is as necessary to be attentive to the breeds as in the other sorts of domestic animals.

And in the breeding, and crossing the different sorts with the view of improvement, much care is requisite to adapt them to the nature of the objects aimed at, on the principles that have been laid down in considering the nature of breeding animals for the purpose of the farm. See *Breeding*.

Whatever the breed or sort of swine may be, that is employed in the raising of the stock, the most perfect and best formed male and female animals of the same or other proper kind should be selected for the purpose. And in providing hogs for the purpose of breeding, they should be constantly well fed, has by being stinted in their food, their growth and healthy condition is considerably affected.

It has been observed that in cases where there is a certain vent for the stock produced, the breeder will be well repaid for growing and purchasing food in this view. And that breeding, in proportion to the greater trouble and risk, is more profitable than purchasing the stores. Further that if it be intended to breed for sale, in a store state, it is of the more consequence to procure a regular and well-shaped breed; as such will always meet a preference in the fair or market, especially if they are to be driven to the southern districts. The nature and size of the breed should depend upon the abundance or scarcity of food. In the former case the large breeds are said by Mr. Knight to be the most profitable, from the circumstance of the difference in the proportions between the living and the dead profitable weight, being the least in the largest breeds.

And it has been suggested that the best stock may be expected from the boar at his full growth, but not more than from three to five years old. And that no sows should be kept open for breeding, unless they have large, capacious bellies. Being well fed from the teat, the sow will procreate at seven months, and if she be of the kind, in which the strong tendency to fat increases the risk of bringing forth, probably the suffering her to breed as early and as quickly as possible may contribute to amend the defect. And it is suggested that if a sow of this description would admit the boar, the third, or within a few days after pigging, imposing upon her the severe task of constant breeding and suckling, would doubtless keep her sufficiently lean and roomy for the production of a good litter. It is probable however that the quality and size of the pigs would suffer.

Some suppose it better to defer the sow's taking the boar till ten or twelve months old, as she becomes more strong and affords better litters of pigs, and that the boar should always be a year old or more before he be put to the sows, as by this delay he attains a better growth, and is more vigorous.

In respect to "the period of being with young, in the sow it is about four months; and the usual produce is from about eight to ten or twelve pigs in the large, but more in the smaller breeds, which in general bring the greatest number, and the most early."

In ordinary sows, after they have had two or three litters they may be killed, but no breeder should part with one, whilst she continues to bring large litters, and to rear them with safety, although custom often induces the farmer to kill such sows and to substitute others of not perhaps half the value in their places. In cases where swine are made an object to the farmer, great care should be taken to have a good boar constantly along with the sows, in order that a proper succession of young pigs may be produced. And by this means the sows are likewise made to take the boar more expeditiously.

It has been observed by a late writer that "as there is great difficulty and expense attending the rearing of young pigs in cold seasons, the farmer should contrive as much as possible to have his litters early in the spring and autumn seasons, as about the end of March or beginning of April, and the latter end of July, August, or beginning of the following month; as at these periods much less loss will be sustained in the death of the pigs, and less expense be incurred in food. The litters which are pigged in June, or the early part of the following month, should always be reared as being highly profitable and advantageous. But it is seldom advisable to keep the late autumn litters, as the cold in the winter is almost sure to destroy many of them" and produce much loss.

With a late litter, it may, however, sometimes, perhaps, be beneficial to suffer them to suckle and feed with the sow, the keep being of the most forcing kind, during three or four months, from which management the most delicate pork might be provided at a scarce season.

Great care should be taken that the sows as they advance in their pregnancy be lodged separately, lest their bellies be hurt by others lying upon them; and it is of still more consequence, that no other swine be within reach of them at the time of bringing forth, since in that case the pigs would most probably be devoured as they fall. The sows should also be attended in pigging with much care in order to preserve the pigs; and it may be necessary sometimes during three or four days. Such sows as have the unnatural propensity of devouring their young, should be well secured at the time, and be disposed of as soon as possible, as they never do any good in keeping as breeders.

It is found that dry, warm, and comfortable lodging is of almost as much importance as that of food; in this system of management, the sows and pigs not being turned abroad by any means in bad weather. The pigs may be weaned in about eight weeks, after which the sows may be shut up, feeding them well, and on the return of their milk, they will mostly express very plainly their desire of taking the boar. The sows require to be fed in an extraordinary man-

nor while they are nursing, particularly if they have a number of pigs to support.

In the pig system it is also of much consequence both in respect to economy in labour of their attendance, and the raising of a large proportion of manure, as well as the advantage of the hogs to have regular and convenient piggeries upon an extensive scale, containing separate apartments for every description, with offices for boiling and stowage, and cisterns to contain wash for the animals. See *Hog-Stye*.

And in the management of these animals, it is of great utility and advantage to keep the different sorts separate and distinct from each other, as the sows in pig, those with pigs, and the stores according to their ages, as it is only in this way that they can be kept to the most profit and advantage.

In regard to the food of this sort of farm stock it has been remarked that "as the breeding of pigs is a business that affords the farmer a considerable profit and advantage in various views, it is of essential importance that he be provided with suitable kinds of food in abundance for the support of the numerous sows that it will be necessary for him to keep, and the great number of pigs that must be raised. Upon this being properly and effectually done, his success and advantage will in a great measure depend. The crops capable of being cultivated with the most benefit in this intention are beans, peas, barley, buck-wheat, potatoes, carrots, parsnips, Swedish turnips, cabbages, lettuces, clover, lucerné, chicory, &c. The proportions in which these crops should be grown for this purpose must vary according to circumstances; as the kind of hogs, their extent, and the manner of disposing of them; but, whatever number may be kept, an equal proportion of root crops and those of the grass kind will be requisite, with about half as much of those of the farinaceous or grain kind, as those of the root sort; and a quantity of the luxuriant vegetable kind, fully in proportion to the number of hogs that are to be fed on such sorts of food." And that in "the supplying of the hogs with food, a distinction is to be made according to the different kinds, in order that the most may be made of the food. The sows considerably advanced in pig, and those with pigs, should be fed in a better manner than the store pigs. The former should be supplied with good wash twice or oftener in the day, and have a sufficient allowance of cabbages, potatoes, carrots, or other similar vegetables, so as to keep them in good condition; which is shown by the gloss of their coats. The sows with pigs should be kept with the litters in separate styes, and be still better fed than those in pig. Where dairying is practised, the wash of that kind which has been preserved for the purpose, while the dairying was at the height, in brick cisterns, constructed for receiving it from the dairy, must be given them, with food of the root kind, such as carrots, parsnips, potatoes, and cabbages, in as large proportions as they will consume them, in order that the pigs may be properly supported and kept in condition. But where the business of dairying is not carried on so as to provide wash of that sort, meal of some kind or other must, Mr. Young says, be had recourse to for the making of wash, by mixing it with water, which, in the summer season, will be sufficient for their support; and in winter it must be blended with the different sorts of roots prepared by boiling, or when for the young pigs, with oats and pea-soup. With this soup and dairy-wash, where proper attention is bestowed, young pigs may, he says, be weaned and reared in the winter season even with profit and success. The pea-soup is an admirable article when given in this intention; it is prepared by boiling six pecks of peas in about sixty gallons of water, till they are well broken down and diffused in the fluid; it is then put into a tub or cistern for use. When dry food is given in combination with this, or of itself, he advises oats as being much better than any other sort of grain for young pigs, barley not answering nearly so well in this application. Oats coarsely ground has been found very useful for young hogs both in the form of wash with water and when made of a somewhat thicker consistence. But in cases where the sows and pigs can be supported with dairy wash and roots as above, there will be a considerable saving made by avoiding the use of the expensive articles of barley-meal, pease, or bran and pollard. The farmer should however cautiously avoid having recourse to such substances, in these circumstances, as being unprofitable.

Mr. Donaldson remarks that in the usual mode the "pigs reared by the farmer are fed, for some weeks after they are weaned, on whey or butter-milk, or on bran or barley-meal mixed with water. They are afterwards maintained on other food, as potatoes, carrots, the refuse of the garden, kitchen, scullery, &c. together with such additions as they can pick up in the farm-yard. Sometimes they are sent into the fields at the close of harvest, where they make a comfortable living for several weeks on the gleanings of the crop; at other times, when the farm is situated in the neighbourhood of woods or forests, they are sent thither to pick up the beech-mast and acorns in the fall of the year. And that when they are arrived at a proper age for fattening, they are either put into styes fitted up for the purpose, or sold to distillers, starch-makers, dairy-men or cottagers."

And he adds that "swine are sold to the butcher at different ages, and under different names; as pigs when a few weeks old; as porkers at the age of five or six months; and as full grown hogs at from eighteen months to two years old. The young pigs are commonly roasted whole: the porkers are used as fresh or pickled pork; and the full grown hogs are for the most part converted into ham and bacon. The demand for porkers, which for London in particular, is very great, and which continues almost throughout the year, is chiefly supplied from the dairies within reach of that metropolis. From the time they are weaned they are kept constantly on whey, or skimmed or butter milk, with frequently an addition of pease or beans, or barley-meal. Such good keeping not only makes them increase rapidly in size, but renders them fit for the butcher at an early age, which is a point of some importance."

It is also a matter of importance in the management of sows and pigs, to keep them constantly well littered down with clean straw, or some other similar article, as by this means they are kept perfectly clean and healthy, and at the same time a large quantity of manure will be raised.

It is obvious that where the practice of cultivating crops of various kinds purposely for the food and support of swine prevails, the sows and store pigs will of course be supported during the winter season, as from the beginning of November to the middle or latter end of May, by the various roots as above that have been stored in this intention, in combination with the preserved dairy-wash, and other articles.

It is advised by Mr. Young that at the latter of the above periods the whole of the hogs in the yard should be looked over and sorted; such as have attained half or more of their growth being drawn and turned upon the clover, lucern, or chicory crops, where they should be kept till towards the latter end of September, the fences being kept in perfectly good order, and proper ponds and other places provided for the hogs to drink at. Under this management they are found, he says, to grow rapidly, the food in general agreeing well with them, and they are then taken up in excellent condition for being fattened.

In this system the material difference from the former mode is, he says, in selecting the sufficiently-grown hogs from the sows that have pigs, and the weaned pigs, and only leaving the latter to be fed with the dairy or other wash, with suitable green food, such as lettuces, cabbages, tares, &c. by which a much larger stock of breeding hogs may be kept. The tares and cabbages may be used for the sows that have spring litters, and the lettuces for those that have autumn litters. See *Lettuces*.

It is observed that these plants are of great use for sows and pigs, promoting the increase of milk in a great degree; affording great assistance where the dairies are small, and in all cases tending to prevent the consumption of grain, which is of great importance in hog management. From the sweet juicy quality of the lettuce the hogs are not only extremely fond of it, but it becomes highly nutritious. In this way the swine may be well supported and carried forward till the stubbles are cleared, when they may be turned upon them, and thus the whole year be provided for, in these different ways, with the greatest economy and profit.

It is however stated by some that although this system of management be advantageous, that of soiling the hogs in the yards with green food, cut fresh in the way directed, under that head, is, notwithstanding the increased expense of it, and the unavoidable waste of a certain portion of the food, highly preferable on account of the vast store of manure that may be raised. It cannot however be attempted with propriety, unless the farmer be provided with abundance of some sort or other of materials for the purpose of litter, and substances of the peaty or earthy kinds, for the purpose of covering the floors of the hog-yards, in order to absorb and prevent the waste of any portion of the liquid matters that may fall upon them. In this method clover, chicory, tares, and lucern, are the kinds of food that are most commonly employed; but there are others that may be brought in to their assistance when necessary, especially on the stronger sorts of land, such as beans eaten green, which afford a large quantity of food in proportion to the land they occupy, the whole stems being consumed; and cabbages may likewise be had recourse to for the summer as well as winter food of these animals. Mr. Young advises, that the yards of the hog-styes should have gates sufficiently large for bringing in carts loaded with the different articles of both food, floors, and litter, as well as for removing the manure that is made in them.

In this system of practice "instead of a few sows only being kept, as was usual in combination with the dairy system, great numbers may be maintained, and a great many young pigs be raised. But in order to derive the greatest advantage from it, the above writer thinks it should as much as possible be so contrived that the sows only pig twice in the year," as has been mentioned above; as by this means there will "never be a long and expensive season for rearing the pigs before they are put to the staple food of clover or potatoes, &c. But this circumstance is much removed by the provision of crops raised expressly for swine."

The use of hay-tea in the store feeding of hogs has been attempted by Mr. Saunders of Stroud, Gloucestershire, with much success. He was led to the use of this liquid from considering its effects in weaning calves. In his experiments, as stated in the Agricultural Magazine, the sorts of hay made use of were *clover*, *sainfoin*, and *lucern*; and he "thickened the tea or wash indiscriminately, with either grains, or bran, or pollard, or any kind of meal, or boiled cabbages, or *boiled potatoes* (carrots, though excellent, he had none); sometimes adding two or more of these articles, as his stock of either most enabled him. And he had the greatest satisfaction to find, that he made *a single suck of boiled potatoes*, when mixed with wash, and without any other ingredient, go as far as four or five sacks, (though boiled) when he gave them to the pigs alone; and the expense of the wash, thickened with potatoes, is considerably lower than potatoes alone. With the view of showing the practicability of prosecuting the plan individually upon a larger scale, he gradually increased his stock to upwards of four hundred; and in the course of his experiments he used nearly fifteen hundred hogsheads of the wash, consuming, when his stock was at its highest, about five hogsheads daily. And incredible as it may appear, he maintained them, collectively, at the very low rate of one penny a-head per day; and in excellent store order, and many of them fit for the butcher. It deserves particular attention, he says, that, in a week or fortnight after he commenced his experiments, the pigs, which he had before been feeding with potatoes alone, improved in their coats, which, from looking coarse assumed a gloss, and became fine

and short; a proof surely of the great nutrition of the food, and of its perfectly agreeing with pigs.

"Nor is it, says he, less remarkable, that this voracious animal, though fed with this food but twice a day (which he prefers to oftener) would lie down contented for the remainder, provided he was well-ringed, and had a warm and dry place to shelter himself under.

"And this he attributes to the following causes, besides the nutritive properties of the wash:

"He found it beneficial to store the boiled potatoes in large casks (in which he conceives they would keep good above a twelvemonth) and when they had remained in them some time, freed from the water that they were boiled in, (which is considered noxious) they not only went farther, but they generated a spirit; and the wash being also, as he apprehends, of considerable strength, they disposed the animal to betake himself to rest, from their soporific and intoxicating qualities; a circumstance evidently conducive to his quicker growth. Nor can an objection be raised to this food when applied to the flesh of the animal. So far from possessing any pernicious quality, it communicates, perhaps, a richer and more delicate flavour to the pork and bacon than they receive when fed after the common mode, and the butchers and others, not only eagerly purchased his pigs, but commonly remarked that they rapidly improved when put up to fatten."

And hence, says he, arises another most important consideration.

"He is confident he could make one sack of meal, of whatever description, go as far as two sacks in the common mode of fattening. For, by gradually thickening the wash with meal, it forms, he thinks, the best introduction to the higher and last stages of fattening, both for pork and bacon; indeed that method should be followed throughout the process, using the wash instead of water. The increased quantity of a cheap and highly nutritious food, thus administered, will satisfy the voracious habits of this animal, and yield, he says, the greatest profit; and this alone would cause an immense annual saving of corn, which would tend to ensure plenty and cheapness; the grand desiderata in all experiments. For the price of a commodity, in a great degree, depends on the relative quantity produced, and the regular consumption; to lessen the consumption, therefore, diminishes the demand, and has the same effect as increasing the supply, which must necessarily cheapen the article."

And his calculations of the daily expences of this mode of feeding, are the following:

He observes that "clover, or sainfoin hay, at 4*l.* 13*s.* 4*d.* per ton, is four shillings and eight-pence per hundred, and one halfpenny per pound; and that twenty pounds of either, well boiled, will make, with the addition of the incorporating ingredients, sufficient wash or food to maintain, throughout the day, fifty store pigs, from three months old to an indefinite age upward."

Estimation of daily expences of keeping fifty store pigs.

	L.	*s.*	*d.*
To potatoes, two bushels, (120lb.) at 5s. per sack	0	2	6
To clover, or sainfoin hay, 20lb. (which will give 10 quarts, or 2½ gallons of liquid food to each pig)	0	0	10
To coal, half a bushel (at 6*d.* per bushel, average value)	0	0	3
To attendance, boiling food, serving, &c.	0	0	6
Total	0	4	1

This is 1*d.* short of 1*d.* a head per day.

Again;

Potatoes, 1 bushel, (60lb.)	0	1	3
Grains, 2 bushel, at 6*d.* per bushel	0	1	0
Clover, &c.	0	0	10
Coal	0	0	3
Attendance	0	0	6
Total	0	3	10

This is 4*d.* short of 1*d.* a head.

Or;

Potatoes, 1 bushel	0	1	3
Meal of any description (particularly oatmeal, as being the cheapest) or pollard	0	1	4
Clover	0	0	10
Coal	0	0	3
Attendance	0	0	6
Total	0	4	2

This is exactly 1*d.* per head.

It is remarked that "carrots, either raw or boiled, are excellent; and these, with oatmeal and grains, would make a cheap and good addition. And that the hay, when put into the furnace to boil, should be inclosed in a net, or a basket with a lid to it, or in a tin kettle and cover, filled with large holes, and the potatoes, (or carrots, &c.) should be steamed over the tea, whilst gently boiling or simmering. This may easily be done, by fitting to the furnace, a vessel, having a number of holes of the size of a common auger bored through the bottom of it, so as to allow the steam to pass through the potatoes with which the vessel is filled; and having a little moist clay, or a wet flannel or cloth put circularly round the bottom, where it rests on the mouth of the furnace, so as to secure the steam from escaping. By this mode of steaming the potatoes a considerable saving will be made in the article of coal. The potatoes should be but slightly steamed or boiled, and not reduced to a pulp, and whilst hot should be trod or rammed in casks for future use. The hay, after boiling, may be dried, and perhaps, offered to store cattle; or else thrown to the pigs as litter, or, to add to the dung heap. The wash should be carefully given to the pigs in a lukewarm state, and if meal or pollard

be added it should be thrown into the tub or cooler, immediately after boiling the wash, and well mixed together;—but steaming the meal or pollard, and even the grains, might be a further improvement. The water, where there is a sufficient fall, may be led into the furnace, without any trouble whatever, by means of a leaden pipe; or may be conveyed into the furnace by a spout from the pump; and the tea may be drawn off, through a cock into a cooler, which should be placed by the side of the furnace. To convey the wash to the pigs he used an open barrel or hogshead, suspended upon a pair of shafts with wheels to it, and drawn by a single horse."

It is added, that "in these estimates of the expense of maintaining the pigs, it should be observed, that he has taken no credit for the article of manure; and thus his pigs will make the farmer a present of their dung, as well as pay him a good price for their keep. Fifty strong stores, with a sufficient quantity of stubble, (which is frequently ploughed into the land) or carpenter's shavings and saw-dust, or virgin earth, or sand, especially sea-sand, (where obtainable) laid down in the yard, will make, he says, in the course of the year, from two to three hundred waggon loads of excellent manure: the sea-sand will add saline particles to the manure, and check evaporation." And he thinks it "necessary to remark, as a most favourable circumstance, that the hay-tea binds the dung of swine, and renders it hard and black, like sheeps dung; and if it does not produce this effect, it must assuredly be either bad in quality, or not properly boiled, or not rendered sufficiently strong; all which particulars should be most carefully attended to; and the state of the dung is an admirable guide to go by. The hay should always be of an excellent quality; and that which heated best, and contains most of the saccharine juices, should have the preference. Bad hay is certain destruction to the pigs. Clover stands first, next sainfoin, and lastly, meadow hay. Indeed, most of his experiments were made, he says, (though not by choice), with meadow hay."

On the former of the above plans of keeping swine, the sales for lean hogs should, Mr. Young observes, annually take place in October, the litters of April being then disposed of as stores, and those of August kept till the same period in the following year, in order to be sold as baconers, when none are fattened on the farm.

In regard to "the expense of keeping all sorts of store-swine, it must obviously vary considerably, according to the convenience of procuring their food, and the excellence of the management that is pursued. In suckling sows, it has been estimated upon the average at from eighteen-pence to three shillings the week, and while in pig from one shilling to eighteen-pence; weaned pigs, at first, from one shilling and sixpence to two shillings and sixpence per head, and afterwards, till they are become fully grown, at from one to two shillings each in the week." Calculations of this sort are, however liable to much error, or differ greatly under different circumstances.

In respect to the practice of fattening of hogs, it is a business usually performed at two different times of the year, as in October and February or March: the former is, however, the most principal period. In this system various substances have been recommended; but those most commonly employed are some sort of farinaceous material, with skimmed milk, and dairy or other kinds of wash. For the smaller sorts of fattening hogs, coarsely ground oats mixed with these washes are excellent. Barley-meal and pollard are likewise frequently made use of for the purpose, with much success. The meals of pease and beans, when given in sufficient proportions for the purpose of fattening, are apt to heat them too much, and produce a difficulty of breathing; but for the large or full-grown hogs, pea-meal or peas unground are probably the best material that can be made use of. A portion of bean-meal, or whole beans, may likewise be given occasionally with advantage, as both these articles contain a much larger proportion of nutritious matter in the same bulk, according to Darwin, than any other sort of grain, and are more lasting in their effects on the system, from their undergoing the process of digestion more slowly, perhaps on account of their containing a larger proportion of oil in their composition. Malted barley given whole has likewise been found highly beneficial in the fattening of hogs, the quantity of sweet nutritious matter being thus greatly augmented, according to Mr. Bannister. Acorns in the same state have likewise been found to fatten hogs, but they cannot be depended on as a food for this use. Potatoes and carrots have also been occasionally tried in the same application; but as they never answer well without being boiled and combined with the meal of some sort of grain, it is a much better and more economical practice to convert them to the purpose of store feeding, and depend upon farinaceous substances for fattening the animals.

It is stated by the author of Modern Agriculture, that "in Hampshire, Gloucestershire, and some others of the forest-districts, beech-mast and acorns are much used, not only as food for hogs while rearing, but also as means of fattening them. In the former case, the hogs are driven into the woods, and allowed to forage for subsistence for a considerable part of the year, as well as in autumn: In the latter, those intended for slaughter in the end of the year, are brought home from the forests soon after the fall of the acorn and beech-mast is over; they are then put into styes, and their fattening is completed with the same sort of food, (a great quantity of which is collected by the poor people and sold to the farmers for the purpose,) with an addition of peas or beans or barley-meal." But that "the dairies are the great sources whence the butchers draw their supplies of hogs, as well as porkers. Just, says he, as the dairies are employed, either in the making of butter, or of cheese, so whey mixed with barley-

meal, or skimmed and butter-milk, are the chief sorts of food on which the hogs on a dairy-farm are fattened. Many are the incidental additions daily made to the stock of provisions set apart for the fattening hogs; in short, every sort of offal from the dairy, the kitchen, &c. is thrown into the trough; but milk and whey, or barley-meal, with an allowance of peas and beans, for a few weeks before they be killed, constitute the chief articles of food given to fattening hogs on all dairy-farms."

And it is added, that "very great numbers of hogs are annually fattened at the distilleries in the various parts of the kingdom. It is stated in the Report of the county of Surry, that between nine and ten thousand are fattened on the grains, wash, and other offals of three distilleries only in that district. From this some idea may be formed of the total number of hogs thus annually made fit for the butcher. In the first stage of fattening they are only allowed grains and wash; but for some weeks before they are ready for market, they are allowed daily a certain quantity of meal or grain; this not only brings them faster forward, but renders their flesh firmer, and better adapted for curing as salt provisions, the use to which it is for the most part applied." But, he thinks, that "perhaps of all the modes in which hogs are fattened, that adopted at the corn-mills and starch-works is the best; while the food on which the hogs are fattened (the refuse of grain) is freest from any nauseous mixture; it is also more nutritive than any other that is applied to the same use." These are the principal modes of fattening these useful animals.

In regard to the quantity or weight of pork produced by a given quantity of pease, beans, meal, or other materials employed in the fattening of hogs, it has not been well ascertained, and it is probable that a great deal will depend upon the size, breed and disposition to fatten; but, judging from the value of the animals before and after they have been fattened, it is supposed by Mr. Knight in a paper in the second volume of Communications to the Board of Agriculture, that a Winchester bushel of the first of the above articles may add about nine or ten pounds to the weight of a good hog of twenty score, or perhaps something more upon a larger, and considerably less on one of a small size. A hog, he says, when put up to fatten in good condition, (and they should never be put up in the contrary state,) which when fat will weigh twenty score, will consume in the proportion of six or seven bushels of pease or other similar materials.

In respect to "the method of giving the different materials that are employed in the fattening of swine, there are different opinions entertained; some contending that they should be used as much as possible in a solid form, wash, as drink, being occasionally used; while others prefer the contrary method as the most beneficial: as in the latter mode there will be less time taken up by the hogs in feeding, and of course more left for them to sleep and rest in, as well as more economy in the food and labour of giving it, it is probably the most advisable." Mr. Young supposes "the most profitable method of converting corn of any kind into food for hogs, is to grind it into meal, and mix this with water in cisterns, in the proportion of five bushels of meal to one hundred gallons of water, stirring it well several times a day for three weeks in cold weather, or for a fortnight in a warmer season, by which it will have fermented well and become acid; till which time it is not ready to give." This mixture must always "be stirred immediately before feeding," and "two or three cisterns should be kept fermenting in succession, that no necessity may occur of giving it not duly prepared. The difference in profit between feeding in this manner, and giving the grain whole or only ground, is so great, that whoever tries it once will not, he thinks, be apt to change it for the common methods." He further states that "pea-soup is an excellent food for hogs, and may, though he has not sufficiently compared them, equal the above, especially if given in winter, milk-warm." It is however well observed that wherever food is prepared by heat, the expenses of fuel and labour are a great drawback on the profits of the system. It should therefore be well considered before it is undertaken. But, in whatever way the food may be given, great care must be taken that the hogs have a full allowance at sufficiently short intervals to keep them constantly in a state of rest, as it is on this principle that they become fat in an expeditious manner. It is indeed frequently observed in fattening hogs, that they pay better for their keep in the latter part of their fattening than in the former; which probably arises in some measure from their not being fed in a sufficiently full manner, or with sufficient frequency in the beginning, so as to keep them in a state of perfect quietude in the sties.

With regard to the length of time that is necessary in fattening these animals, it varies much according to the state in which they are put up, their sizes, and the differences in their dispositions to fatten, but it is in general from five or six weeks to two or three months while this process is going on; it is likewise of great importance to keep the hogs clean, dry, and warm, by having them frequently well littered down, the advantage of warm sties, with warm food in cold weather, has been found to be very great in promoting the object of the feeder.

In all cases it is the best practice to have the pigs castrated while young, as the male pigs may be gelded at about three weeks old without danger, and the female ones be cut or spayed when a month old; though, in the latter case, the operation is frequently performed at a much later period. The sows, when not wanted for the purpose of breeding, may also be spayed: this business is mostly done by persons who are in the constant practice of it, and requires experience and care. See *Spaying*.

There is a constant necessity to keep all sorts of swine constantly well ringed, in order that they may

rest quietly in the sties, and of course thrive in a more perfect manner. This has also been effected by cutting away the cartilage of the nose, in which there is no danger.

In the management of hogs much loss seems to have arisen from the supposition that they can only be kept with profit in so far as they may consume the materials that would otherwise be wasted on the farm. There cannot however be any doubt but that swine will pay for their keep as well as any other sort of live stock whatever, where a judicious system of cultivating crops purposely for them is pursued. This has indeed been fully shown by various statements that have been made on the subject by different writers.

The author of the Treatise on Cattle has well observed that "it is not improbable, that the reputation of Westphalia for the excellence of its cured pork, is derived from an high antiquity." That the superior delicacy and luxurious flavour of young milk fed pork is acknowledged, although such a commodity is not to be obtained in every part of the country." "And he adds that "pork, of all other flesh meat, is best adapted to curing and preservation with salt, and has the further merit of never cloying the appetite; for it appears that men will subsist longer upon that diet, without desire of change, than upon any other flesh; in various parts of the country the labourers, and even the farmers themselves, very rarely taste, or desire to taste, any other. It is doubtless, he says, from its solidity, the most œconomical and the most nutritious food."

But he adds that it must not be forgotten "that the superior excellence of swines flesh is materially to be attributed to the superior food which they require, and that pork or bacon will always be solid and good, in exact proportion to the solidity and goodness of the articles on which the animals have been fed. For although grass, hay, roots, or oil-cake will fatten a sheep or an ox, perhaps to the maximum point of goodness, nothing hitherto discovered will do the same with a swine, but milk, corn, or pulse." When fattened with all other sorts of materials the flesh is loose, flabby, and of very inferior flavour and quality.

In different districts there are different modes of curing the flesh of swine, according to the intention for which it is wanted. In the county of Kent when cured as bacon, it is the practice to singe off the hairs, by making a straw fire round the hog, an operation which is termed swaling. The skin in this process should be kept perfectly free from dirt of all sorts. "When the flitches are cut out, they should be rubbed effectually with a mixture of common salt and saltpetre, and afterwards laid in a trough, where they are to continue three weeks or a month, according to their size, keeping them frequently turned; and then, being taken out of the trough, are to be dried by a slack fire, which will take up an equal portion of time with the former; after which they are to be hanged up, or thrown upon a rack, there to remain till wanted." But in curing bacon on the continent, it is mostly the custom to have closets contrived in the chimneys, for the purpose of drying and smoking them by the means of wood fires, which is said to be more proper for the purpose.

But a more usual mode of curing this sort of meat is that of salting it down for pickled pork, and which is far more profitable than bacon. In this method, "after the hog is cleansed of the hair, and the head taken off, together with the legs and hands, and the necks, loins, and all the lean bones cut out which will amount to nearly two thirds of the whole hog, the remaining part, which is the fat or prime pork, is to be cut into pieces of the size proportioned to the circumference of the salting-tub, and every piece rubbed on each side and on every part with common salt, having some beaten saltpetre sprinkled on each. The bottom of the tub should also be covered with salt, and when the pork is sufficiently powdered, the pieces laid in, with the rind upwards, and every one pressed down with all the strength that can be used, and wedged in so close as to leave no apparant chasms. Over this layer is to be spread a covering of salt, with a very slight sprinkling of saltpetre, as too much makes it hard. In about a month or five weeks the brine will begin to rise, and in a short time afterwards, cover the whole surface of the tub; but if, from a defect in the salt, it should fail to dissolve into brine within that period, it will be necessary to make a quantity of brine and pour over the pork; for unless the whole be covered with brine, it will not keep well. In adding the brine, care should be taken not to disturb the pieces of pork" as that often does much mischief to the meat.

In the county of Westmoreland, where the curing of hams has been long practised with much success, the usual method is for them to be at "first rubbed very hard, generally with bay-salt; by some they are covered close up, by others they are left on a stone bench, to allow the brine to run off. At the end of five days they are again rubbed as hard as they were at first, with salt of the same sort, mixed with rather more than an ounce of saltpetre to a ham. Having lain about a week, either on a stone bench, or in hogsheads amongst the brine, they are hung up by some in the chimney amidst the smoke, whether of peats or coals; by others, in places where smoke never reaches them. If not sold sooner, they are suffered to remain there till the weather becomes warm." They are then packed in hogsheads with straw or oatmeal seeds, and sent to the places of sale. It has been found by experiment, as stated in the survey of that district, that hams lose twenty per cent. of their weight in the curing, which fully demonstrates the advantage and economy of consuming them without this sort of preparation.

Swine are subject to many disorders, most of which will be found under their proper heads; where the parts behind the ears, as is often the case in some sorts, crack and become sore in hot seasons, they should be anointed with a little saturnine ointment; and where the udders of the sows take on hard glandular swellings, as is sometimes the case, the use of

camphorated saturnine washes or ointments may be employed with benefit, care being taken to have the parts clean wiped before the pigs are admitted to suck. And in such cases half a drachm of calomel may likewise be usefully given every second or third night for two or three times, by which a favourable change may be induced.

In short the hog from the excellence of its flesh, its prolific nature, and its quick fattening properties, may be considered as one of the most profitable and advantageous of our domestic animals; and which might probably be reared and fattened in many situations in which it is yet but little regarded by the farmer.

SWINE-CRUE, a provincial term used for a hog's stye.

Swine-*Herd*, a keeper of swine.

Swine-*Thistle*, the same as the sow thistle. See *Thistle*.

SWINGLE, a term signifying a crank; also an implement used for beating rough flax.

Swingle-*Hand*, another term applied to the same implement.

SWINGLE-TREE, a term signifying a splinter bar whippin, or whipple-tree. See *Whipple-Tree*.

SWINHULL, a term applied to a hog's stye.

SYCAMORE, the name of a tree well known in many places. It grows to a large size; the wood is soft, white, and valued by the turners: this tree thrives better than most other sorts near the sea, and is frequently cultivated to screen plantations of other kinds from the spray.

It is a tree of the timber kind, which throws out a wide spreading head. Its leaves are vine-shaped; and on their first appearance are of a pleasant green; but their beauty is soon destroyed by the perforations of insects, which lessens its value for ornamental purposes.

It is a sort of tree which is easily increased, as in the autumn, when the keys are ripe, they may be gathered, and in a few days after sown, about an inch and a half deep, in beds of common mould. In the spring the plants will appear, and make a shoot about a foot and a half by the autumn following, if the ground of the seminary be tolerably good, and they are kept clean from weeds. In the spring after they come up, they should be planted in the nursery, in rows two feet and a half asunder, and their distance in the rows must be one foot and a half. Here they may remain till they are big enough to plant out finally, with no further trouble than taking off unsightly side-branches, and such as have a tendency to make the tree forked, except digging between the rows, which must always be done every winter.

It is a tree that grows well on most sorts of soils, and of course may be usefully cultivated in many cases by the farmer. It is observed by Mr. Young, in the seventh volume of his Annals of Agriculture, to be the only tree which grows erect, and resists the wind and spray of the sea; but the beech has lately been found to answer well in such situations.

SYKE, a rill or small brook, in a low boggy situation.

SYTHE. There are several different sorts in use for different purposes, and in mowing grain crops, they are frequently prepared in different ways for placing the corn with greater regularity and exactness, as may be seen in a plate in the fifth volume of the Repertory of Arts and Manufactures, &c. See *Scythe*.

T

TABERN, a term sometimes applied to a cellar.

TACK, a term provincially applied to the substance, solidity, or proof of food, in respect to the food of cattle or other sorts of live-stock.

TAGGE, a term applied to young sheep of the first year.

TÆNIA, in *Farriery*, a broad worm like a piece of tape, for which reason it is called the tape-worm. See *Worms*.

TAIL, that part of an animal which projects from the rump, and which is useful to it as a means of brushing off flies, &c. This part is different in size and length in different animals. The horse's tail has undergone various modifications, according to the fashion of the times, from the dock or stump of former times, to the bushy half-lengths of the present. These indeed are the most rational and becoming, if any species of mutilation be supposed to add to beauty. See *Docking*, *Nicking*, &c.

The practice of *docking* or cutting the tails of sheep is had recourse to, not only in this country, but also in others, and every district where the inhabitants pay much regard to the improvement of wool-bearing animals. The tails are usually cut when the lambs are three or four months old, as when the operation is deferred beyond that time it cannot be performed with safety to the animal. It is a practice which is objected to by some intelligent breeders, on the ground that it renders the sheep unable to defend themselves against the attacks of flies during hot seasons. By others however it is strongly recommended, because it tends to preserve the health of the animals, by keeping them more clean from the ordure which they, in a great measure, deposit on the fleece.

TAIL-*Soaked*, a disease incident to cows, by which the joint of the tail near the rump is affected.

TAIL-*rot*, in *Farriery*, a disease affecting cows that are ill fed during the winter. See *Yellows*.

TALL *Oat Grass*. See *Avena* and *Grass*.

TARLINGS, a term applied to the lighter parts of grain, which in clearing fall to the hinder parts of the heap, especially where the wind is had recourse to in the operation.

TALLOW CHANDLER'S GRAVES, the refuse of tallow chandlery, which is left after the melting of tallow, in a sort of cake, and which is an excellent manure, when blended with rich earthy materials; such as the vegetable mould from old ditch banks, the depositions from the bottoms of stagnant water ditches, or the turfy matters of turfy or boggy situations. These, whether to be used for grass or grain, may be blended with it in the proportion of four parts or more to one of the graves, and should be very minutely incorporated together by repeated turning and mixing. Its price however at present is much against its being employed as a manure. See *Manure*.

TANNER'S *Bark*, the bark remaining after being made use of by the tanners.

It is the bark of the oak tree that is chiefly made use of in this way, and which should be well rotted, by being laid in a heap before it be applied. It is said that for lands of the more stiff, cold and heavy kinds one load of this substance will afford them more improvement than two loads of the best dung. From being much employed in hot beds, it has lately become scarce and probably too expensive for manure. Where it can be procured in sufficient quantity, even after being used in forcing, it may be laid on with advantage.

It has been suggested that when laid upon grass land, it should be done soon after Michaelmas, that the winter rains may wash it into the ground, for if it be laid on in the spring, it will burn the grass, and instead of improving will greatly injure it, at least for that season. And where it is used on corn land, it should be spread on the surface before the last ploughing, that it may be turned down for the fibres of the corn to reach it in the spring: for if it lies too near the surface, it will forward the growth of the corn in winter; but in the spring, when the nourishment is chiefly wanted, it will be nearly consumed, and the corn will receive little advantage from it. Nor will it be proper to have this manure lie too near the roots of any plants, for when this happens it is prejudicial to most of them, but especially to bulbous and tuberous-rooted flowers. But when it is buried just deep enough for the fibres of the roots to reach it in the spring, the flowers have been exceedingly improved by it; and in some places, where this manure has been used in kitchen-gardens, it has greatly improved the vegetables. In the course of time tan is with certainty converted into vegetable mould. And when it becomes rotten and is spread pretty thick, it has been found of great use to grass ground. But the best method of rendering it useful is probably to mix it with lime

or perhaps with salt. Or after it is taken out of the tan-pit, and washed, to blend it with an equal quantity of fresh horse-dung, including the litter, and cover it from rain, but to let the whole be kept moist. And when the heat is gone off, to incorporate it with a fresh quantity of horse-dung, to renew the heat: when that is gone off, the whole being made into a compost with chalk, will form a very enriching manure for most purposes.

It was found that two waggon loads of tan from the tanners, with one waggon load of unslaked lime, on being mixed together, and lying for a week, and then used as a top-dressing for turnips and grass, were highly useful.

And it has been long since noticed by Mortimer that a piece of land in Cumberland of two acres and a half, was let for 11l. annual rent, in consequence of the emptying of the town tan-pits on it. And many other statements show it to be a powerful manure where it can be had.

TANSEY, *Wild.* See *Silver-weed.*

TAPE-WORM, in *Farriery.* See *Tænia* and *Worms.*

TAPPING *Oaklings*, the cutting of the tap-roots of young oaks, See *Oak* and *Timber.*

TAP-ROOT, that sort of root which shoots directly downwards to a great depth. There are many roots of this nature which are in constant use by the farmer, such as the carrot, parsnip, beet, &c. and there are many plants of the tree kind which have tap-roots, as the oak, &c.

TAR, a well known substance employed for various uses.

It is a material that may be found useful as an application for cuts in sheep by clipping, and also to the parts affected by the fly.

It is also of great use in some cases for applying as a paint to boarding, &c. but in this use a little tallow or other coarse fat should be melted with it, as by this means it goes farther and resists the weather more effectually.

TAR *Rope*, a term used to signify rope yarn, such as the thread of old cables. &c.

TAR *Water*, the fluid prepared by pouring water upon tar and letting it stand some time. It has been lately observed by Dr. Darwin, that the watering of ground with this water is capable of destroying the white slug, which is so highly destructive to vegetables.

TARE-*Barley*, a term applied to a mixture of tares and barley.

TARES, well known plants of the vetch kind, of which there are two species; the common, purple-flowered spring or summer tare; and the purple-flowered wild or winter tare.

The first sort has the legumes sessile, subbinate, suberect, the lower leaves retuse, toothed stipules marked by a spot, and smooth seeds. It is an annual plant which flowers in May or June; and it has the stems varying in size climbing or prostrate. The plant is more or less pubescent. The leaves three or many winged, with an elongated tendril, two or three cleft, and opposite or alternate leaflets, which are rather sharp pointed, often retuse and of various width, stipules semisagitate, more or less toothed, and marked on the outside by a black or pale impressed spot. The flowers are axillary, solitary or binate, subsessile varied with purple. The legume somewhat compressed, brown rough seeds, numerous, a little compressed, very smooth.

In the second sort, the legumes are sessile, solitary, smooth, the leaves subtrifugous, the lower ones being retuse, the stipules entire and the seeds tuberculated. It is likewise an annual plant, flowering in April or the following month.

It has the stems procumbent and divaricated; it is pubescent, the leaves two or three winged, with a simple tendril, which is often very short and almost abortive, the leaflets opposite, obcordate, sometimes lanceolate, and narrowed towards the top of the stalk. The stipules are semisagitate, commonly very entire, unspotted. The flowers subsessile, solitary, small, blueish. The legume is upright, very smooth, and many seeded. The seeds are cubical and rough-tuberculated.

There is a variety of this sort with a white flower; which is more tender, and which is little used in field husbandry.

It is distinguished from the former by its smooth legumes, its tough tuberculated seeds; its tendrils not being branched, and the leaflets not being more than six in number.

The following experiments in the culture of these different kinds of tares, were made by the Rev. Mr. Laurents, in order to ascertain their differences in hardiness, and are thus stated by the writer of the Agricultural Survey of the County of Suffolk:

I. *Experiment.*

On 30th of September, 1783, he sowed seeds of the winter tare and of the spring tare near one another in the same soil and exposure; and covered both with a coat of crumbled mould one inch deep. The weather proving mild the spring tare soon made its appearance; and two days after came up the winter tare. This ascendancy the former did not fail to maintain over the latter until the middle of December; at which time that was about six inches high, and this not above four. They both were in a vigorous and thriving condition, when a frost came on and continued for some weeeks. On a thaw taking place, he found the spring tare lying on the ground, slimy, and putrefied to the very root. The winter tare had received no damage. It grew up afterwards, and was ripe before the middle of August.

This difference in the effects the frost had on them, led him to view the state of tares in more open situations; where he found that in some grounds scarce any plants had been destroyed, in others patches of something in a state of putrefaction, resembling the dead tares in his garden, were observed.

II. *Experiment.*

And on the 6th of March, 1784, both sorts were sown in the manner described above, and in their springing up and growth a progress similar to that

which he had remarked in autumn was observed. Near a week later than the winter tare of the autumnal sowing, the spring tare of the vernal sowing arrived to perfect maturity. But the winter tare of the vernal sowing was mildewed, not a single pod of it ripening.

From these two circumstances, there appears, he thinks, a material difference in the constitution, if he may so call it, of the two sorts of tares in question. He says nothing as to the trifling difference in the colour and size of their seeds, but passes on to the only visible marks of distinction he was able to trace in watching the process of the two experiments. And this is a disparity in the first leaves of the upper part of the stalks of the plants when gathered about the end of November, while the leaves on the branches, which afterwards issue in the lower part, and in time from the bulk of the plants, resemble one another in the two vetches. This is all he has been able to offer towards the decision of the question.

The experimenter thinks that it requires no great degree of penetration in the husbandman to discover the necessity of keeping the seeds of the two tares separate and unmixed; since sown out of season neither is found to prosper. Hence the seedsman too may learn a lesson. What the practice in other places may be he cannot tell; but in the course of last summer, wishing to compare with our winter tare that which is cultivated in the Pays de Caux, and called there by the farmers *hyvernache*, he searched almost every shop in Rouen, where it was likely to be found, in vain. And the reason assigned for his disappointment was, that the time of sowing it was over. So very nice and exact a proportion between the wants of the farmer and the stock at market, struck him, he says, as a case somewhat remarkable; the solution of which is this: after the autumnal sowing, the remains of the hyvernache are thrown in among the other vetch. Now, continues he, this practice stands condemned by the result of the second experiment.

In the way of distinction in these different sorts of tares, it has been remarked by Mr. Bannister that "the seeds of the winter and spring tare are not easily discriminated, being nearly alike in size and every other characteristic; but that on the appearance of the blade the difference is at once to be perceived. The winter tare vegetates with a seed-leaf of a fresh green colour, whereas the spring tare comes up with a *grassy spear*, of a brown dusky hue."

It is evident from the tall hardy growth and succulent quality of the winter tare that it must be a plant of much value to the farmer, as affording an abundant produce of green food for animals; and by being alternated with those of the grain kind, in ameliorating or preventing the exhaustion of the land that must otherwise take place. It has been suggested by the writer of the Agricultural Survey of the County of Middlesex, that it "may be made the means of enabling the arable farmer to support as much live stock as the grazier," as while crops of this sort remain upon the ground they afford larger supplies of the best kind of green food on the acre than the most rich and fertile grass lands; and they may be taken from the ground at so early a period in the summer season, as on the friable loamy soils to admit of a clean crop of turnips being obtained from the same land in the same year, and of those of the more heavy kinds sown with wheat. And while they are capable of being raised with success on most sorts of soils and situation, they support and fatten cattle and sheep of different sizes and breeds in an expeditious manner. And further, they afford a good preparation for other sorts of green crops, and in that way keep up the succession of such sorts of food for the fattening of additional quantities of animals, and in that manner afford abundance of manure in situations where it could not otherwise be procured. On the whole, he supposes, that by a judicious combination of this plant with those of turnips, clover, and saintfoin, the poor downs, sheep walks, and other waste lands may be rendered from ten to thirty times more valuable than they are in their present state.

To the farmer who has had recourse to the proper raising of these crops, there cannot be much doubt but that tares may be highly useful in the view of improving the land and supporting large quantities of live stock, and a plant that should be more generally grown in districts, where the support of cattle stock is an object.

In the first volume of the Farmer's Magazine noticed below, it is observed that "one material object procured by sowing tares, is, that the farmer is never at a loss for a sufficient stock of *green food*, be the season almost what it will. They also come in with great advantage betwixt the first and second cuttings of clover, or when the latter fails. Indeed, those farmers who are unprovided with tares, are at a great loss for meat for their horses, after the middle of August; and many have to resort to their hay stacks, which is one of the causes why that article is often so scarce. To attain the full benefit of this species of green food, the sowings ought, the writer thinks, to be at different times, beginning the first as early as possible, so as progressive cuttings may be got, without allowing them to stand till over ripe, when horses are not fond of them. In England, they have a custom of sowing winter tares; but he is apprehensive the climate of Scotland will not admit of this practice; at least, from some trials which have been made, expectations were disappointed. At any rate, summer tares may be got for food from the middle of July till the middle of November, and in favourable seasons, even later. There can however be little doubt but that the winter tare will stand the severity of the northern climate without injury.

It is a plant which in respect to soil, according to the author of the Present State of Husbandry, admits of considerable latitude, growing without difficulty or trouble on all the varieties, from the thin gravelly, to those of the deep and stiff clayey kind, but flourishing in the most vigorous and perfect manner on those of the gravelly, loamy descriptions, that are not too moist or wet.

In regard to the preparation of the land for this

sort of crop, there is less care necessary than for many other kinds of grass crops, as it will succeed well where the soil has not been so much broken down or reduced into fine mould; but it always grows in the most perfect and vigorous manner where a degree of fineness has been produced in the land by proper tillage having been given. But in common, two or three ploughings with occasional good harrowings in the intermediate times may be fully sufficient for the purpose at whatever season the crop is put into the ground. But they are sometimes sown even on one ploughing, especially the winter crops; the practice is not however to be recommended, especially on the stronger sorts of soils. Where the land is poor these crops should always be manured for, as is the practice in Suffolk.

In respect to seed, it has been observed that as the seed of the spring tare does not succeed well when sown for the winter crop, nor that of the winter kind when put in for the summer product, care should be taken to keep the seeds of the two sorts as perfectly distinct as possible. And that as they are from their being both of nearly the same colour and size as well as their agreeing in other particulars, liable to be mixed in the seed shops, it may be the best practice for the cultivator to preserve his own seed, as by that means he may not only be certain of having the seed good in its quality but of the right sorts, and of course may depend more fully on his crops. And it has been suggested by the writer of the Middlesex Report, that steeping the seed in dry seasons may be of utility in promoting the quick vegetation of the crop in many situations of land. With regard to the quantity of seed that should be employed, it should vary according to the nature of the soil, and the time of sowing. But from two bushels to two and a half are the proportions most commonly recommended. Some however advise three bushels, but on medium soils in the middle of the season the former, according to the above writer, may be fully sufficient; and where the land is of a more rich quality and the seed put in early, less may answer the purpose very well. But on poor sorts of land where the seed is sown late and the climate is backward, the latter quantity may not be too much. It has been observed by a late writer that "where the crops are either to be cut for soiling or to be fed down, the proportion of seed should be considerably increased, as not only a greater produce is thereby provided, but the growth of the crops rendered more quick and full."

In regard to the period and manner of sowing these sorts of crops, it is evident the former must vary with the intentions of the cultivator, but the winter sowings should be performed some time between August and October; in late exposed situations and poor soils more early than those of the contrary description. In the former about the beginning of August may not be too early, as has been shown in the Middlesex Report; but in other cases the latter end of that month or the beginning of the following may be a better time. The business should however for the general crop always be performed in such time as that they may be perfectly established in the soil before the cold season sets in, as by that means they may succeed much better. And for the spring sowings of these crops they may be executed from the beginning of March to the end of April with success; however, the sooner the better, as the plants will have got the more fast hold of the ground before the hot season sets in. It is of great use and advantage in providing a due succession of green food for spring consumption, to sow these crops at different periods in the autumn months.

The mode of sowing crops of this nature is mostly that of the broadcast, which should be performed as evenly as possible over the surface of the well-prepared land; the seeds being afterwards well covered in by proper harrowing, in order to prevent their being picked up by birds, and ensure their perfect vegetation and growth. It has been suggested, however, that in rich clean soil, it is probable the row method would succeed well with this sort of crop, as is the practice in some of the southern districts of the island, according to a late practical writer.

With some it has been the custom to sow a little rye with their winter tare crops, and a small quantity of barley with those of the spring; on which it has been observed, that "as plants of different sorts never succeed well together, it is probable that little advantage can be derived from the practice, especially as the tare is not a plant that stands much in need of protection in the early stages of its growth, and may be injured by too much shade and closeness."

It has however been suggested in the first volume of the Farmer's Magazine, that the most productive method of sowing this crop "when intended for seed, is to mix them amongst beans when drilled, at the rate of one firlot of tares to one boll of beans. From trials made, it is ascertained, it is said, that the quality of the tares is vastly improved by being blended with beans, as, by clinging to the latter, they are kept from the ground, and enjoy the full benefit of the sun, for ripening them in a perfect manner." And they are in this way much easier harvested than when sown by themselves. They answer, at the same time, for bands to tie the principal crop; and the produce may, on an average of seasons, be considered as at least double. As a considerable quantity of tares are annually imported in this country from England for seed, the writer is confident, if they were sown in the way here recommended, that it would not only render this importation unnecessary, but also enable the cultivators to supply other districts where they might be wanted."

It is stated however as "obvious, that when tares are intended for green food, there is no necessity for mixing them with beans. But, that when such is the purpose, they require to be sown tolerably thick, so as the surface may be early covered; and if the ground is good, and recently dunged, an acre of them will afford as much keep for horses and cows, as can be gained from a full clover crop; at least the writer has found them fully as beneficial."

It has been found that crops of this sort are capable of being grown well after wheat or barley, but, that they may be grown after almost any sort of crop where the land is in good heart.

These sort of crops, from their covering the land in a very complete manner, when they are sufficiently full, do not require any great attention during their growth. Some, however, make a point of hoeing, drawing out and clearing them of all the more coarse and rank kinds of weeds, that are in danger of doing injury to the tares, and which they cannot smother and overpower by their close growth. This business, when done, should be performed as early in the spring as possible. And it has been advised, "in order that the land may be in better order for the scythe, to have a light roller passed over the crops when the season is tolerably dry, in the very early spring months, as by this means all inequalities may be levelled down. Where any of the parts of crops of this sort that have run to seed, or any others are left for the purpose of a supply of seed, it is the usual practice to cut and *wad* them in the same manner as for pea crops, in order to their being afterwards housed or stacked up and threshed out in the winter season, when there is sufficient leisure for the purpose."

In the process of making tare crops into hay, more attention is found necessary than in those of most of the artificial grasses, as wet is more injurious to them, and they require more sun and air; but in other respects they demand the same cautious management, in order to preserve the foliage from being lost.

The time for cutting for this purpose is, according to the author of the Synopsis of Husbandry, when the blossoms have declined and they begin to fall into flat. When well made, the hay is of the best and most nutritious quality or properties.

The produce in these sorts of crops, as in those of other kinds, must be different, according to different circumstances, but where they are good in the winter kinds it is commonly very considerable.

The writer of the Report of the State of Agriculture in Middlesex, states it as the result of experience in having frequently weighed green tares, to be ten, or twelve tons per acre, which is a large crop. And when made into hay at about three tons the acre, which shows the disadvantage of making these crops into hay. The value of the produce, estimating it as if the whole were made into hay, being in that district from twelve to fifteen guineas the acre; and in situations where other sorts of hay sell at fifty shillings or three pounds, at from about seven pounds ten shillings to nine pounds the acre. And it is found, that the spring tare crops are lighter, and most liable to be injured by a dry season.

The produce in seed is likewise found to be considerable, being by some stated at from three to six sacks; but in other instances forty bushels or more, have been obtained from the acre. It has been suggested, that this sort of seed is greedily devoured by pigeons, and that it may probably be used for poultry with advantage and profit, as being a very stimulant sort of food.

These statements show the produce in green food to be large; but from its succulent nature, and the luxuriant growth of the crops, it is probably not greater than is frequently produced.

With respect to the application of tare crops, it has been well remarked by a late writer, that "there can be little hesitation in pronouncing that of soiling them with horses or other sorts of live stock on the farm, as the most advantageous and beneficial method." The great importance and advantage of this mode is, it is observed, "rendered particularly evident, by the great loss which has been just noticed, in converting them into hay. But in the practice of soiling, much loss is also evidently sustained, by cutting the tare crops at too early a period, as has been stated in the Survey of Agriculture for the County of Suffolk."

It has been, however, advised by the author of the Survey of Middlesex, that "the farmer's stock should be wholly supported on them, from the time they begin to blow till the blossoms begin to fall off, and the formation of pods take place." And, on account of the risk from wet, he advises, "that all the stock of a farm should be soiled on them green, as it will have the good effect of taking the stock off the grass land, long enough to allow of its being mown for hay; and by this means the meadow hay be much increased in quantity, and there will not be so much occasion for pasture, the tares abundantly supplying its place." And that besides, "at the time the cattle return from green tares, the grass land in the mean time having been mown, may be ready to receive them." And the able writer remarks, in addition that "as it would be wasteful in the extreme to turn live stock into a field of tares, as their treading and lying down would do great mischief to the crop, even by feeding it in small patches hurdled off; the most advisable method would be to mow the tares of the first half acre, and to carry the produce into the stables, cow houses, and fold-yards, or on to poor land, to be consumed by stock; then to hurdle the growing tares from such *cleared ground*, into which put the stock, and feed them all with the tares, given to them in racks, removing the hurdles and the racks forward daily to the edge of the growing tares; which will manure the land uniformly, and deposit all the urine in the soil."

The writer of the Gloucester Report on Agriculture, has stated another method of proceeding, which seems by no means ineligible, which is "to feed them through rack hurdles, which are made the same as the common five-railed ones, only leaving the middle rail out and railing upright pieces across, at proper distances, to admit the sheep to put their heads through. A swathe of vetches being mown in the direction you wish to plough the land, a sufficient number of these hurdles, allowing one to five sheep, are set close to it: at noon the shepherd mows the swathe and throws it to the hurdles, and the same at night; next morning a swathe being first mown, the hurdles are again set: thus moving them once in the twenty-four hours; by this trifling additional trouble the vetches are eaten clean off, and the land equally benefited."

It is observed by the writer of the Hertfordshire Report, that, in the heavy land districts, he found tares very generally cultivated for soiling the teams;

a husbandry that cannot be too much commended. And he adds, that it appears by the writings of Ellis, that this branch of agriculture was common in that county above sixty years ago, before it was at all practised in many other counties, and he was glad to find it hold its place steadily in the management of the present period.

It is stated, that Mr. Leach manures for tares, and if they are mown early, and three earths are given to the land, he gets good turnips after them. And that they are universal about Rickmansworth and Watford, many being fed off by sheep.

And it is stated by the same writer in his Survey of Norfolk, that the culture of this plant has increased very considerably in that district; within his memory, they are multiplied at least tenfold. He adds, that Mr. Overman begins sowing winter tares about Michaelmas, once more before Christmas, and sometimes twice and thrice more, with spring tares for succession. After mowing, he does not plough the land; but runs sheep over it till wheat-sowing. But the cultivator who has made by far the greatest exertions in this husbandry that he ever met with, is Mr. Purdis, of Eggmore, who has 300 acres every year, seeding no more than is necessary to supply himself: they are fed by his sheep; used in soiling his numerous horses, and immense quantities made into hay. His crops of 1802 he viewed with much pleasure, and found them very great indeed. In such an extent, they are necessarily sown at different seasons for succession, both winter and spring. Some he has dibbled; but intends drilling many in future. Others sow only winter tares for soiling horses.

It issuggested, as the remark of Mr. Blithe, that "the sowing tares for summer-feeding sheep, is an absolutely new improvement in the husbandry of West Norfolk, and he thinks it a very great and important one; he does not know who first introduced it: he is largely in the practice himself, sowing both winter and spring sorts, and in succession. And the writer found Mr. Hart, at Billingford, feeding off his spring tares, the winter ones, first growth, being done, the sheep were in pens moving regularly forward; brought in at night, and in the day on the layers: a piece of 20 by 30 yards given every day to 400 breeding ewes. They draw back on the cleared ground, not resting on the unfinished tares. They were sown on a two-years *olland*, and as fast as cleared, the land was *tempered* for wheat. Winter tares fed off in May in the same field, are now, in August, a fine crop again for the sheep, when they finish the spring ones."

And in both the counties of Gloucester and Worcester, it is the practice to show them as pasturage for horses, and eat them off early enough to allow of turnips being sown the same season. But, as "in the wet seasons, where the tare crops are large, the stems are apt to become rotten upon the ground, and in this condition such food often proves prejudicial to the horses; in all such cases it will be imprudent to eat them any longer for the purpose of soiling."

And it has been stated in the twenty-second volume of the Annals of Agriculture, that, in the county of Sussex, these sorts of crops are of such use and importance "that not one tenth of the stock could be maintained without them; horses, cows, sheep, hogs, all feed upon them, hogs are soiled upon them without any other food. This plant maintains more stock than any other plant whatsoever. Upon one acre, Mr. Davis can maintain four horses in much better condition than upon five acres of grass. Upon eight acres he has kept twelve horses and five cows for three months without any other food; no artificial food whatever is equal to this excellent plant.

"They find this crop to be a hearty and most nourishing food for all sorts of cattle. Cows give more butter when fed with this plant than with any other food whatsoever."

And that "by having one crop of vetches succeeding another, Mr. Halstead in the same county, insures a crop the whole summer of the best food that can be given to cattle; after this, he sows turnips, then wheat."

The great importance of the use of these crops, where large stocks of sheep are to be supported, has been fully shown above, being found to be a sort of husbandry which is "exceedingly useful, for they come in at a time when rye and turnip crops are eaten off, and before the clover and other grasses are in sufficient forwardness for being turned upon, and afford a seasonable supply of food for ewes and lambs." Mr. Bannister advises "the waiting till the tares have gained a sufficient increase of stem before the sheep are turned in, and then to divide the ground by hurdles in the same manner as is practised above; by this means, there will, he thinks, be little waste, and the ground be enriched in a much higher degree than if the stock had been suffered to ramble over the whole crop at once, which should never be the practice with this sort of crop."

These statements fully show the benefits that may be derived from this sort of crop in the supporting of live stock, and consequently in preparing lands for other sorts of crops, as those of the grain kind, such as wheat in the heavy sorts of land, and corn and turnips in those of the lighter kinds. See *Soiling*.

TEAM, a number of horses or oxen drawing at once in the same plough, cart or other carriage.

It has been long a disputed point among farmers whether horses or oxen form the most economical and advantageous team for the purpose of the cultivator in performing his work, and which remains still undecided, though many intelligent agricultors now incline to the side of horse teams, except in particular circumstances and situations.

It has been observed by a late writer that the circumstances in which the latter have been chiefly supposed to be more advantageous than the former are in their being kept at less expense, and their not declining in value. But that these, when examined, are perhaps not so decisive of their superiority as they may at first sight appear; for where the work of the farm is done by the younger sort of horses, which is perhaps the best method, the decline in value cannot be of any material consequence, while the superiority in point of the dispatch of work is very great. And in regard to the keep, as oxen

cannot perform their labour well in continuance without oats or some other sustenance of a similar kind, it would seem not improbable but that young horses may pay nearly as well as oxen, and be kept with little difference in the expense. It is suggested that the principal difference is in the oxen being kept at less expense when not employed. But horse teams under proper management should never be unemployed in any case whatever.

And in respect to " the common opinion, that oxen are superior to horses in the tillage of heavy lands, it does not appear to be well founded, especially when drawn in *yokes* and *bows*, as the poaching must be greater than by horses working at length. But when in harness they may, from their greater steadiness, be preferable; of course, under different management, are capable of being employed in both ways. But in all such cases, as where quick motion is of more importance than the steady drawing of heavy weights, the horse is much superior to the ox, as well as in carting, where great speed is required in the unloaded state, and wherever the roads or lands are rough, sharp, and stony, as they cannot be shod so well as horses to stand such roads." And in harrowing with light harrows, where a jumping irregular motion is necessary, it has been shown in the Annals of Agriculture that horses are the most proper, and to be constantly preferred. In short, that teams of the ox kind may be made use of with benefit in many cases in business about the farm, but are incompatible with all sorts of distant work, and especially on the road.

It has been stated by Mr. Emerson in the 5th volume of Communications to the Board of Agriculture, as the cause of oxen enduring work better than horses, that the " ox in his work chews his cud, and in consequence receives a supply of nutriment which continues to refresh him all day; when the work of the day is finished he hastily fills himself, and lays down to rest and chews his cud; in the morning early he again fills himself, which furnishes him with support during his day's work; when the ploughman takes a little bread in the middle of the day, even in that short space of time taken for that purpose, the oxen often lay down and rest. Compare the horses through the day and night, you will find on such comparison that these observations are well founded: the horses, in a continued standing posture, require a great length of time before they can sufficently satisfy themselves with food; indeed the carter is wholly employed before and after their work, in giving them small quantities at a time, in order to induce them to eat quickly as much as possible, to enable them to have time to take rest, that they should be able to perform their work; whereas the oxman, after foddering his oxen before and after work, milks or any other work he is ordered to do. The shoeing of horses and many other contingent expenses are very considerable: the ox requires no iron placed on his foot, being much better without." It is not however possible, for oxen to work in many sorts of ground without being shod. And others have contended that " oxen are equally tractable with the horse; their strength, like his, depends upon their age and breed, and their activity on their make and proportions; and that a large deep-chested ox at six years of age, is equal to a strong cart horse. Even on the road the ox is sometimes superior. In stiff pulls (as on declivities oxen are the great support.) If they are unable to proceed, they will always stand their ground: whereas horses soon lose their feet in a steep or slippery road. But that the ox should only be employed from his fourth to the tenth year."

It has been remarked in a late useful Calendar, that " there are two cases in which oxen are certainly more beneficial than horses; 1st, when a farmer lives in a district where there is a breed of cattle well adapted to work; and, secondly, when his farm is so large that he can buy in a considerable lot of cattle annually, at a small expense per head, and feel no inconvenience in turning out such beasts from the teams to fattening as do not work well. In both these cases the writer has little doubt of the superiority of oxen to horses. But in countries that do not possess a breed of cattle well adapted for work in the state of oxen; and on small farms, whence fairs must be attended at the distance of an hundred miles to purchase a few, and consequently at a great expence per head, and possibly without land for fattening any, the benefit will be very questionable. In such a case, he should prefer the bulls of the country, which are every where to be procured probably much cheaper than oxen; are broken in with but little difficulty; which work well, and which will recover from fatigue sooner than an ox. This he believes from what he has experienced, and from all the information he has procured, is stating the question of the comparison of horses and oxen as nearly to the truth as it can be done in few words. There are, however, he admits, some work in the business of a farmer, in which horses are better than either oxen or bulls, and therefore it may be advantageous to keep a few horses."

Mr. Parkinson, a practical farmer, has made some statements in his " Experienced Farmer" lately republished, that seem to make much against the general use of ox-teams. In speaking of the practice of using pairs of horses in Lincolnshire, some time since, he remarks that there were many ox-teams used at that time where the land was dry, and some also on wet land. His father generally used pairs of horses; but sometimes, where he had to make up a third plough in the spring, he took an ox-team. This consisted of four large oxen, with a horse before them: the oxen drew in *yokes* and *hoops*, and this team in one day ploughed about $\frac{2}{3}$ as much as a pair of horses. Thus there were a driver and a horse wanted for each of these teams: and therefore, though the oxen were kept on straw (which was often ill threshed on purpose to be more nourishing for the oxen) on the whole this team was much more expensive than a pair of horses. When we used the oxen to plough or harrow in hot weather, they would stand, he says, half the time hanging out their tongues. He has known an ox killed by being over drove in hot weather; and he has been obliged to loose them out of the harness on account of the large gad-fly biting them in such a manner that they would be quite unmanageable. These are, he says, great ob-

jections to ox-teams in the plough. He has, however found them useful in some other sorts of farm-work, from their slow, steady pace; as in scarifying, leading dung, &c. as the work suits them from its being easy, and having a great deal of standing: they are, says he, much cheaper kept than horses, and eat straw in the winter, and are valuable for making dung. He never saw this practice injure their growth. They may be drawn from 2 till 5 years old, without any loss of time, as they grow to that age, and are then both larger and better beef than three year old steers. He therefore recommends ox-teams for leading dung and the other odd jobs, but not to plough and harrow. If they are drawn to the age of eight or ten years, it is, he thinks, a real injury to the public, and an unprofitable practice."

And it has been suggested in the Survey of the West Riding of Yorkshire, that "from the circumstances of ox-teams being almost universally given up, in those places where they were formerly in repute, a suspicion arises that working them is not attended with profit. Those who object to the use of oxen say that there is nothing saved by working them, as the difference betwixt the value of a horse and an ox, when unfit for work, is more than compensated by the superior labour of the former when employed. At the same time, it is a business of infinite difficulty to get persons to work them. And in answer to the frequent question of the theorist on comparison betwixt the two animals in respect of profit? who says, you buy the ox cheaper than the horse, you support him at less expence, and finally, when he is useless for work, you make him up for the market, and sell his carcase for more money than he was worth when working in your team; whereas, the horse is a costly animal at the outset, must be pampered with plenty of corn and hay, is exposed to many disorders and at the last is only a dinner for a dog:" it is contended that "all these things may be true, and yet the horse may prove the cheapest of the two for carrying on farm labour." And it is further added that "in Britain, oxen were in former times almost universally employed in tilling the ground, and they were gradually laid aside as improvements were introduced. This is a fact which will hardly be questioned; for, at this day, except in remote uncultivated parts, there is hardly an ox-team employed, unless it be on the farms of landed proprietors, who probably have been induced to use them from public spirited motives, without inquiring into the practical result of their operations. They have been told, that it is owing to the obstinacy and ignorance of the farmers, that oxen are not generally employed in farm labour, and, that to remove these obstacles, no method would be so salutary as to work them upon their own farms. That this is a fair account of their motives, the writers presume, will hardly be disputed; and that the fashion, promoted and recommended by the proprietor, was not adopted by the farmer, must solely be attributed to his conviction, that the working of horses was not for his interest or advantage."

And that this is actually the case, is, they contend proved by the following circumstances; that "the very strongest ox will not do the same work as a horse. He cannot be drove at the same step, nor will he work in like manner from day to day. He not only does less labour when employed, but must be refreshed with more rest, or else he would soon turn unfit for work altogether. This of course requires two pair of oxen to do the work which will be performed by one pair of horses, and nearly the same capital stock will be necessary in both cases. Instead of maintaining two horses, you have four oxen to support, which certainly turns the scale. "Oh," but says the theorist, "a little straw will serve for the ox, whereas your horse cannot live without hay." —straw for a working ox! very good indeed. If you work him like a horse, he must be maintained like a horse. He must have his hay and his turnips, and possibly his corn also, if he is kept at hard work. That working oxen are not always supported in this manner, is readily granted, but how are they wrought? In many places, six, eight, even a dozen, are yoked in a team. We here speak of the northern parts of Scotland, where oxen are more generally used than in any part of the island. In a word, oxen cannot be used for dispatch like horses, and, in critical seasons when there is a necessity for a push, the value of the stock might be lost upon a single crop. The only point in favour of oxen, is their value at the latter end. Here no comparison can be made. Notwithstanding which they adhere to their first opinion, that this is more than compensated by the difference betwixt the value of their labour when employed."

And in regard to the national advantages to be derived from a change from horses to oxen, there does not appear any great benefit, as it has been shown by Mr. Pitt, in an excellent paper in the fifth volume of Communications to the Board of Agriculture, "that as those used in agriculture are in a great measure a nursery for those wanted for other purposes: the extent of such change can take place no farther than about the work of 100,000 horses.

"To ascertain what general effect such a change might produce in increasing food for mankind, as what he calls the higher kept farm horses are generally, or at least a part of them in preparation for sale, for the road or harness; he must suppose the deduction made, from what he has called moderately kept farm horses; now supported at four acres and a half per head: then the deduction of 100,000 of those would save the landed produce of 450,000 acres.

And the deduction of young stock, in the same proportion, one-ninth of the whole, would save one-ninth of 250,000 acres, to preserve even numbers, suppose 30,000

In all saved 480,000 acres.

The idea in all the midland counties is, he observes, that two oxen will be required to do the work of each horse; 200,000 working oxen will therefore be wanted instead of the horses thus deducted. To give the oxen a fair chance in this calculation, he will suppose them fit to work at three years old, and

the workers to be of the ages of three, four, five, and six respectively, 50,000 each; the same number coming one, two, and three years old, will be wanted for succession stock, and 50,000 annually fatted off; the land necessary for their support may be nearly as follows:

	Acres.
Keep of 50,000 steers, of the ages of coming one, two, and three years old respectively, 150,000 acres in all, at one acre each per head per annum	150,000
200,000 working oxen, of full three, four, five, and six years old, 50,000 of each, at two and a half acres per head per annum	500,000
Less land cannot, he believes, be possibly allowed to keep them in working condition; they must have hay and sometimes corn when closely worked, 50,000 fatting, at 3 acres per head	150,000
Land for the oxen necessary, acres	800,000
Deduct for the horses	480,000
Difference	320,000

"This 320,000 acres of land will produce 50,000 fat oxen, or 32 acres will produce five fat oxen: suppose them 270lb. per quarter each, or 5,400lbs of beef from 32 acres; this is 168¾ of a lb. of beef per acre per annum: but a dairy will produce more, and a flock of sheep well managed quite as much human food, per acre. Little advantage, therefore, would be derived from this change of substituting oxen for horses in agriculture, unless the use of horses on the road, and for purposes of pleasure, luxury, pomp, amusement, trade, mining, manufactures, commerce, and war could be abolished or lessened; an event which he supposes no friend to the prosperity of this country will wish to see brought about to any great extent; as it seems to be now generally understood that luxury in a moderate degree, is a principal encouragement to commerce and manufactures, and consequently a powerful instrument of prosperity." And accordingly Mr. Malthus says, "the advantages of luxury, when it falls short of actual vice, are certainly great: it cannot be denied, but it contributes to the comforts, enjoyments, and consequent happiness of a nation; but if carried too far, it will completely defeat its own purpose; the surest way is to stop short of the mark."

But the statements and observations given below may tend to show in a still more clear manner the differences in the use of one sort of team over the other.

It is remarked by an able writer in the Agricultural Magazine, under the title of *Agricola Northumbriensis*, who, from his having "been actively employed as a practical farmer on *a large scale*, for the last twenty-four years of his life, *during* a *part* of which he has *employed oxen* for *draught*, may be supposed to have acquired some knowledge of the subject; that though some of the lands he occupies are more favourable than others to the working of oxen, yet were he bound to give them even but generally the preference to horses, he is strongly of opinion that a great reduction of the rents which he could otherwise afford, would become indispensable. Nay, on one farm, which, besides perennial pasture, contains 300 acres of land managed under a five course shift, (oats; fallow and drilled leguminous crops and turnips; wheat and barley; clover and ray grass pasture;) which is merely strong soil of a middling and inferior quality, and which eight horses will perform with ease, all the necessary operations in the cultivation of 180 acres in tillage, besides leading great quantities of lime, delivering corn, &c. &c. he is of opinion that the necessary number of oxen would consume so much of its produce, were they employed in labouring it, that he could not afford to pay much, if any thing, more than one half of the present rent; and surely, he says, when it is considered that the ability to pay rent arises from the great amount of the produce, and the small amount of the necessary expences, no man will contend, that, notwithstanding a great reduction of rent, the ox may still be preferable to the horse system, in a national point of view.—Under the latter, he is persuaded that he sends more human food to market than he could possibly do under the former.—During one part of the year, a considerable part of his land is much too wet for oxen, in the manner in which they are generally, and probably in that in which they are from necessity employed; and on most of the remainder the soil is too hilly, and of so gravelly a nature, that notwithstanding all the care and attention which could be bestowed in shoeing, &c. they would suffer very materially from sore feet. This, he apprehends, is the case in most parts of the kingdom; but even in favourable situations, he cannot conceive that one pair of oxen, out of fifty, can be procured, which, with one man, will perform near so much work in a proper manner, and for twelve months together, as two horses, either in the plough or cart, even supposing the former to consume as much corn and hay as the latter; and it must not escape our recollection, that experiments have demonstrated the fallacy of theories relative to the consumption of ruminant animals being less than that of horses. Very accurate trials have, he says, proved that a working ox will consume as much, or more, hay and corn for fourteen days in succession, as a working-horse." And he asks if any of the correspondents of the work, are "prepared to prove that twenty pair of the best oxen in the kingdom will, with twenty men, completely plough as much land for 313 days in succession, as the same number of men with twenty middling horses, both oxen and horses being furnished with the same quantity and kind of food, that work-horses are generally allowed? And also how much more, or rather how much less, than prime cost, oxen maintaining such competition would be worth, at the end of the year, supposing markets in the same state? The warmest advocates for oxen will not, he presumes, contend, that a given number, say fifty, of the best of these animals, will completely perform (with twenty-five persons, and in the above space of time)

near so much work as an equal number of the best horses, with one man for each pair. Most of their calculations are made, he understands, on four oxen against two horses. He is, however, of opinion that, on an average of the kingdom, (keeping corn from the oxen) it will require six oxen of four years old, or upwards, with one man and a boy, to perform as much work as two good horses driven with reins, by the holder of a properly constructed plough. When he speaks of this useful implement, he does not mean heavy wheel, but common swing-ploughs, well constructed, and particularly those recommended by that able and ingenious agriculturist and mechanic, Mr. Bailey."

It is added, that "in Hertfordshire and other counties, he has seen, (what is the general practice), four or five heavy horses (without the necessary mettle) employed in a plough. In Northumberland, Roxburghshire, and most parts of Scotland, almost all ploughing is, he says, performed by two horses in a plough, driven by the ploughman, with reins. In these parts of the kingdom, lands as strong as any in the southern counties, are cultivated with ease, in this way; and considering the disadvantages of climate, &c. produce as valuable crops as any in England. Indeed, he is fully persuaded, that in the north of England and south of Scotland, the management of land and live stock is throughout more able and judicious, than in most of the more southern parts of the kingdom; and that if the farmers in the latter, paid as heavy rents as they do in the north (where within the last seven years, the rents of farms have, he says, generally been doubled, many trebled, and some quadrupled on the expiration of leases for twenty-one years) they would not have it in their power to be guilty of so great a waste of strength as that of employing four or five horses in a plough."

And in pursuing the same subject in a subsequent paper, he offers some remarks and calculations in support of his opinions.

He states that "in his district, and he believes in most other parts of the kingdom, those who were engaged in stocking farms last spring (1803) found that good six year old oxen, brought almost as high a price as four year old horses, whose mettle and strength rendered them fit for draught. He is not inclined to dispute that when six or eight oxen are used for one team, they will generally, after being worked a few years, (but five or six years is, he says, too long a time) bring more than prime cost; but that, when two to four oxen only are employed for one team, and laboured against a pair of good horses, five to ten hours per day for 313 days in the year, they can be kept in proper condition for two-thirds of the expense of the horse, he positively denies. It is believed by some, that ruminant animals, oxen for instance, consume much less food than horses, but that this theory will not stand the test of experience may be easily proved in most parts of the country. To overthrow it, however, he shall only adduce what is stated in the Northumberland Survey, the accuracy of which statement (as he is well acquainted with the gentlemen by whom the experiments were conducted,) he can fully depend upon. By these experiments it appears, in the words of the surveyors, "that three working horses, about fifteen hands and a half high, eat in fourteen days, ninety-six stones of hay; which is, for each horse, at the rate of sixteen stones per week, with an allowance of oats, twelve gallons a week. Mr. Thompson's eighteen horses in twelve days eat 430 stones of hay, which is fourteen stones per week each horse, allowance of oats sixteen gallons per week; Mr. Atkinson's horses eat per week thirteen stones of hay, two bushels of potatoes, and sixteen gallons of oats, each; Mr. Jobson's five year old working oxen, with a full allowance of hay, had each ox, six quarts of oats per day. In fifteen days four of them eat 164 stones, seven pounds of hay (which is after the rate, for each ox, of nineteen and one-fourth stones per week) and of oats ten and a half gallons per week, three days after the same oxen were put to hay only, and in seven days eat seventy-nine stone ten pound, or twenty stones each ox per week, which is only three-fourths of a stone more than when they got ten and a half gallons of oats in the same time. It is reasonable to presume that in the course of a considerable space of time, they would perform most work and continue in the best condition, with the allowance of corn. This is a singular circumstance, and deserving of farther investigation. An unworked ox three and a half years old was put to good old meadow hay the 29th of November, and eat forty-nine stones in twenty-one days; or per week, sixteen stones five pounds. An idle horse (fifteen and a half hands high) eat of the same hay, twenty stones in ten days, or per week, fourteen stones; and had no corn."

A writer in the 2nd volume of the Farmer's Magazine has given a statement on a somewhat similar plan to that of the above Survey, which is more favourable to the use of horse teams.

Expence of an ox for one year.

Summering on grass, being the customary payment for a cow.				£.	3	10	0
¼ of an acre of tares during summer at 5l. - - - -					1	5	0
Wintering, on straw	£.	1	10	0			
½ an acre of good turnips, at 5l. - -		2	10	0			
		4	0	0			
If on hay, 200 days, at 8d.		6	13	4			
Half of this as the average expence,		10	13	4	is 5	6	8
Interest, harness, shoeing, as per Survey, -					1	5	0
		Total			11	6	8
Deduct supposed increased value of the ox					1	6	8
Gives the annual expence of one work ox					10	0	0

TEA

Hence the 1t year, with 8 oxen will cost	£. 80	0	0
The 2d and 3d years,	6 120	0	0
Expence of three years,	L. 200	0	0
Average for one year	L. 66	13	4
To which must be added the expence of a driver, which he cannot estimate, including wages and victuals, below	14	6	8
Gives the total annual charge of each ox plough	L. 81	0	0

Expence of a Horse for one year.

Summering on grass, 165 days, at 6d.	L. 4	2	6
Vetches or tares, as for the ox	1	5	0
Straw for half the winter, at the same rate with the ox	0	15	0
Hay half the winter, or 100 days, at 8d.	3	6	8
Oats, 70 bushels, at 2s. 3d.	7	17	6
Harness, shoeing, and annuity, as per survey	3	5	0
Annual expence of one horse	L. 20	11	8

Hence, says he, the annual expence of a two-horse plough will be 41l. 3s. 4d. leaving a balance in favour of horses for farm labour, and against the use of oxen, of 39l. 16s. 8d. for each plough. The ploughman is not charged in either, being the same in both.

And it is further contended, that "in the strongest soil the improved swing-plough can never require more than three horses, and that only for once ploughing in particular seasons and situations. Suppose three required for half the year, and with a driver, this would add 17l. 9s. 2d. to the expence of each horse plough in such stiff soils, still leaving a balance of 22l. 7s. 6d. against each ox team." And "extending this comparison, with the authors of the Survey, who suppose 5000 ploughs in Northumberland, and, allowing Great Britain and Ireland to contain forty times the extent of tillage land in Northumberland, the two-horse ploughs give a difference of nearly six millions sterling annually. Supposing half the ploughs to have three horses, the difference would be nearly five millions. In such years of scarcity, the difference would be more than double. It must, however, be observed, the writer says, that the above comparison is made with the improved swing-plough, and will by no means hold good with the extravagant horse teams so prevalent in the south, which are more expensive even than ox-teams. And it would, he supposes, go a great ways towards lessening the danger of future scarcities, to devise a means of introducing the swing plough universally into practice."

In regard to the second calculation respecting the value of produce, by using ox labour, it comes, he says, much nearer his, than the direct estimate of expence. Had the authors of the Survey allowed nearer the average price, the difference would not have been, he says, very material.

They calculate directly, the loss on each ox team,	L. 8	3	0
Estimate of loss of produce by each, is	27	13	0
His calculation with two-horse ploughs,	39	16	8
Ditto, with three horses,	22	7	6
The average of the whole is	24	10	7½
And leaving out the first, as greatly too low, the average will be almost	30	0	0

It is concluded that, "upon the whole, the loss to the farmer, in the first instance, cannot be under 25l. annually for each ox-plough team. And it may be worthy of remark, that the whole of this loss must ultimately fall upon the landlord and the community."

But as neither of these statements appear to the author of the papers in the Agricultural Magazine, to be sufficiently favourable, to horses, he furnishes the following calculations and conclusions, previously observing, however, that "in almost every district in which oxen are employed in the cultivation of the soil, the general practice is to yoke them when three years, and to work them till they are six years old, employing for the first year, when they are weak and unaccustomed to the draught, eight for each plough, and six, for the same work, in the two succeeding years. It is with this description of teams, therefore, that we should make our comparisons. He shall not, however, entirely overlook those for which fewer oxen are supported. In the first place it seems proper to endeavour to ascertain the

Expence of a labouring ox for one year.

Summering.—Pasture grass, with an allowance of tares, (two acres of the former, and about a quarter of an acre of the latter)				L.	s.	d.
				5	0	0
Wintering.—Straw	1	10	0			
Good turnips about half an acre	2	15	0			
	4	5	0			
Most of the land in this kingdom being unfit for the turnip husbandry, work oxen are, in many districts, supported with hay and straw, (mostly with the former) and even where the straw is good, thirteen stones of hay, per week, will be required to continue each ox in proper condition, which for thirty weeks, at five pence per stone, will amount to	8	2	6			
	12	7	6			

This cannot, reasonably, be deemed too great an

allowance, he says, when we consider that the above experiments have proved that working oxen, supported on hay and a considerable quantity of corn, consumed weekly, nineteen stones and a quarter per ox.

One half of this is the average expense	6	3	9
Interest on the price of the ox at five per cent. per annum - - -	1	1	0
Harness, shoeing, &c. - -	1	2	0
	13	6	9
Deduct the increased value of an ox for one year	2	0	0
Annual expense of an ox—without corn	11	6	9

Expense of a labouring horse.

Summering.—Pasture, grass, upwards of two acres - -	5	0	0
Wintering.—Straw - - -	0	15	0
Hay fourteen weeks, fifteen stone per week, at 5d. per stone - -	4	7	6
Oats, (partly small dressed out of those sent to market) 72 bushels at 1s. 11d. per bushel	6	18	0
Harness, shoeing, &c.	1	10	0
Annuity to pay off 26l. (the purchase price of a four year old horse) in fourteen years	2	12	6¼
Expence of a working horse for one year	21	3	0¼

In several parts of the country, good draught horses, four years old, may, he says, be purchased for about twenty-one to twenty-three pounds. He has, however, taken twenty-six pounds as an average, reckoned on a horse working fourteen years, and allowed compound interest at five per cent. per annum. Those who deem twenty-eight pounds necessary for the purchase of a good horse, to continue to work well for fourteen years, will, of course, increase the annuity to 2l. 16s. 3¼d.

He adds, that "the expense for the ploughman (holder) being the same for an ox or a horse plough, it is unnecessary to include it in the estimates. Adverting, however, to the nature and situation of land in general, and to general practice, a driver for an ox plough seems necessary. This will, perhaps, be disputed, but he presumes that agriculturists in general, will concur in the opinion that, in order to plough nearly as much with oxen as with two good horses, it is necessary to yoke three or four of the former at one time, it seems fair, therefore, to add the expense of a driver for the ox-ploughs; the account will then stand thus:

	£.	s.	d.
Expense of eight oxen for one plough	90	14	0
Wages, victuals, &c. for a driver -	16	10	0

	L.	s.	d.
Annual expense of a plough for which eight oxen are supported - -	107	4	0
Expense of six oxen for one plough	68	0	6
Wages, victuals, &c. for a driver	16	10	0
Annual expense of a plough for which six oxen are supported - -	84	10	6
Therefore, the expense of an ox-plough, being, the first year - -	107	4	0
And the second and third years	169	1	0
That of three years will be - -	276	5	0
And the average for one year -	92	1	8
The expense of a two-horse-plough being annually - - -	42	6	0½

A driver being unnecessary when proper reins are furnished for the holder.

The balance in favour of horses will be - - -	49	14	7½

If no three-year old oxen are employed, the account will stand thus:

Annual expense of a six-ox plough	84	10	6
Ditto, of a two-horse ditto - -	42	6	0½
Balance in favour of horses - -	42	3	5½

If we suppose three horses not more than a sufficient power, in some particular situations, for a few weeks, or even months, in the year, it is evident, he says, that the balance will still be greatly against oxen. He has, however, frequently seen two horses, driven by the holder with cords, plough more strong or hilly ground, in a given time, than four oxen, yoked at one time, six being allowed for one plough.

"But, continues he, these calculations do not show the total loss sustained by the agriculturist from giving the preference to oxen; for these animals, of a good kind, would, in grazing, increase in value to a greater amount than the value of their labour, calculating on the common prices per acre for ploughing, &c." And here he notices some popular arguments used on the subject, such as that, "oxen, after they have fed the hungry, will themselves become the first of human food. Horses, after they have eat the food of the fatherless, become a nuisance to the animal world; or buried in a corner, lie a total loss to agriculture and to the community." He is apprehensive, that dead horses are not generally buried any where, but really lie a "nuisance to the animal world." They certainly ought, however, as well as other animals, and oxen which die of disease, lameness, &c. &c. to be buried in ten or twelve loads of the richest earth that can be found. Some time after putrefaction, the whole mass should be intimately mixed and applied as manure; experience having proved that such manure is highly fertilizing. It is not true, therefore, says he, that when an old work

ox will bring prime cost, or more, as human food, an old horse is fit for dogs only. Besides the force of this popular argument is destroyed, when the above estimates are attended to. For by the annuity added in estimating the annual expense of a work horse, that animal actually costs his owner nothing at the expiration of fourteen years. It is by such arguments as these, says the able writer, and not by proper investigation, that the popular cry, during the late scarcity, was raised against the employment of horses in agriculture, but this method of cultivating the soil will not operate so as to render the quantity of beef in our markets less than it would be were horses superseded by oxen; for it cannot be denied that that system which offers the greatest encouragement to the breeders of cattle is the most likely to ensure a large supply of these animals, and the grazier having more profit than the labourer, of oxen, it follows that grazing is the greatest incitement to the breeder to increase the number of his cattle. But that the universal employment of two-horse, in preference to six ox, teams, would greatly increase the quantity of beef in our markets, he shall endeavour to prove in another way.

He thinks, "it is easily deducible from the above estimates, that to maintain a working ox, requires the produce of about four, and to support a working horse, that of about five, acres of land; consequently a six-ox team will require about twenty-four, and a two-horse team about ten, acres of land: so that the community lose the produce of fourteen acres of land yearly by every six-ox team in the kingdom. Suppose one half of this land to be under grass, and the remainder in tillage, viz.

7 acres of grass.
2⅓ ditto of oats.
2⅓ ditto of turnips and fallow.
2⅓ ditto of wheat.

The produce on a moderate computation would be yearly

90 stones of beef.
13 quarters of oats.
And 7 ditto of wheat.

He understands that some eminent calculators have estimated the number of ploughs employed in the kingdom of Great Britain and Ireland at 210,000; now if we calculate on this number, the account will stand thus:

st.	*cwt.*			*£.*
210,000 × 90 =	2,362,500	of beef, which at 3l. per cwt. amounts to		7,087,500
210,000 × 13 =	2,730,000	quarters of oats, which at 16s. per quarter, amount to		2,184,000
210,000 × 7 =	1,470,000	quarters of wheat, which at 45s. per quarter, amount to		3,307,500

The amount of provisions which would be annually lost to the community were ox universally preferred to horse teams - - - *L.* 12,579,000

"And that the loss sustained by the occupiers of land would be precisely that profit which they receive on its produce. Some writers calculate this profit at one third, and others at one quarter of the produce. It is obvious, however, he observes, that estimates on this head, cannot be depended on, and that the profit will vary with the circumstances under which the cultivators of the soil pursue their important art. But it is, in some parts of the country, and ought to be in all parts of it, very considerable. But, say the advocates for oxen, it is almost admitted that it is necessary occasionally, to employ three horses in a plough, and we can in several situations, plough five or six acres per week, with only four oxen; he shall therefore estimate the expense of a four-ox plough.

"These gentlemen, however, should, says he, recollect that in several parts of the country eight oxen are occasionally employed for a plough, and that this would, in the estimates, have stood against the admission that three horses are sometimes necessary for one plough. On land already improved, however, this number of horses is seldom, if ever, necessary, where proper management is pursued; but, in some parts, it is customary, instead of ploughing the land intended for fallow between Martinmas and April, to defer that operation till May, June, and even July, when it is comparatively as hard as stones.

"But here he must remark, that in estimating the annual expenses of a working ox, he has thus far, not only *not* included the expense of corn, but deducted 2l. for his increase in value; but that when only four oxen are employed for one plough, they will at all increase in value, or maintain a competition against two good horses for a considerable length of time, even with a liberal allowance of corn and hay, he cannot admit; referring to the experiments already mentioned for the necessary quantity of corn."

	£.	*s.*	*d.*
The annual expense of a working ox when only four oxen are employed for one plough, will be (including corn, and making no allowance for an increase in value) - - - -	17	11	2¼
And that of a four-ox plough, including the driver - - - - -	86	14	10
Therefore the annual expense of a two-horse plough being - - -	42	6	0½
The balance in favour of horses will be	44	8	9¼

"Allowing, says he, then, merely for the sake of argument, that four oxen will, for a considerable

length of time, plough as much land as two good horses, and that with a liberal allowance of corn and hay, the former can support the competition, without being impaired in value, it is clear that the work cannot be done at nearly so cheap a rate by the oxen as the horses.

"It has, he understands, been contended by some advocates for oxen, that with four of the best of these animals, as much land may be ploughed within six to twelve months, as with three middling horses, and that the work may be as well executed, and at a cheaper rate, by the former than the latter. It is scarcely necessary to remark, however, he thinks, that even if the oxen could perform the same quantity of work (which he will not admit) they could not perform it at so cheap a rate as the horses, by 6*l.* 15*s.* 9¾*d.* per annum. Others assert that there is no occasion whatever to employ a driver for an ox plough, and that the most advantageous mode is to yoke two at a time, and furnish the ploughman with reins to drive them. Suppose, says he, we admit this for argument's sake, it is obvious that the balance will still be greatly in favour of horses. He adds that he has just been informed that some very warm advocates for the superiority of oxen, who have been at much pains in selecting a few of these animals with particular qualifications, contend that two of them, driven by the ploughman, can perform nearly as much work as two good horses, and for a considerable length of time; that they can, however, really maintain such a competition, for a few months, even in a remarkably favourable situation, without being much reduced in value, or rather, without being reduced to skeletons, he does not believe. Supposing however, that they were thus matched for six months (and for that time he cannot conceive that any quantity or kind of food whatever, would enable them to perform nearly as much work as two horses) surely their owners would not be so unmerciful to their favourite animals as to refuse them as much nourishing and strengthening food as labouring horses, under the best support, are allowed; and reckoning the quantity of corn equal, even two oxen to a plough, would be more expensive than two horses, for it has been demonstrated, by the experiments already quoted, that working oxen consume more hay weekly, by near six stones each, than working horses."

"As it is universally admitted that the productive powers of the land are not, in the smallest degree, impaired, merely by employing horses in preference to oxen in its cultivation, "the balance in the comparison of expense and produce" is greatly in favour of the former animals. It is fair therefore to conclude, he thinks, that those who prefer horses to oxen in farm labour, display (as far as a judicious choice of animals for draught will go) the greatest "agricultural talents" or knowledge of the economy of performing farm labour.

And in answer to the assertion of the superiority of the labouring ox on certain sorts of soils the same able writer also offers some further calculations; though his "estimates of the annual expense of the ox and the horse given above, include that on turnip soils, and those on which it is injudicious management to cultivate that valuable root. In these calculations, however, as the average is taken, it will require some little trouble to ascertain the expense on each sort of land; he therefore now adds separate estimates.

Annual expense of a labouring ox on turnip farms.

	L.	*s.*	*d.*
Summering.—Pasture grass, with an allowance of tares	5	0	0
Wintering.—Straw, 1*l.* 10*s.* Turnips about half an acre, 2*l.* 15*s.*	4	5	0
Interest on the price of the ox at 5 per cent. per ann.	1	1	0
Harness, shoeing, &c.	1	2	0
	11	8	0
Deduct the increased value of an ox in one year	2	0	0
Annual expense of an ox without corn	9	8	0
Expense of eight oxen	75	4	0
Wages, victuals, &c. of a driver	16	10	0
Annual expense of a plough, for which eight three-years old oxen are supported, exclusive of that for the holder	91	14	0
Expense of six oxen	56	8	0
Wages, victuals, &c. of a driver	16	10	0
Expense of a plough, for which six oxen, four years old, or upwards, are supported	72	18	0
Therefore the expense of an ox plough being the 1st year	91	14	0
And the 2d and 3d years	145	16	0
	3)237	10	0
That for one year will be	79	3	4
The annual expense of a two-horse plough (including 2*l.* 12*s.* 6¼*d.* the annuity necessary to pay off the purchase price of a horse in fourteen years, allowing compound interest) being	42	6	0½
The balance in favour of horses will be	36	17	3½

Annual expense of an ox where turnips are not cultivated.

	L.	*s.*	*d.*
Summering as above	5	0	0
Hay and straw in winter	8	2	6
Interest, harness, shoeing, &c.	2	3	0
	15	5	6
Deduct the increased value of an ox in one year	2	0	0

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	L.	s.	d.
Annual expense of an ox without corn	13	5	6
Annual expence of eight oxen	106	4	0
Driver	16	10	0
	122	14	0
Annual expense of six oxen	79	13	0
Driver	16	10	0
	96	3	0
Expense of an ox plough the first year	122	14	0
Ditto of ditto the second and third years	192	6	0
Ditto for three years	3)315	0	0
Ditto for one year	105	0	0
And the annual expense of a two-horse plough being	42	6	0½
The balance in favour of horses will be	62	14	0½

It is stated that "these are the general modes of feeding and employing labouring oxen, under which experience has proved that the quantity of land ploughed, in the most favourable situations, is scarely equal to, and in most situations not above four-fifths or five-sixths of that done by a pair of good horses (driven by the holder with cords), in the space of 12 months. Experience has also proved that in some situations four good oxen (two of them employed and driven by the holder for four or five hours at a time) with about as much corn, and much more hay when turnips are not given, as horses are allowed, will perform nearly as much field labour in one year, as two good horses driven as above, and fed in the usual manner. Under these circumstances however, oxen have not improved in value; on the contrary, many of them, at the expiration of a year, have been depreciated in the estimation of the grazier." Let us now, says the writer, endeavour to estimate the

Annual expense of an ox upon a turnip farm, when four oxen are supported for one plough.

	L.	s.	d.
Summering. Pasture grass with an allowance of tares	5	0	0
Autumn, winter, and spring. Hay for thirty weeks, ten stone per week, at 5d. per stone	6	5	0
Ditto half an acre of good turnips	2	15	0
Ditto oats (partly small) 60 bushels at 1s. 11d. per lb.	5	15	0
Interest, harness, shoeing, &c.	2	3	0
	21	18	0
Therefore the annual expense of a 4 ox plough being	87	12	0
And that of a two horse plough	42	6	0½
The balance in favour of horses will be	45	5	11½

Annual expense of an ox, where turnips are not produced, when four oxen are supported for one plough.

	L	s.	d.
Summering. Pasture grass and tares	5	0	0
Autumn, winter, and spring. Hay for 30 weeks, 19 stone per week, at 5d. per stone	11	17	6
Ditto, oats 30 weeks, 2 bushels per week, at 1s. 11d. per bushel	5	15	0
Interest, harness, shoeing, &c.	2	3	0
	24	15	6
Therefore the annual expense of a 4 ox plough being	99	2	0
And that of a two horse plough	42	6	0½
The balance in favour of horses will be	56	15	11½

These calculations, from their being more *particular* than those given above, will, the writer thinks, more clearly show the superiority of the horse over the ox on all descriptions of land; and he adds that they are founded on the quantities of food consumed in the course of very accurate experiments conducted by some practical farmers, who themselves paid the most minute attention in weighing, &c. &c. and that almost all the advocates for oxen have, he says, overlooked this important fact, namely, that these animals consume a much greater quantity of hay, &c. in a given time than horses. These estimates will also more clearly show, he thinks, that the five wonderfully powerful oxen mentioned by his opponent would consume the produce of considerably more than twenty-five acres of land, when his four horses would consume that of only twenty acres annually.

These facts and statements, which have been founded on actual trials place, the question of the superiority of ox or horse teams in a different light from that in which it has been perhaps too generally considered.

And in a subsequent volume of the same work, a *Durham farmer* seems to have placed the disadvantages of using ox teams instead of horses in another point of view: he says that "the ploughs in general use in the county, are the swing-plough, called Small's or Rotheram plough; which is worked on all kinds of soils, by two horses, and one man only. And that a farm of two hundred acres will require three of these teams, or what are provincially called drowls; but of these six horses, two or more will be mares, and from one of these mares a farmer will have

a foal every year, sometimes two. The colts at two years old are broke into the plough, and at three and four years old, will sell rough from the plough for from twenty to forty pounds, according to figure and action. The mares are put to light ploughing and carting when with foal, and during the next summer also, with the foal running by her side. And a farmer having a succession of colts, is never at a loss to make good the temporary absence of the mares to supply his teams, which are a *fother cart*, for manure and lime, and a *gehoe*, or long cart, for hay and corn, both drawn by two, and sometimes three horses. Waggons are very seldom used.

In the calculation upon horses and oxen, a deduction has always been made for the annual decrease in value of the horse, but intelligent farmers here avoid that loss, as may be seen by the following statement. And no farmer ought to suppose loss by horses—the decrease of value is, he says, with the consumers of horses.

DEBTOR.	£.	CREDITOR.	£.
To cost of six horses and mares, four years old	150	By after three years, a colt horse, or mare, sold every year for 8 years, at 25l.	200
To expence of keep of colts before they are put to the plough, 8 years at 10l. -	80	By 6 on hand, being bred from the first stock, at 25l.	150
To balance gained	120		350
	350		

But the balance may be more or less, according to the qualities of the mares, and the choice of suitable stallions for getting handsome stock. The use of mares and breeding of horses, is one of the circumstances he has not seen published in the question of animal labour, but it must strike every one's observation, that if agriculture was wholly or generally performed by oxen, our manufactures, commerce, and the thousands and tens of thousands of all kinds of vehicles for trade and pleasure, must also be drawn by oxen, or we must become importers of horses, at an expense equal to any thing that has ever yet been paid for corn.

"And there is another circumstance, not yet noticed in any account he has seen, which is decisive in his mind in favour of horses. The service of the ox is limited to four years, that is, from three to seven years old, the horse twelve years, that is from three to fifteen years old. A farm of two hundred acres requiring six horses, at five acres each, or twelve oxen at four acres each, to be allotted for their keep—then thirty acres would be required for the horses, and forty-eight acres for the oxen. But from the long duration of the service of the horse, there can only be added ten acres to the thirty for the keep of two succession colts: whereas from the short duration of the service of the ox, the young stock to supply the yoke cannot be less than—

4 three years old to succeed the oldest.			
4 two ditto	ditto	the three years old.	
4 one ditto	ditto	the two ditto.	
—		*Acres.*	
12 at 3 acres each, is		36	
12 at 4 ditto working oxen		48	
—		—	*L.*
		84 at 3l. per acre	252
6 Horses and mares, and 2 colts		40 at 3l. ditto	120
		44	
Balance in favour of horses			132

"On a middling farm of 200 acres, taking for granted that a farmer breeds and sells his horses or buys colts, working them and selling them for profit; then *vice versa* on the same farm with oxen, allow the farmer to sell off four oxen every year at 25l. each, there is 32l. left, which added to 2l. more per acre, on 44 acres if in tillage, &c. as the produce above, 3l. as taken at. The balance in favour of horses on such a farm will then be 120l. In short, after what he has stated as the practice of the county of Durham, every farmer must perceive it his interest to employ horses; and, as to the public benefit, notwithstanding the laudable exertions of Lord Somerville and others in recommending oxen for the public interest, he is of a different opinion, from the circumstance of 44 acres being gained from a farm of two hundred acres, when worked by horses, the value of which for public benefit is shown above, and the certainty of our being importers of horses, if oxen were to come into general use for agricultural labour. The very great advance on horses within these few years, has, he adds, induced several dealers in the north to import from Ireland, numbers which are now to be met with in all our great fairs; a proof that the consumption exceeds the supply at home, which is an evil: and if oxen are to be substituted for horses, it will prove an evil of the greatest magnitude.—The horse is, he thinks, the primum mobile of all our wealth and consequence."

In respect to the feeding of teams whether of horses or oxen, it is a point that requires much thought, care, and attention, as where a want of economy prevails, it may lessen the profits of the farmer in a very high degree, as is obvious from the vast consumption of expensive food that must take place.

The yearly expense of keeping a labouring horse and an ox previous to the late rise in the different articles that are made use of as food, have been thus stated in the sixteenth volume of the Annals of Agriculture.

Annual expense of a working horse.

	L. s. d.
Oats, for thirty-four weeks, at five and a half pecks weekly, eleven coombs, at 9*s.* per coomb - - -	4 19 6
Straw with chaff, broken ears of corn, &c.	

	L.	s.	d.
left by the threshers, for eighteen weeks, at 2s. each	1	16	0
Green tares given in the stable for eighteen weeks, (without any corn) at 3s. per week	2	14	0
Hay, sixteen weeks, thirty hundred weight, at 2s. 3d. per hundred weight	3	7	6
Annual decline in value, hazard in buying and keeping, and farrier	3	5	0
Interest of purchase money	1	1	0
Shoeing	0	8	0
Total	17	10	6

Annual Expense of a working Ox.

One hundred and four bushels of bran at 5d. each, to be given with chaff at various times	2	3	4
Straw with chaff for eighteen weeks at 1s. 6d. per week	1	7	0
One acre of turnips for winter	2	0	0
Hay for eight weeks, thirty hundred weight	3	7	6
Tares, ten weeks, at 3s. per week	1	10	0
Grass, sixteen weeks, at 2s. per week	1	12	0
Hazard of accidents in keeping (none at all in buying) with the farrier, may be valued at 8s. and are more than equalled by the annual improvement of the ox	0	0	0
Interest of purchase money	0	12	0
Shoeing (if used for road work)	0	10	0
Total	13	1	10
Difference of expense in favour of ox	4	8	8

The difference in the expenses of food since the above period may probably demand the addition of one-third, to these accounts.

It has been ascertained by actual trials that working horses without being fed too highly, or so as to improve in flesh, have consumed in the proportion of twenty pounds of good hay each in the course of the day, with a weekly allowance of two bushels of oats each, and chaff. With a smaller allowance, which is often made by farmers, they cannot be kept constantly at work, without falling off in condition, by which there must ultimately be a loss to the farmer. The above allowance is necessary for about twenty weeks during the winter season.

According to the present prices of the different articles of food, the expences of the keep of four horses may be calculated in this way:

Winter Food.

	L.	s.	d.
To seven tons of hay, at 4l. per ton	28	0	0
To 26 quarters of oats, at 28s. per quarter	36	8	0
	64	8	0

Summer Food.

	L.	s.	d.
To grass 26 weeks at 20s. per week	26	0	0
To thirteen quarters of oats	18	0	0
	44	0	0
Which is, each horse without chaff	27	2	0
Total	108	8	0

It has been suggested in the thirty-sixth volume of the Annals of Agriculture, that there are only two methods of lessening the immense expense of keeping farm horses; one of which is not to turn them out in the summer, but to have them soiled constantly in the stables or yards with lucerne, tares, clover, and other similar crops, cut green; as in this way, where littering is properly attended to, the manure that is produced will nearly balance the expense of the keep, besides avoiding various inconveniencies attending the pasturing of horses in the fields. And the other that of substituting carrots in the place of oats as a winter food; a practice common in the county of Suffolk, and attended with much success and advantage.

The former is a practice that prevails in most of the best cultivated arable districts of the kingdom. In speaking of the practice of soiling, several facts have been stated of the great benefit and saving produced by this system of management being pursued in different districts; and others may be mentioned in this place. In the very able Survey of Essex, it is observed, that the practice of cultivating green food, and soiling the horses in the yard or stable, during the summer season, is now become very general through the county; and the daily accumulation of dung by this means, together with the superior health and hardiness which is induced in the plough horses, by thus lodging in the straw yard, rather than in the stable, through the winter, is a sufficient inducement with the most able and experienced farmers to continue both practices, and to justify their general recommendation of them throughout the kingdom.

It has been remarked by Mr. Howlet, that not a fifth part of the farmers in this neighbourhood, have recourse to this mode, though it is undoubtedly an excellent practice in various respects, and in some parts of the country is gaining ground, and indeed also in this.

At Ardleigh, it is the practice of Mr. Rogers, who makes it an invariable rule to keep his teams always confined, to soil them, first on rye and tares; they are next served with rye-grass and clover, and also on clover alone; then they have clover that was lightly fed to delay the growth of spring tares. And it is stated that this husbandry cannot be too much commended. He has lucerne in contemplation for the same purpose. And at Bocking, Mr. Saville has a high opinion of this husbandry, and the writer found it an universal practice amongst the best farmers. With Mr. Wakefield of Burnham, who soils his horses on tares all the summer, four or

five acres will feed eight or ten horses till harvest. And at Southminster, Mr. Bawtree, who is much in the practice, and thinks it ought to be universal, supposes that the less water horses have while soiling at tares the better. And at Hornchurch, Mr. Newman is a great practiser of this husbandry; all his horses are soiled, but he does not confine himself to them, he always soils cattle with tares, and greatly approves of the system. But the writer has very scarcely met with any person, who was more convinced of the benefit of soiling than Mr. Wood, at the Spread Eagle in Ingatestone; he has in one respect carried it to a length which he has not before met with. For cart and other horses never put beyond a slow pace, it has long been admitted to be excellent; but Mr. Wood soils all his post horses while in constant work. This is extrordinary, yet he has persisted in it for fourteen years, and with uniform success. The precautions, which well deserve attention, will appear from the detail of his management. Every morning before tares are given, each horse has two feeds of oats, but no water on any account whatever. They have what tares they will eat from the time of their having had the oats, even to harnessing for posting. At night they have each half a pail of water, which is the whole for twenty-four hours. Some other inn-keepers on the road have tried the food, and all failed: Mr. Wood has no doubt of the reason, which was the boys giving water: if this point be not steadily enforced, the practice will be sure to fail. He has never less than twenty-eight horses in the stable, often more, and in fourteen years, he has not had a greasy heel: thirty horses eat four acres of tares, in from two to three months. And a very accurate trial on a farm of the earl of Albemarle, as stated in the Survey of Norfolk, with lucerne, shows the utility of this sort of practice in the supporting of horse teams in a still more decided manner. "On the 11th of May the farmer began mowing four acres one rood and twenty-four perches of the above lucerne, which he had purposely divided off, and applied it by feeding ten cart horses in a walled-in yard. There was neither hay nor corn given to the horses, except the first two weeks they were taken into the yard, when two pecks of oats with some chaff were allowed each horse per week, to prevent any ill consequence from the too sudden change from corn and hay to green food, and they were fed entirely from the aforesaid four acres one rood and twenty-four perches, till the 21st of September following, making exactly nineteen weeks from the period of their first going into the yard. He cannot state with accuracy the quantity of work done during the above nineteen weeks by the ten horses, but as near as he can estimate, eight out of the ten went to plough or other work nine hours every day, (Sundays excepted) and were in excellent condition during this experiment. The yard in which the horses were kept, and which they never quitted, except when at work, was littered with refuse straw from other yards, green weeds from borders or waste lands, or any other refuse litter that could be conveniently procured. The dung was turned over after the horses were taken from the yard, and after remaining about a month in heaps, produced sixty-two loads at thirty-six bushels to the load. The grass had a slight top dressing of peat ashes the first winter, and has received no manuring since, except a small part which did no material good. The first mowing commenced the 11th of May, when it was fifteen inches high; the second mowing 6th of July, and the third mowing 18th of August.

In this application, the calculation of the value of the four acres one rood and twenty-four perches of lucerne is as follows:

	L.	*s.*	*d.*
Keeping ten horses nineteen weeks, at 6*s.* per horse, per week	57	0	0
Sixty-two loads of compost at 3*s.* per load	9	6	0
	66	6	0
Deduct two and a half coombs of oats, at 12*s.*	1	10	0
Chaff	0	6	0
Refuse straw and litter	2	0	0
	3	16	0
Total	62	10	0
Or per acre	13	17	0

There is likewise some advantage in this method of feeding team-horses, in preserving them more free from disorders. It is stated in the Essex Report on Agriculture, that Mr. Wood, as noticed above, who has attended much to the management of horses, has a bad opinion of giving them much water while under this sort of feeding. He thinks, that "soiling on tares can be rendered consistent with quick motion, merely by the denial of water."

The farmers in Hertfordshire are much in the practice of soiling team horses, being fully convinced of the great advantages of it, both in the supporting of the teams, and as conducing to raise a large proportion of excellent manure. They are here in some cases in the habit of feeding in this way all the summer; the best farmers never turn out; they begin with winter tares, then clover, after which winter tares come in, and then the second crop of clover to Michaelmas. With tares some caution should be used in filling the racks, as when too many are given at a time, the horses are in danger of being attacked by the gripes. In some cases four acres of tares are allowed for eight horses, and then as much clover.

In Norfolk, where the practice also prevails, they use tares, but think clover better.

In the second method of reducing the expense of team horses, or that by the use of carrots, parsnips, potatoes, or other sorts of roots which possess a considerable proportion of nutritious matter in a concentrated state or small bulk, much has been effected in various districts of the island. With carrots,

the Suffolk farmers have had much success. In the substituting this excellent root in the place of oats as a winter food, which is now a very common method of management in that county, they have found vast benefits to be produced; as considering the prime cost of the root as a farm product, at about 3*d.* the bushel, and that of oats at the low price of 10*s.* the quarter, and allowing the usual quantity of one bushel of carrots in the course of the day, against two bushels of oats in the week; it is stated in the twenty-sixth volume of the Annals of Agriculture, that the horse at carrots will consume in the proportion of one shilling and nine-pence a week, while that at oats will be two shillings and sixpence. These prices are very much below those of the present period, but they show the difference in the expences of feeding with the different articles as well as if they were the exact prices of the moment. But it is remarked in the same work in addition, that the superiority or advantage of this proportion of the roots to that of the oats, is still probably greater in the feeding of team horses, as they consider the above quantity of roots as feeding very highly, and that perhaps five bushels of the root would be equal to that proportion of oats

In the few trials that have been yet made with parsnips, they seem to have answered in an equal if not superior manner, and to be perhaps a still better substitute for oats.

The potatoe both in the raw and prepared states, have been had recourse to as the means of lessening the very great expense of keeping team horses; and the trials of different experimenters, have shown them to be highly advantageous in this application. The chief objections to them have been their tendency to scour, when given in their raw condition, and the expense under the preparing system. The well conducted experiments of J. C. Curwen, Esq. in Cumberland, in employing them upon an extensive scale, and of Mr. Guthrie in the northern parts of the kingdom, have shown in the most satisfactory manner, the great benefits of making use of them; as large teams employed in the most severe labour have been kept in fine order by this sort of food when steamed, and a little cut chaff; and the expense of the preparation with a proper apparatus for the purpose is trifling. See *Steaming of Cattle Food*, and *Steaming House*.

The trials of Mr. Tabrum in Essex have likewise shown the value of this sort of food in lessening the expense of team horse keep, to be very considerable. In his practice for this purpose, they undergo a preparation with steam, which, including the washing, costs two-pence the hundred pounds. To every three hundred pounds of potatoes thus washed and steamed is added half a pint of salt, and occasionally a small portion of sulphur, and this quantity will be more than sufficient to support a horse that shall be kept constantly at work for six days: nine thousand pounds will consequently be required for the maintenance and preserving in good condition, a constant working horse one hundred and eighty days, or about half of the year; and this may be stated at three-fifths of the usual produce of an acre.

And he finds that horses fed in this manner, will perform with the greatest ease all the common labour of the farm without hay or oats. The expence therefore in wintering a team of five horses in the usual way, when compared with this management, will stand thus:

Horses fed with hay and oats.

	L.	*s.*	*d.*
Five horses twenty-six weeks requiring two bushels of oats a horse per week, in all 260 bushels, at 2*s.* 6*d.* per bushel	33	10	0
Five horses twenty-six weeks requiring twenty-four pounds of hay each horse per night, equals ten loads and one-third of a load, which at 3*l.* per load	31	10	0
	64	10	0

Horses fed with potatoes.

	L.	*s.*	*d.*
Three acres of potatoes producing forty-five thousand pounds will support five horses twenty-six weeks, charging the potatoes at $\frac{1}{4}$*d.* per pound, they are equal to	46	17	6
Washing and steaming ditto, at 2*s.* per hundred pounds	3	15	0
Three bushels of salt at 6*s.* per bushel	0	18	0
Sulphur	0	2	6
	51	13	0
Leaving a balance of	12	17	0
	64	10	0

The use of steamed potatoes has been objected to by some, on account of their sticking too much in the teeth of the animals. The practice of merely warming them can be of no advantage whatever, as the food is not thereby improved. It has however been advised, where this sort of root is used without preparation, that the potatoes be very clean washed, and some have them sliced, but others use them without cutting, being given two or three times in the day, in the proportion of about a twelfth part of a bushel at a feed, or when only fed twice, something more, so as to consume about half a bushel per horse per day. Where the potatoe is used in this state, a larger proportion of dry meat is necessary, such as straw, hay, or cut chaff of some kind, as without this, they are very apt to produce a scowering or the gripes. It is best however to be regulated in the feeding of horses with this root in this state, by the effect which is produced upon them; but they should never be given in too large quantities. And some disapprove of them wholly for working horses; but suppose that they may be useful for young ones.

There is also a mixed sort of management with

other sorts of food and that of the potatoe, which has in some cases been found to diminish the charge of keeping team horses.

It is stated by Mr. Fisher, in the fourth volume of Communications to the Board of Agriculture, that "a practice which he has some years followed with great satisfaction and benefit; and by which, though his horses do as much work as any farm horses not constantly upon the road can do, as he leads his own coals and lime for manure, from the distance of twelve or fourteen miles, yet without using a quarter of marketable oats through the year, they are as healthy, as sleek-skinned, as fit for work, and in full as good condition as any in his neighbourhood. His farm is but fifty-three acres, from twenty-three to twenty-seven acres of which are always under the plough, and for working of which and his saddle, he keeps three horses; for which horses he keeps a four acre field near the house in constant separate rotation, that he may have green or succulent food for them through the year; that is, one acre each year is a fallow crop with potatoes set with the plough; a second acre with barley, laid down with fourteen pounds of red clover, and half a Winchester bushel of rye-grass seed; a third acre, clover and rye-grass for summer food; and the fourth acre, wheat, (or sometimes for change oats) after clover. Only a small part of the potatoe acre is for the horses, as he has never found it necessary to set more for their winter use, than one Carlisle peck, containing six gallons heaped for each horse, of the black potatoe, which is not in general liked as human food, is of a hardy nature, not easily injured by wet, and extremely productive; this season was much against the dunn or general crop of potatoes. His black, upon the same acre with equal management, were double in product; the three pecks yielding eighty in return, about one-seventh less than the past or former year; they are always kept in a spare stall in the stable, and clean washed each morning for the day's use, they are preserved from the frost by flakes and sods all round, and are sufficient for the three horses from November till May; each feed must be given after their water, twice or three times a day, according to their work, a corn measure full each time, according to the horse's size; and now and then after the turn of the year, when oats are threshing out, a feed of hinderends in lieu when hard at work."

In regard to "the clover, he generally begins to cut from the middle to the 20th of May, before it begins to flower; the acre is divided into three cuttings from top to bottom, by which none but the part cut is trodden upon; it is cut fresh every morning, but if twice a day the better, and given before work, at dinner, and before turning out at night. On Sundays they seldom get any, being out at grass. The clover is always cut twice over, and often three times, and then ploughed in for wheat; but besides this, he has never got less than fifty stone of good clover hay from it, but generally more: this season ninety stone. From the last part of each cutting getting nearly ripe before the horses could eat up to it, he was obliged to cut for its next growth; the horses whilst at clover never taste hay or oats, save upon a journey, and then they always carry clover. As he has found this method to answer for seven years past, there certainly can be no risk, he thinks, in recommending it to general farm use. He is fully persuaded, that whoever gives it a fair trial, will never leave it off."

And another method of feeding team horses in the same view has been advised by Mr. West of Hampshire, which is to have the berries of the hawthorn collected in the autumn months. In October, November, and December, 1798, he gave to his working horses upwards of seven hundred bushels of these haws, or white thorn berries, with chopped hay and straw in lieu of corn. Two bushel of berries were equal to one bushel of oats; they were got by old people and children at seven-pence per bushel. All the horses were fond of them, and performed their work as well as with their usual quantity of corn; and his neighbours used them with the same success.

Another circumstance in this sort of management must also be carefully attended to, in order to lessen the expense, which is that of having as much as possible of the dry materials made use of as fodder, as hay, straw, and the stems of different leguminous plants cut into chaff by proper machinery before it is employed with other sorts of food, as by this means such matters are found from actual trials to go much further, as well as to have a better effect upon the animals. It has likewise been suggested by Lord Dundonald, and supported on the authority of many other experimenters, that some diminution of expense may be produced by having the oats reduced by a bruising machine; but others contend on the other hand that the animals thus fed do not thrive or stand their work so well, as when they have the corn whole, therefore the matter does not seem to have been fully decided by any correct trials made for the purpose. See *Bruising of Grain.*

The substituting of barley in the place of oats, has likewise been considered by the above noble writer, as well as others, as a method of lessening the expense of team keep, as it is supposed to go much farther in the same proportion. Some have, however, considered it as possessing a too stimulating quality, however it is well known to be more opening than oats, which would seem to show the contrary. And its being in use as the common food of horses in most hot climates, would seem to prove its utility as an article of food in this intention. Besides it is well known to possess highly nutritious properties in the feeding and fattening many sorts of domestic animals.

There is likewise another mode of lessening the charge of keeping team horses in particular situations, which is by having recourse to the gorse or furze plant, (*ulex uropaeus*) which must be employed while young and green, being cut or chopped small or bruised in a mill for the purpose. Experiment has shown it to be capable of being raised in large proportions per acre; more than fifteen tons, or than was capable of supporting six horses for as many months, has been stated as the produce of an acre

of land, in the thirty-sixth volume of the Annals of Agriculture. See *Furze*.

It is probable that there are other substances of the same nature, that might be employed with similar advantage.

In the usual mode of feeding in Essex, it is the practice to allow during the winter season, and while the horses are fed on what is called dry meat, two bushels of oats per week; but half the quantity is often only given. And during the summer, and when soiled on green food, half the first quantity is only made use of. From necessity the road teams are fed better, or at greater expense than the plough horses, both in respect to hay and oats, the latter being proportioned to the pressure of the work. This method of feeding renders the expense extremely high. The expenses of horse keep at Bradfield is stated in the following manner: thirty-two weeks at fifteen shillings, or two bushels of oats at three shillings and six-pence, are seven shillings; hay for six, one and a half cwt. at four shillings, is six shillings; for twenty weeks, one bushel a week, three shillings and sixpence. One acre of tares will last twelve horses a week, and worth three pounds twelve shillings at the lowest, or six shillings a horse. Decline of value, two pounds, shoeing fifteen shillings, and farrier five shillings.

	£.	s.	d.
Thirty-two weeks at 15*s*.	24	0	0
Twenty weeks at 9*s*. 6*d*.	9	10	0
Decline	2	0	0
Shoeing	0	15	0
Farrier	0	5	0
	36	10	0

But a deduction on account of one-third of the team being in the straw yard for three months:

	£.	s.	d.
Oats, two bushels a week, thirteen quarters, at 30*s*.	19	10	0
Summer food twenty-two weeks, at 3*s*.	3	6	0
Hay thirty weeks at twenty-eight pounds per day, two ton, one hundred and forty pounds, at 3*l*.	6	3	9
Shoeing, (it was a guinea seven years ago)	1	10	0
Tax	0	12	0
Decline	3	0	0
Farrier	0	10	0
	34	11	9

A similar attention becomes necessary in the feeding of ox teams with those of the horse kind in order to see that they have a suitable proportion of food for the work they are to perform, and for keeping them in proper condition; while at the same time there is no waste committed in their food. In the autumnal and early spring months when these animals are in work they should have a plentiful supply of hay, straw, and cut chaff, besides a quantity of some sort of roots or green solid food once at least in the course of the day. In this intention carrots or turnips and cabbages answer perfectly well. Large oxen consume in the proportion of forty or fifty pounds of the last sort of food per day. In the autumn when working hard in the teams some farmers, from the diminished nutritious power of the grass, have recourse to oats in the straw or otherwise, and cut chaff, which though expensive answers well.

It is the practice in general during the summer to keep them in the yards or stalls, as horses, with different sorts of green food, being well littered down, and having a full supply of water when they are in want of it.

In Hertfordshire, in the practice of Mr. Whittington as stated in the Survey of that district, four teams of oxen are wrought with sixteen oxen, being of the Hereford and Sussex kinds. They are wrought on straw and turnips, but never on straw alone, and never gives them either oats or bran, but oil-cake, which, as he thinks, answers greatly for them; a cake and a half a day with straw being better than hay; yet cakes are cheaper, and keep the beasts in better condition. In barley sowing, the oxen work well, thus fed on cake and barley straw. He works them on grass; but they do better on tares. He uses them from four years old to eight, and they are the better for fatting. He has shod some, but thinks, when the land is not excessively stony, they do better without. Mr. Beckford, at Offley, never shoes his oxen, and finds no inconvenience from it. Another farmer works oxen, generally two at a time, for half a day, in a plough with one man, and three in length or abreast, to break up his wheat or oat stubbles in winter, after wheat sowing. He works them as above, on turnips and straw, in the winter; on straw, and half a peck per day of oat and barley-meal, mixed in equal proportions, in the spring; and on grass in the summer: when the grass is short or bad, as the case has been sometimes, he then soils them with clover, mown 24 hours before it is given them. He works two with one man, and relieves them at noon with the other pair. They will plough three-quarters of an acre per day in breaking up land; but he prefers using three for that purpose, as they will do an acre, and the work is less hard for the oxen. He has now 20, which he calls five teams, and proposes to increase them to 24, or six, in the spring, summer, and autumn, and for winter will give four teams, of six in a team, to break up the wheat and oat stubbles in fallowing the land. Some of his oxen, in certain fields belonging to him, and in second or third ploughings, will plough an acre. There is one great advantage in ploughing with oxen, to which use alone he applies them—they cannot be hurried on like horses, and the land half ploughed. He has had fifteen years experience of them; they will, when wanted, cart well.

Some allow a bushel of bean meal per week to working oxen with their other food, and think it necessary to keep them well.

Some farmers in Hertfordshire in working oxen,

after having tried them in yokes and bows, are decidedly in favour of harness. And in shoeing think casting them preferable to doing it in a break: their legs not being tied to any fixture, are not so apt to be strained or bruised; but it is essential for safety to do it on an empty stomach and before they drink.

Some suppose that the most profitable system with oxen is to work them 4 years, and then sell or fat them.

It has been stated by the author of Practical Agriculture that "in the working of teams, whether of the horse or ox kind, one circumstance is to be constantly kept in view; which is, that, as their keep is so very expensive, they be always employed; as it is obvious that if they stand idle half or a third of their time, the labour that is performed must cost the farmer double or a third more than in cases where they are constantly at work, and of course much loss be sustained. On arable farms this is particularly necessary to be attended to, and of course in the autumn and winter, when the business of the plough is at a stand, other sorts of team-work, such as carting in the former, on light dry soils, chalk marl, clay, and on the wetter grass lands, manure in small carts, and in the latter, in frosts, manures of the compost or other kinds, removing various sorts of earthy materials from borders and other places, for mixing with or forming the bottoms of dungsteads, and when the weather is open, in taking the corn and bringing manure, or any other business that is to be done, as it must always pay the farmer to have it accomplished in such circumstances, as that the team must otherwise remain unemployed. The keeping of teams upon poor food, such as straw, during the winter, in order that they may not be in work, is always bad management, as their labour in the rest of the year must stand the farmer very high. And that in the seed time every care should be taken that they perform a proper full day's work, as without this be well attended to much loss may be sustained at an important season.

Mr. Young's advice to the farmer is that at this period "he should not let them work less than nine or ten hours; but this he will not, he says, be able to effect if the ploughmen have to take care of their horses. It is best to have horse-keepers, for the mere attendance of the teams, so that the men who hold the ploughs may have nothing to do but the mere ploughing. Let the horse-keeper have the horses fed and harnessed ready for the ploughman, to be in the field by six o'clock. At eleven they should come home for an hour and a half to dine and bait, during which time the horse-keeper is in attendance again. At half an hour after twelve, they should go out again and work till half an hour after five, when the horse-keeper should again take the teams. By this method a pair of horses, in a well-made plough, will, he thinks, without any driver, plough an acre and a quarter, or half, very easily; and no object is more important, than the plough's doing a good day's work in the spring of the year. The consequence especially, of making the most of dry weather in March, is extremely great. One acre ploughed and sowed then may be fairly worth two that are left till the beginning of May."

But though this mode of management may be proper and advantageous where the farms are compact and the lands at hand, there cannot be a doubt but that where the grounds on which the work is to be performed are at a great distance, it may be more economical and better to bait them on the field than to return home for the purpose, particularly in seasons when the days have not much length.

In cases where this sort of management is pursued, a much larger proportion of work will be performed, than where the care of keeping and cleaning the animals is imposed on the head man of the farm, as he necessarily shortens the day's work for the sake of affording himself more time. A person employed in various little works about the farm-yard, in whom perfect confidence can be placed, may, with the constant attention of the farmer's eye, be properly employed in taking care of the horses.

According to the author of the Synopsis of Husbandry, "the management of the plough team varies essentially in different counties, and even in different parts of the same county; whether we consider the labour to be performed as a day's work by the same number of cattle, the quality and quantity of their food, or the stated hours for baiting and attendance. In the eastern part of this county (Kent), the waggoner or head ploughman pays, he says, an early regard to his horses, and baits them continually with chaff and corn from the time of his rising at four o'clock, till six or seven, when the day's work commences; and in the afternoon, whilst the mate is baiting, the waggoner employs himself by cutting caving into chaff, or where this is not in sufficient plenty hay and straw mixed, and sometimes oats in the sheaf. At eight in the evening he goes to bed, and leaves the attendance on the team to his mate, who sits with them till ten, so that the horses are left but a few hours to themselves; and this diligent attendance is unavoidably necessary, since in this county the horses are not permitted to have any rack meat, but have generally a full allowance of corn; whereas on the other side of the county, the stable door is rarely opened of a morning before five or six o'clock in the winter, and by nine in the evening the horses are racked up and left to their repose; and as by this method of giving the horses rack meat, the less chaff is required, so there is generally a sufficient quantity of this produced by the thresher; if not, the labour of cutting does not often fall to the share of the ploughman, but is paid for by the farmer to a person who is expert at this business."

It is observed that "in support of the former practice may be urged, the reserve of a considerable quantity of fodder, which when given to the horses without limitation, forms a large item in the rual accounts at the end of the year, especially when the situation is within a small distance of London, or any place of considerable note where hay usually

fetches a large price; to which may be added the advantage which the horses reap from the constant attendance that must necessarily be paid to them when baited in the manner before described, whereby the servants are kept continually in their work, and prevented from loitering away the afternoons at the ale-house or the smith's shop, as is too frequently the case with those who have more leisure on their hands; a great expense is likewise saved, which must otherwise be paid for cutting chaff. On the other hand, the farmer who prefers the more general custom of allowing rack meat to his horses, may, he says, enumerate the following advantages accruing from this method: First, the weekly allowance of corn may be more sparing, where the horses have constantly some kind of rack meat to resort to, than when their whole dependance rests on the manger; nor is it necessary that such rack meat be wholly confined to hay, but may consist partly of pea or bean straw, at those times when the labour of the horses is light; and in seed time, or whenever the team is tasked with heavy work, though saintfoin, clover, &c. may be allowed them of a night, yet this need not be given to an unlimited degree, which indeed would quickly end in the consumption of a large stack, but be trussed out in such proportion as the master may judge expedient, obliging the servants to tend the horses with chaff in the afternoon. Under these restrictions, the consumption of fodder may, perhaps, not exceed in value the sheaf corn allowed to the teams in the first mentioned part of the district. A second consideration in favour of this practice, is in having the ploughman at leisure in the afternoon to employ about occasional jobs, whilst in that part these domestics have a just excuse for refusing to lend a helping hand towards expediting any other work than what appertains solely to the management of their horses: and this advantage of having the servants at liberty to employ in the afternoon is of no inconsiderable moment, since by their efforts many jobs may be accomplished, which would otherwise have demanded the aid of a labourer, the expenses of whose hire in the course of a winter will swell up to a large amount; not but there are many farmers who never employ their servants in an afternoon to any other work than what the care of the horses affords them; and this relaxation on the part of the master, has given so great encouragement to his servants in their obstinacy, as to furnish a pretext for disobeying every order but what respects the horses or the work to be done by them."

And to these considerations a third may be added, which in the end may, the writer says, "turn out of more consequence than either of the former, and that is the opportunity enjoyed by the farmer who gives his horses rack meat, of seeing the stable door locked up at night and opened again in the morning; and this cannot be so conveniently done where the ploughman is to sit up late and to rise the next morning at three or four o'clock; and thus an object of the most serious consideration is left to the care of fellows, who are rarely deserving of any trust; namely, the danger from fire, whereby the negligence of the servant may involve a family in total ruin, not to mention the great waste of candles in the many dark hours wherein the ploughman is necessarily engaged with his horses."

In Essex, according to the Report of that district, "upon light and temperate lands, two horses in the wheel, or common foot plough, are usually employed, and these are managed with much dexterity by one person, who holds and drives the horses to a very equal labour at the same time. Upon the stronger land three and sometimes four horses are required to plough; these as necessarily require a driver, and here in like manner with the two-horse plough teams, is the day's work, at plough and at harrow, done in one journey of $7\frac{1}{2}$ or 8 hours. To plough an acre, or at most 5 roods, is the common day's work. This is the general mode of working the farm horses, but which (under the peculiar circumstances of this county) is not to be applauded or approved of by any means. In open counties where the work lies detached, and often at the distance of two or three miles from the farm house, the rounding of the day's work into one journey, particularly in the winter season, seems to be a practice indispensably necessary: but in a county like Essex, where the farms lie compact yet moderately large, and where the farm houses in general are tolerably centrical and conveniently situated, it cannot surely admit of an excuse for the ploughmen in the middle of their journey, to halt to breakfast upon the headland, (perhaps at the back of the stable, or contiguous to the farm yard), the horses all the while shivering with cold, getting stiff and diseased from neglect and the consequences attendant upon their morning's labour, whilst the ploughmen are idly consuming the time, which custom has sanctioned, to complete their days work in one journey. By dividing the labour of the day, and baiting between two journies of $4\frac{1}{2}$ hours or 5 hours each, a greater time would be allowed for the performance of more labour, which in this manner would be done with far greater ease to both men and horses, and particularly with much less exhaustion and injury to the latter.

On this it is remarked by Mr. Howlet, that "perhaps however, at the distance of more than a *mile* from the house, as is often the case in farms consisting of 2 or 300 acres only, the travelling four miles a day is a matter deserving of some attention. And as to the danger of catching cold, &c. it is easily (in general) guarded against by a careful ploughman, by placing the horses under such parts of the hedge as screen them from the wind, and they amuse as well as refresh themselves by eating their lock of hay, while the men are refreshed with their morsel of bread and cheese. This is all dispatched in 20 minutes, or at most half an hour: less time than would be required for going home and returning again, without allowing a single moment for baiting either man or horse."

There are many different practices made use of in the keeping of team horses; some recommend their being kept in short stalls in the stable, separately, that the corn may be eaten with more certainty and

the harness more readily put on. Others, however, are in favour of open sheds, proper racks and mangers being fixed in them, with a pump and cistern, and a suitable yard for their going into at pleasure, being supposed in this way to be better, without dressing, than in the stables or sheds with such care as is commonly bestowed upon them. The practice has been found to succeed perfectly in many cases. And the open shed method is both convenient and answers well in the practice of soiling with food of the green kind with a due supply of litter.

It has been suggested that as cold is unfavourable to team horses, the stable practice may be proper in the more northern districts, while the open shed system may have advantages in the southern parts of the kingdom.

It is stated as the system of management with the best farmers in the county of Essex, to keep their team horses in warm well littered yards, with sheds for them to retire under. Into these they are turned at night, and kept in them day and night when not wrought. And in Norfolk in many instances the same practice is followed.

For the greater convenience of feeding teams, it is necessary to have proper bins of a suitable capacity for containing the weekly allowance of corn, being furnished with a proper sieve and measure for the purpose, as well as locks and keys for the horsekeepers.

There is much difficulty in ascertaining the expences of teams from the differences in the expense of keep in different situations, and the modes of feeding being so extremely various; but it has been partly shown above, and is probably in general from about 25 to 35 pounds per horse, according to the cheapness or dearness of situation.

The necessary proportion of horses to the extent of the farm is also a circumstance that is of much interest to the farmer, but which must of necessity vary greatly according to the nature, situation and state of the land, as well as the mode of husbandry under which it is conducted. It has been remarked by Mr. Bannister, that one team on a sandy, gravelly, or any other light kind of land, will be able to execute a larger proportion of labour in a given length of time, than two on those of the stiff or heavy clayey descriptions, from the circumstance of the work being greatly retarded by their tenacity. Also that in hilly or steep situations, more force or strength in the teams will be required, in proportion to the extent of the lands, than under the contrary circumstances. In cases too, where there is much work to be performed on the road, a greater strength of team will be wanted, than where this is not the case.

In deciding the necessary proportion of team, the farmer must likewise well consider the extent which the sward or grass land bears to that which is in the state of tillage, as where the proportion of the former is considerable, there will be much less team work to be executed, of course a much less strength may be sufficient.

Where the farm is under the hay system, as there is seldom much team work, except in conveying the produce and carting manure, a smaller extent of team is mostly sufficient, in proportion to the quantity of land, than in other cases.

And in the dairy management the same is the case, but as in this case it becomes necessary to raise green crops as cattle food, a somewhat stronger team may be required than in the former case.

In perfectly tillage farms, whether conducted under the naked fallow system or the more improved management under the convertible husbandry, a much greater force of team will be required in proportion to the extent of land that is to be cultivated. Some reduction of team labour may, however, be effected in both cases, by having recourse to green smothering crops in the place of the fallowings, which should always be done as much as possible.

It has been stated that in the eastern counties it has been common to employ four horses on farms that contain only forty acres of tillage, with suitable proportion of grass. And with seventy or eighty acres under the plough, and thirty or more in the state of grass, six horses have been often employed. And in these cases seldom more than two horses made use of as a team. In districts where not less than three or four constitute a team, the proportion is still higher. But under good management in the improved methods of cultivation a much less extent of team may be sufficient. The business of forty acres in tillage with thirty or more in sward, and a few in wood, has been accomplished without difficulty by a pair of good horses. And two oxen with one horse would in many cases be adequate to the same extent of land. With two horses and four oxen, the labour of an arable farm of from one to two hundred acres or more, may be managed without inconvenience.

In the tillage districts of Norfolk, Essex, and Hertford, the number of horses run mostly in about the proportion of from four to five to one hundred acres of land; but diminish in general in some degree as the farms become more extensive.

There can be no doubt but that there are some other sorts of animals besides those of the horse and ox kind that may be occasionally employed in team labour. The mule is an animal well calculated for this purpose, from its being more hardy and enduring work a greater length of time or to a more advanced age than the horse. In some cases the smaller sorts of mules have been recommended as more hardy and useful, but in Worcestershire large mules have been found more beneficial for team purposes.

The ass may likewise be employed for team labour with advantage in small concerns, from its hardy nature, and being capable of living on more scanty fare than the horse. And it is very useful for numerous purposes about the farm-house.

Whatever sort of teams may be made use of upon the farm, they should always be well attended to, and no neglect of any kind suffered in regard to them; and when attacked by disease, recourse be had as quickly as possible to proper remedies.

Team, a term applied to an ox-chain passing from yoke to yoke.

TEAMER, a term applied to a team of five horses.

TEAMERMAN, a word used to signify a waggoner, carter, or driver of a team.

TEAP, provincially a tup or ram.

TEATHE, a term applied to the dung of cattle in feeding off green crops; or which, in a more particular sense, signifies the soil or improvement left upon the pasture lands in feeding them with live stock, or the fertilizing effects which are produced on them, in consequence of such cattle or other stock being foddered upon them with any sort of food, whether such improvements be caused by their dung, urine, treading, breath, perspiration, warmth of their bodies, or other similar causes. It is a term much made use of in the husbandry of Norfolk. Thus the farmers in that district are sometimes inconvenienced for clean ground on which to throw their turnips, and notwithstanding the value of the *teathe*, when the land will bear the bullocks, cases have occurred, where they have requested their neighbours to permit them to throw turnips upon a contiguous piece of old lay ground or *ollond* as they call it, preferring the loss of the *teathe* to the checking of the bullocks.

TEATHING, the practice of eating turnips off, upon young wheat crops, in the early spring months by live stock, as sheep and bullocks. It is often written *Tathing*.

It is a singular husbandry, which the writer of the Norfolk Report says he met with on entering the district of Fleg in coming from Yarmouth. It consists in carting turnips on to wheat in February and March; they call it to *pull and throw* on wheat, eating them on that crop by sheep and bullocks; if sheep are kept; if not by bullocks alone. In Mr. Everit's practice it has been found that the wheats thus treated were the heaviest crops gained; it makes the straw as stiff as reed. It is not practised as a preventive of the crop being root fallen, for that is little known there; when finished, the field is harrowed, and if necessary hoed. Others do it sometimes *too* late, with cows and bullocks. But Mr. Brown of Thrigby, confines this practice to land that is light, and subject to red weed; never later than March, and then wishes for some showers directly after: he finds that this practice does not make the wheat *too* rank, but the contrary, by stiffening the straw. The practice is pretty general, the writer says, in Fleg; and some, but not so much in Blowfield hundred. And Mr. Syble does it like his neighbours, *here and there* on a piece given to poppy. The same rule at Repps and Martham; but some doubt whether it answers. Mr. Frances has been *caught* sometimes by draught, and he has seen others. He remarked that the open fields give as good wheat as the enclosures, yet never have turnips thrown upon them. He thinks it better to throw turnips on wheat stubble, treading all well down for barley. And Mr. Hornard, of Leedham, on his light soil is in this practice: he had two pieces under the same circumstances, one tathed and the other not, and the former was the best crop; on an average of seasons, he thinks it certainly does good. He was the first there who practised it twenty-eight years ago; but had seen it near Norwich, he has continued it ever since; begins in February, and continues through March; he has no sheep, but if he had, would do it with bullocks also. And on his light land, Mr. Cubit of Stoning, has carted muck on to his wheat in winter, throwing turnips after for sheep: he has done it for bullocks, but sheep answer the purpose much better.

Also about North Walsham, the practice of throwing turnips on wheat is known, but that is all. Mr. Margateson, the writer says, he does not approve of it with bullocks; he has done it, and mischief was the result; but with sheep only, it is good husbandry with those who keep a sufficient number. Mr. Petre of Westwick, who keeps seventeen score of sheep, is also in this husbandry: his bailiff, Crowe, informed the writer, that he practises it on light land with much success. Others have seen it employed, but with little advantage. It is probably a practice best adapted to the light sorts of soil, but which should be used in a cautious manner.

TEAZLE, a plant of the thistle kind cultivated for the use of clothiers. It is sometimes known by the name of *Fullers-thistle*. The heads of the plants are formed of numerous well turned vegetable shoots.

In respect to soils, those most adapted to the growth of this plant are all those of the more strong and deep kinds, but which are not too rich, as loamy clays, and such as have strong marly bottoms and are fit for the growth of wheat crops. Where they are broken up from the state of old ley, or turf it is, the better; but wheat stubbles are sometimes made use of for the purpose with considerable advantage.

With regard to the situations of the land, the most favourable, are those that are rather elevated, open, and incline a little to the south. And the higher grounds, particularly where the country is inclosed, are the most advantageous, as the natural superabundant moisture in the heads of the plants is more completely dissipated in wet seasons, which in other more low situations is apt to lodge so long upon them as to cause them to decay and become less valuable.

It is advised that in the preparation of the ground where it is a lea, it be ploughed up deeply in the early part of the year, as in the beginning of February; and that where it is inclined to moisture, it should be executed in narrow ridges of not more than three bouts each, the furrow slices being laid over in as even and regular a manner as possible, the fine mould from the furrows being raised by the plough or spade so as to cover the surface very well. But in lands that are sufficiently dry, and which are broken up from stubble, the ploughing may be deferred to a later period, and be laid in ridges of much greater breadths and in a more flat form. But in either case the surface should be left in as fine a state of mould as possible for the reception of the seed, as upon this much of the success of the crop depends. Mr. Billingsley has remarked that in the providing seed, it should constantly be taken from such plants as are the most perfect of their kind, and the most productive in heads, as there is much difference in the quantity that is afforded by different plants, some

producing nearly a hundred, while others do not afford more than three or four. It should be suffered to remain till it becomes perfectly ripened, and be used while fresh, as such as has been long kept seldom vegetates in a perfect manner, and of course does not answer the purpose of the farmer.

With respect to the proportion of seed, that which is mostly employed on the acre is from about one to two pecks, according to the above writer, but some make use of a larger quantity. But it is disadvantageous, to sow the seed too thick, as the plants are injured in their early growth by standing too closely together, and having their growth thereby contracted.

In regard to the season of putting in crops of this sort, it is commonly about the beginning of April. But as the seeds grow in the most expeditious and perfect manner when put in while there is a considerable portion of moisture in the soil, the sowing should never be deferred much longer than this period, lest the drought should become prejudicial.

The common method of putting this sort of crop into the ground, is the broad-cast, it being sown evenly over the surface, in the manner that is practised for turnips. But before this is done the land should be well harrowed down, in order to afford a fine state of mould as a bed for the seed. It is then to be covered in by a slight harrowing with a light short-tined harrow such as is used for grass seeds.

But this sort of crop may be sown in rows in the drill method, at the distance of eight, twelve, or more inches from each other, in the same way as that of the turnip. But this mode is not, however, we believe, much employed by those who are in the practice of raising crops of this nature.

In the culture of crops of this kind, a great deal depends on the land between the plants being kept perfectly clean and free from weeds; in having them set out to proper and sufficient distances; and in having them well earthed up; of course it becomes necessary that the grower should see that these operations be executed in a perfect manner. The business of digging between the plants is usually executed by means of spades which have long narrow bitts not more than about four inches in breadth, having the length of sixteen or eighteen inches. With these the land is usually worked over in the intervals of the plants three or four times during the summer months; and about the beginning of November, when they stand too closely together, they should be drawn out in order to fill up any vacancies that may have occurred. Where there are still too many plants remaining, it is sometimes a practice to prepare another piece of ground, into which these are transplanted. It is, however, found that those plants which are never removed produce the best heads, of course the business of transplanting should be as little practised as possible.

And in the course of the following winter, as about the latter end of February, the land between the plants is to be again worked over by the narrow spades, care being taken that none of the mould falls into the hearts of the plants. And again about the middle of May, when they begin to spindle, another digging over is given, the earth being raised round the root-stems of the plants, in order to support and prevent them from being blown down by the wind. Some cultivators perform more frequent diggings, that the ground may be rendered cleaner and more mellow; consequently the growth of the plants be the more effectually promoted. This business has usually the name of spaddling, and is executed with great dispatch by labourers that are accustomed to perform it: the use of the hoe has been attempted by some in executing it, but without much success. Where these diggings have been finished, nothing further is necessary till the period of cutting, which is generally about the month of July, which is known by some of the uppermost heads beginning to blow; as, when the blossoms fall, they are ripe, and in a state to be cut and secured.

It is the best method to have the heads cut as they become ripe; but the work is mostly executed at three different times, at the distances of about ten days or a fortnight from each other. It is performed by means of a knife, contrived for the purpose, with a short blade and a string attached to the haft. This last is done in order that it may be hung over the hand. A pair of strong gloves is likewise necessary. Thus prepared, the labourer cuts off the ripe heads along the rows or lines with about nine inches of stem, and ties them up in handfuls with the stem of one that is more perfectly ripened. And on the evening of the day on which they are cut, they should be put into a dry shed; and when the weather is fine and the air clear, they should be taken out and exposed to the sun daily till they become perfectly dry. Much care must, however, be taken that no rain falls upon them. In doing this, some make use of long small stakes or poles, on which these handfuls are hung during the time of their preparation.

As soon as they are completely dried, they should be laid up in a dry room, in a close manner, till they are become tough and of a bright colour, and ready for use. They should then be sorted or separated into three different kinds, by opening each of the small bundles. These are distinguished into *kings*, *middlings*, and *scrubs*, according to their different qualities. They are afterwards, the author of the Somerset Report says, made into packs, which, of the first sort, contain nine thousand heads, but when of the second twenty thousand; the third is sort of very inferior value. By some, before forming them into packs, they are done up into what are termed staves, by means of split sticks, when they are ready for sale.

It is obvious that the produce in crops of this nature must be very uncertain, there being sometimes fifteen or sixteen or more packs on the acre; and at others scarcely any. The produce is disposed of to the cloth manufacturers in Somersetshire, Wiltshire, and Yorkshire, and in general averages about forty shillings the pack. From the circumstance of the land being under the necessity of being kept in a

high state of pulverization and cleanness, the expenses of cultivation must be considerable, so as to render this sort of crop a hazardous undertaking, especially as the plants, when the season proves wet about the time of blossoming, are liable to rot and be of no value.

It has been stated that formerly "an acre of land, if well grown, and what is deemed a full crop, often produced nine packs of *kings*, nineteen of *middlings*, and two of *scrubs*." The common price per pack of the first sort, was twenty, the second sort fourteen, and the third sort eight shillings. But in the time of war, they are generally double these prices.

Expenses per acre.

	£.	s.	d.
1st, Rent of the ground for the crop, which is one year and a half	5	0	0
2d, Ploughing and sowing	0	15	0
3d, First dressing or delving	1	0	0
4th, Second delving	0	10	0
5th, Hilling	0	15	0
6th, Cutting and carrying home	1	15	0
7th, Tythe	0	5	0
8th, Clearing of the stalks, and binding them in bundles	0	5	0
9th, Making out at two shillings per pack, *spleets*, *staves*, and *wreaths* included	3	0	0
All which make the total expence	£. 13	5	0

But in the Agricultural Survey of Somersetshire, the expenses at present are stated to be as below.

Expenses per acre.

	£.	s.	d.
Two years' rent	3	0	0
Ploughing	0	15	0
Workmen's labour in digging, &c.	3	15	0
Making out in bundles, tying together, and bands, at 2s. per pack	0	14	0
	8	4	0
Profit	5	16	0
	14	0	0
Average Produce.			
Seven packs at 40s.	14	0	0

In this estimate tythes and taxes are not however valued.

It has been observed that "the uncertainness of teasel crops has induced the cultivators to blend other plants with them the first year, such as beans, &c. in order to repay them in some measure for the great expense of tillage and keeping the land clean; but this is a practice that should be avoided as much as possible, as the growth of the teasel plants must constantly be injured by such a practice.

It is evident that from the fine preparation the land undergoes in rendering it fit for the growth of the plants, and the fine state of pulverization and cleanness that it is kept in by the after-culture which is necessary, that it must become well adapted to the reception of wheat after the teasel crops are removed, and which may mostly be put in on one ploughing. But as the teasel robs the soil on which it is grown of a considerable portion of its fertility, as is shown by its succeeding the most perfectly on lands that are newly broken up from the state of old sward; it may not be advisable to follow it by such grain-crops, except where the lands are very rich; but to interpose some sort of green crop, either of the bulbous-rooted or stem kind, in their place, by which injury may be prevented.

It is suggested by Mr. Parkinson in his Experienced Farmer, that this is a sort of crop that "may be grown to advantage on many lands, in a rotation on the fallow to prepare for wheat, and by burning the straw and refuse stuff after the crop is reaped, will be found not to impoverish, but rather improve the land. He says, that in their young state, they stand the winter without danger; and are a good crop for clearing land of all weeds, from their lateness in the process of hoeing, there being few weeds that vegetate at so advanced a season:" on all these accounts they become an advantageous crop for the farmer.

TED, a term made use of to signify the spreading abroad new-mown grass, which is the first thing done in order to its being dried, and made into hay.

TEDDER, a rope or chain by which an animal is tied and confined in the fields, that it may not pasture on too wide a range.

TEDDER-*Stick*, a stake or pin drove into the ground to fix the tether rope to.

TETHER. See *Tedder*.

TEETH, little bones fixed in the jaws, which serve not only to reduce the nourishment, but show the age in some animals.

The horse has forty teeth, including the tushes, which are thus distinguished. Twenty-four are called *grinders*, being placed at the bottom of the mouth, beyond the bars, twelve on each side of the channel, viz. six above, and six on each side. These teeth continue, and do not give place to new teeth in their room, so that they are of no use in distinguishing a horse's age. But they are subject to wolve's teeth.

In reference to the other sixteen, twelve of them are called in their infancy, *milk* or *foal teeth*, and the remaining four go by the name of *tushes*.

The twelve foal teeth are short, small and white, and are seated on the fore part of the mouth, six above, and six below. And these change and cast, to give place to others; which, in process of time, become long, large, and yellowish.

These new teeth are distinguished by different names given them, according to their putting forth, and it is the manner of their coming forth, that gives the knowledge of the first years of a horse's age.

Of these twelve, four are called *nippers*, four *middling teeth*, and four go by the name of *corner teeth*.

The four nippers are seated on the fore part of the mouth, two above and two below. When a horse has put forth these, he is concluded to be from two and a half to three years old.

The middling teeth are placed near the nippers or gatherers, one above, and one below on each side of the jaws. They come out and appear between three and a half and four years.

The corner teeth are placed still more forward in the mouth, one above, and one below, on each side of the jaws.

They begin to shoot between the fourth and the fifth year, and are got above the gum at five years. And when surmounting the gum at that age, they become hollow, and mark commonly till seven or eight years.

By marking is meant, that in the hollow or cavity of the corner teeth, a little black speck is formed; which, from its resemblance, is called the bud or eye of a bean. But when the horse passes six, the cavity begins to fill, and the black mark disappears by degrees; yet this diminution of the cavity and the mark continues from six till seven and a half. However, at eight years the cavity is filled up, and the black mark gone, and the tooth is then full, and even as if it had been shaved: it is then said, that the horse has razed; which happens a little before the eighth year, and after that the horse does not mark; so that the surest knowledge of his age is then formed from his tushes.

The tushes are placed beyond the corner teeth upon the bars, two on each side below, without being preceded by any foal teeth. The two under tushes cut sometimes at three years, sometimes at three and a half, sometimes at four; but the two upper tushes appear sometimes at four, sometimes at four and a half; sometimes before and sometimes after the corner teeth, without any certain rule; and till the age of six they are chamfered within. And about ten years of age the two under tushes appear much worn, which serves for that age. After that they grow out in length, and become bare of flesh, because the gum shrinks and retires; and at last, about the fifteenth or sixteenth year, the horse shells.

It is said that "a horse is not capable of any great fatigue till his tushes have cut the skin." See *Age of a Horse*.

TELLURE. See *Tiller*.

TEMPER *of a Horse*, in *Horsemanship*, the disposition of the animal, which should be carefully attended to in a purchase. See *Buying*.

TEMPERING *of Land*, a term signifying the preparing it for a crop, especially of wheat. It is a term in use in Norfolk.

TENANT, a person holding land or other property of another, either by grant, lease, or otherwise. Tenants are of different kinds, according to the nature of the tenures by which they hold their lands; but in this last respect they properly belong to the business of the law.

It is observed in the Survey of Gloucestershire, that "the leases of rackrenters there generally commence at Lady-day; and in this case in the vale, the going-off tenant holds a part of the grass lands to old May-day, and has likewise the going-off crop of wheat, with the use of the barns for the purpose of housing and threshing it, till the Midsummer following. In this usage there is, the writer says, great inconvenience, especially where the new tenant is at variance with the old one, which is not uncommonly the case. Each have an opportunity of distressing and incommoding the other in various ways. The improved spirit of agriculture has discovered both to landlord and tenant, the absurdity of this ancient custom; and it is gradually falling into disuse. Where an improvement has taken place, the coming-on tenant enters the preceding Michaelmas to plough the land for the spring crops; the tenant going off at Lady-day ploughs for the wheat crop and often sows it. In the case of ploughing only the work is paid for; and when sowed, the crop is valued at Lady-day, and paid by the coming-on tenant. The going-off tenant is also frequently paid for his seeds left after the last year's crop. Under this practice the new tenant enters on the whole of the estate at Lady-day. And it is added that Michaelmas takings are not uncommon, though in one respect, they are particularly inconvenient, as the old tenant has no time to spend the crops of the preceding summer on the premises, and the new tenant is either obliged to sell his stock at a most unfavourable time, or purchase fodder for the support of it at his new farm; a circumstance he cannot always command, and when he can, at great loss. But there are other takings which commence at Candlemas, which have some conveniences, particularly that of enabling the new tenant to "*hain up*" his pastures early, which is a matter of considerable consequence, for the new tenant going off at Lady-day always stocks as far as he can till the last moment, thereby leaving the ground as bare as possible; nor is the mischief of this late *haining* always compensated by the manure left from the cattle, especially if the season has been wet and the ground tender. Two years care will sometimes scarcely recover the land to a good and even turf after having been much trodden or "*poached*."

With respect to agreements between landlord and tenants, it has been suggested by Mr. Parkinson, that "for small farms leases are less necessary; but a large one cannot well be let without a lease. Upon a small farm whose land is good, a man's improvements soon come round; and if the tenant or landlord disagree, either of them is easily accommodated; but upon a large farm it is quite otherwise. It would not be worth a man's while to fix himself upon a large scale for a year or two; and it would be attended with great expense and loss, to move from any great distance, with large quantities of stock, for a short time. Besides, the plans of improvements upon a large farm are more extensive; and it is longer before the money laid out in them is returned, especially upon poor land. But undoubtedly the

tenant upon either a small or a large farm ought to have a security for his property; and there should be an agreement to allow him a proportionate recompense for every improvement by which he has raised the land in its value, as by giving it more manure than could be made from the produce of the farm. When the manure produced upon the farm is the property of the farmer, and by the terms of his lease, he is obliged to sell it to the coming tenant at a fair valuation, he often endeavours to make more manure the last year than any other, and by that means benefits the estate: but if on the contrary he is not paid any thing for it, he will perhaps do every thing in his power to prevent any future improvement upon the farm, as on some account or another he may fancy himself ill used upon leaving it. For all under-draining properly done, and for new buildings that were necessary for the farm, the tenant ought to be allowed a reward proportionate to the number of years less than twenty he may have had the use of them. He should likewise receive an allowance for quick fences; and the planting of orchards, or of aquatics and other useful trees in proper places; on producing fair bills, with receipts to them of the expenses; provided he leaves the estate without committing any wilful waste.

"The landlord who enters into such a covenant with his tenant, may reasonably expect to have his farm delivered back to him upon terms equally fair. If the tenant has committed any waste, he should be obliged to make good all damages. Now such mutual conditions would do away many absurd restrictions that are at present laid upon the tenant; as it would then be his interest not to injure the farm, because he must pay for all damage wantonly done, and the landlord would have no reason to check the farmer's experiments and improvements, which would be a great encouragement to both ingenuity and industry; for gentlemen's agents are very apt, from *too* anxious care of the estates, to restrict tenants in such a manner that they are little better than a mill-horse, who can go over only a particular circle of ground. He has known an agreement made to lay a certain quantity of lime on land; where, if the land had been his, he would have given more money than the lime cost, that it might not be laid on.

"Sometimes, besides many other injurious modes of culture, which the ignorance or whim of the steward obliges the farmer to follow, he is tied down to plough and sow crops of corn only four years in six, and no turnips or clover. But the restricting a man from ploughing up grass-land without leave, is certainly, he thinks, proper, till the landlord sees what use his new tenant makes of the land, he does plough: but if he is industrious, and tills well, he would suffer him to plough every inch if he chose; as on good arable land it will certainly make in future a difference of from one pound to three pounds an acre in rent to the landlord." The nature and situation of the farm is, however, to be well considered before this is done.

"And where the duration of the term is 21 years it would, he thinks, be very proper that three years before the lease expires, he should be restricted in the rotation of his crops, so as to leave the farm in a proper state to be profitable to the coming tenant. This would likewise give time for the tenant to fix himself elsewhere, if the landlord and he do not agree again; as well as for the landlord to make proper choice of a new tenant.

"It is very common for tenants to live in a very poor way, and obtain little profit from the want of introducing a proper system of husbandry upon their farms, as it is only this that can afford a full profit."

TEND, provincially to look after sheep, or other sorts of stock, also to keep birds from grain.

TENDON-*Strained.* See *Back-Sinew Strained.*

TENDRIL, the clasper of a vine, or other climbing plant.

TENEMENT, any thing, as a house, &c. held by a tenant.

TENT, in *Farriery*, a kind of plug of lint, or tow, rolled up in the form of a solid wedge, for the purpose of being thrust into a small aperture in a sore; with a view either to dilate it gradually, or to prevent its closing prematurely. For dilatation, bits of sponge are used dipped into a melted composition of rosin, wax, and oil, in proper proportions, and strongly pressed between two iron plates, so as, when cooled, to retain their compressed form. See *Wounds.*

TENURE, the manner in which tenants hold their lands, &c. of their landlords, &c.

The tenures of lands are extremely various in every district of the kingdom, being, however chiefly *freehold*, *copyhold*, or *leasehold*, though there are many other local sorts of tenures of land. The freehold is most probably in the largest proportion over the whole country, the copyholds in the next, and the leasehold tenures in the smallest.

It is stated in the Survey of Essex, "that freehold estates are the most valuable to the immediate proprietor, there can be no doubt; but the purchaser of a copyhold may remember, that the original purchase is by so much the lower; and whether he lets the occupation to a tenant, or farms, and cultivates it himself, he may possibly make as good interest of his capital as if he had bought a freehold. Perhaps, also, its general and final utility to the public, may be nearly or quite the same. This, the writer thinks, is certain, copyhold estates whether in the hands of the proprietors or tenants are as well cultivated as the free, excepting only in the article of timber, and even in that the difference is seldom visible. The like may be said of leasehold estates, and even of those in mort-main."

In Hertfordshire, where a large portion of the property is held by copyhold tenure with a fine certain or at the will of the lord; but which fine never exceeds two years rent, the land sells at about six years purchase under the price of freehold, according to the Report of the State of Agriculture for that district.

It is further suggested in the first of the above Surveys, that "with regard to the tenures by which the more temporary occupiers hold their farms, they are as

already observed, extremely various, some upon leases of longer or shorter duration, some without any lease at all, agreeably to the taste and pleasure of the landlord; though by far the greatest number, especially of those in the possession of the smaller proprietors, are let upon leases of from eight or ten to twenty-one years."

It is observed from what has been done in Norfolk and other counties where the tenures are of more length, as from 7 to 21 years, that the improvement of the land is much connected with the practice of such tenures.

And it is suggested in the Gloucester Report on Agriculture, that "it were much to be wished, that a general rule could be adopted for the commencement and end of tenures: it would ultimately, the writer thinks, be highly advantageous to landlords and tenants, and will probably be one result of the labours of Agricultural Societies."

TERETES, in *Farriery*, one of the three sorts of worms, which infest the bodies of horses. See *Worms*, *Ascarides*, and *Bots*.

That sort of earth-worm which is found in horses resemble the common earth worms in many respects, being only sharper at both ends, callous towards the middle, and do not contract or dilute themselves so easily. Some of these, which have been seen to come from horses, hinder them from thriving till they are dislodged by proper remedies.

TERACE, a term provincially applied to a coarse hair sieve, for separating the inferior flour from the bran.

TETANUS, in *Farriery*, a spasmodic disease, of which there are several modifications. See *Locked Jaw*.

TETTER, in *Farriery*, a term applied to the flying-worm, or ring-worm. It runs upon the skin in different directions, from whence it receives its name. It is most commonly found on the rump, and runs down the joints of the tail; and if neglected is said to turn into a canker. It will now and then settle upon some fleshy part of the body, which will be attended with so troublesome an itching, as to make the horse rub against walls and posts, till he will bring away the hair and skin, and even tear his flesh with his teeth, if he can come at it. It, however, differs little, if at all, from the mange, and is to be cured by similar means. See *Mange*.

TERRIER, a kind of dog used for hunting the fox or badger and various sorts of vermin. He is so called, because he creeps into the ground as the ferrets do into rabbit-burrows, and there attacks the fox or badger; either tearing them to pieces on the spot, or else hauling them by force out of their lurking holes; or at least driving them out of their hollow harbours, so that they may be taken by a net, or some other contrivance. Sportsmen have commonly a couple of terriers with them, in order to put in a fresh one, as occasion may require, to relieve the other. The time proper for entering terriers is, when they are about a year old.

TESTICLES, in *Farriery*, the organs by which the semen is prepared in animals. These in the horse, as well as various other quadupeds are seated in a scrotum, which in the first takes its origin and growth from the external parts. The testicles are glandular, and have four coats, with proper veins and arteries which communicate with those of the kidneys, &c.

THACK, provincially thatch. See *Thatch*.

THACKSTER, provincially used for thatcher.

THATCH, straw laid on the top of a building, rick, &c. to keep out the wet.

There are many different sorts of materials that may be made use of as thatch, but those which are most commonly employed are the straw of different sorts of grain, as wheat, rye, &c. reed, stubble, heather, &c. The straw of wheat and rye when well laids probably form the neatest and most secure covering, for general purposes. It has indeed been stated, that "the most suitable material for the purpose is that of good wheat straw that has not been much bruised in threshing out the grain. But when this cannot be had in sufficient quantity, rye straw may be substituted in its place; however, from its rough and stubborn quality it is neither so neat in its appearance, so durable, or affords so secure a covering." And that "barley and oat straw are sometimes made use of for the purpose, but they form very indifferent coverings, and such as are not by any means lasting."

The reed is a highly valuable article for the purpose of thatch, where a lasting roof is required; but is much too expensive, and stubborn for common purposes.

It is remarked by Mr. Marshall, in the Rural Economy of Norfolk, that there the favourite material for roofs, and that which is the most eligible after good slate for farm purposes, is reed. And that "a reed roof properly laid, will lie fifty years without touching; and thirty or forty more, with only adjusting (driving) it, and levelling the hollows with a little fresh reed. At an hundred years old, it may be relaid; and will then, if laid upon the upper parts of the roof, last through a considerable part of another century."

The reed is, he says, "principally cut from the margins of the (*broads*, large pieces of water) and is carried, perhaps, forty or fifty miles into the central and northern parts of the county." And it is added, that though "a covering of reed is, in the first instance, costly; when its durability, and the high degree of preservation in which it keeps the roof are taken into the account, it is of all other the cheapest covering; besides its being, whether in the extreme of heat or cold, the most comfortable."

It is stated, that "the price of reed, in the place of its growth, is from three pounds to three guineas a hundred; containing six score fathom; each fathom (composed of five or six sheaves) measuring six feet in circumference. A hundred of reed will cover five squares of roof: the laying is a halfpenny a yard, or four shillings and two-pence a square; and the tar rope and rods for fastening it on, cost eighteen pence a square: so that a covering of new reed costs about eighteen shillings a square

containing one hundred square feet; besides carriage, and what is called 'roofing;' namely, a cap of wheat straw placed upon the ridge, in a somewhat similar manner, and for the same purpose as ridge tiles are put on. This capping, which is done in a most effectual, but in a tedious and expensive manner, costs in materials and workmanship about sixteen pence each foot in length: which, upon a roof of sixteen feet and a half spar, is an additional expence of four shillings each square of reeding."

With regard to "the carriage, it is in proportion to the distance. Taking twenty miles as a medium distance; and one shilling a mile as a medium price; the expence is, he says, twenty shillings a 'load' of sixty fathom, or forty shillings a hundred; which laying five squares is a further addition of eight shillings a square: therefore the whole expence of a covering of reed fetched twenty miles may, he supposes, be laid at thirty shillings a square."

The writer has been thus minute, he says, in his account of this material, as it has been much overlooked in other districts, where it may be found useful.

And with respect to the stubble, it is said to be a material that may be made use of with propriety and advantage in some situations. This is the stubble of such wheat crops as have been cut at a great height; which after being mown close to the ground and raked up, serves this purpose, especially for the more common purposes of the farm, such as covering hay and straw stacks, &c.

The last material heather, is also found a highly valuable article for the purpose of thatch in districts where it grows in abundance, as it is extremely durable. See *Heather*.

The thatch which is removed from the stacks or buildings may be used as litter for various purposes.

THATCHER, a person who performs the business of thatching. On large arable and hay farms it is necessary to have a person who is perfectly conversant in this business, and that of building or setting up the stack, as without it much trouble and inconvenience may often be sustained.

THATCHING, the operation of covering the roofs of buildings, stacks, &c. with some sort of thatch. It is an art that requires considerable care, attention, and practice to perform it in a proper manner.

Before this business is begun, it is necessary that the materials, of whatever kind they may be, should undergo some preparation. With articles of the straw kind the usual method is this: The substances after being well moistened with water, are drawn out in handfuls perfectly straight, and even into regular lengths, and the short straw separated from them, leaving them placed in convenient bundles to be carried to the thatcher by the person who has the serving of him.

In regard to the application of the thatch to stacks of hay or corn, there are different methods pursued, according to the nature of the materials employed. Where long straw is made use of, the operator or workman usually begins at the eaves or bottom of the roof, depositing it in handfuls in regular breadths till he reaches the top, the different handfuls being so placed endways as to overlap each other, the upper ends being constantly pushed a little into the bottom parts of the sheaves. In this manner he gradually proceeds breadth after breadth till the whole of the roof is covered, which is usually done to the thickness of about four or five inches. And in order to retain the thatch in its place, short sharp pointed sticks are occasionally thrust in, in a slanting direction upwards, and sometimes small sticks sharpened at the ends are bent and thrust in along the top parts and sides. But as the water is apt to follow the course of the sticks, it is, perhaps, a better practice to make use of ropes of twisted straw for this purpose. In some cases these are applied only round the bottom parts of the roof and the sides; while in others, which is a much better and more secure method, they are applied in such a manner over the whole stacks as to form a sort of coarse net work of nine or twelve inches in width in the meshes, the ends being well fastened either to bolt-ropes passed in suitable directions for the purpose, or to different parts of the straw of the stack. This method of tying on the thatch should always be had recourse to where the stackyards are greatly exposed to the effects of wind, as without such precautions much injury and loss may frequently be sustained by the former.

In the application of stubble as a thatch, it is mostly put on by sticking one of its ends into the roof of the stack in a regular and exact manner, so as that it may stand very close and thick; when the other, with such loose straws as may occur, is to be cut over or pared off, with a very sharp tool for the purpose, so as to form a neat and impenetrable thatch, having the appearance of a newly thatched house roof: the whole being well secured in its place by short pegs made for the purpose, somewhat in the same way as in the other stacks.

With whatever sort of materials the thatching of hay and corn stacks is performed, it should never be attempted until they have fully settled, as under the contrary circumstance it is sure to rise into ridges afterwards, and by that means admit the water to pass down into them, and of course do much injury to the corn or hay.

In the execution of this business in a proper manner, a considerable portion of ingenuity and attention is required; but with these sorts of stacks it is mostly quite sufficient that they be thatched in such a manner as to effectually prevent the entrance of water, and so secured that the winds cannot disturb them, as to have the work executed in any other way is wholly incompatible with that dispatch which is constantly to be attended to at such seasons of hurry and bustle. The eaves and other parts are cut and trimmed in an even exact manner in finishing the work. See *Stack*.

In the thatching of the roofs of houses or other buildings with any of the sorts of straw, the same rules are in some respects to be followed, only the materials are to be laid on to a considerable thick-

ness and be more firmly secured. They are applied in regular narrow slips, or what in some districts are termed *gangs*, from the eaves of the building to the ridges, the ladder being moved forward as the work proceeds. The thatch is secured by short sharpened sticks thrust in where necessary. And bended sticks sharpened at each end are likewise sometimes made use of near the ridges, being thrust in at each end. In finishing the work the thatcher employs an iron toothed rake, with which the whole is raked over from top to the bottom, so as to render it completely smooth and even, and take away all the short straws.

The method of thatching with reed, according to Mr. Marshall, who seems to have paid much attention to the subject, in his account of the Rural Economy of Norfolk, is this, "No laths being made use of, in laying it a little of the longest and stoutest of the reed is, he says, scattered irregularly across the naked spars, as a foundation to lay the main coat upon: this partial gauze-like covering is called the "*fleaking*."

On this *fleaking* the main covering is laid, and fastened down to the spars by means of long rods—provincially, "*sways*"—laid across the middle of the reed, and tied to the spars with rope yarn; or with "*bramble bonds*;" which formerly were much in use; but which are now, he says, pretty nearly laid aside, especially for new roofs."

And he adds that "reed is not laid on in longitudinal courses, in the manner that straw thatch is usually put on, nor is the whole eaves set at once. The workman begins at the lower corner of the roof, on his right hand for instance, and keeps an irregular diagonal line, or face, until he reach the upper corner to his left, a narrow eaves-board being nailed across the feet of the spars, and some *fleaking* scattered on; the thatcher begins to "set his eaves," by laying a coat of reed, eight or ten inches thick, with the heads resting upon the fleaking, and the butts upon the eaves-board. He then lays on his *sway* (a rod about the size of a small edder) about six or eight inches from the lower points of the reed; whilst his assistant, on the inside, runs a needle, threaded with rope yarn, close to the spar; and, in this case, close to the upper edge of the eaves-board. The thatcher draws it through on one side of the sway, and enters it again on the contrary side, both of the sway and of the spar: the assistant draws it through; unthreads it; and, with the two ends of the yarn, makes a knot round the spar; thereby drawing the sway, and consequently the reed tight down to the roof: whilst the thatcher above, beating the sway and pressing it down, assists in making the work the firmer. The assistant having made good the knot below, he proceeds with another length of thread to the next spar; and so on till the sway be bound down the whole length; namely, eight or ten feet."

This being done, "another stratum of reed is laid on, upon the first, so as to make the entire coat eighteen or twenty inches thick at the butts; and another sway laid along, and bound down, about twelve inches above the first."

And "the eaves being thus completely set, they are adjusted and formed; not square with the spars, but nearly horizontal: nor are they formed by cutting; but by "driving" them with a "*legget*;" a tool made of a board eight or nine inches square, with a handle two feet long, fixed upon the back of it, obliquely, in the manner of the tool used by gardeners in beating turf. The face of the *legget* is set with large headed nails to render it rough, and make it lay hold of the butts of the reeds."

Then "another layer of reed is laid on, and bound down by another *sway*, somewhat shorter than the last; and placed eighteen or twenty inches above it: and above this another, and another, continuing to shorten the sways until they be brought off to nothing, and a triangular corner of thatching formed. After this, the sways are used their whole length, whatever it happens to be, until the workman arrives at the finishing corner."

It is remarked that "by proceeding in this irregular manner seams between the courses are prevented; and unnecessary shifting of ladders avoided."

And it is further stated "that the face of the roof is formed and adjusted like the eaves, by driving the reed with the *legget*; which operation, if performed by a good workman, not only gives the roof a beautiful polished surface, but at the same time fastens the reed; which, being thickest towards the butts, becomes, like a tapering pin, the tighter the farther it is driven."

It is stated that "reed running from four to six or eight feet long, the heads meet at the ridge of the roof, whilst the butts are still at a distance from each other. For this reason, as well as for that of the wear being less towards the ridge, the shortest (which is generally the worst) reed is saved for the upper part of the roof. But even supposing the uppermost courses to be only four feet long, and that the heads (belonging to the two sides) be interwoven in some degree with each other, the butts will still remain six or seven feet asunder: and the ridge of the roof consequently be left in a great measure exposed to the weather. In order to remedy this inconveniency, and to give a finish to the ridge, a *cap*—provincially, a "*roof*"—of straw is set on in a masterly, but in an expensive manner. In this operation, the workman begins, it is observed, by bringing the roof to an angle, with straw laid long-way upon the ridge, in the manner in which a rick is topt up; and to render it firm, to keep in its place, and to prevent the wind from blowing it off, or ruffling it, he pegs it down slightly with "double broaches;" namely, cleft twigs, two feet long, and as thick as the finger, sharpened at both ends, bent double; and perhaps with the twisting the crown, and perhaps barbed, by partial chops on the sides, to make them hold in the better. This done, the workman lays a coat of straight straw, six or eight inches thick, across the ridge; beginning, on either side, at the uppermost butts of the reed, and finishing with straight handfuls evenly across the top of the ridge." And "having laid a length of about four feet in this manner, he pro-

weeds to fasten it firmly down, so as to render it proof against wind and rain. This is done by laying a "*broachen ligger*" (a quarter-cleft rod as thick as the finger, and four feet in length) along the middle of the ridge, pegging it down at every four inches with a double broach, which is first thrust down with the hands, and afterwards driven with the *legget*, or with a mallet used for this purpose. The middle ligger being firmly laid, the thatcher smooths down the straw with a rake and his hands, about eight or nine inches on one side, and, at six inches from the first, lays another ligger, and pegs it down with a similar number of double broaches, thus proceeding to smooth the straw, and to fasten on liggers at every six inches, until he reach the bottom of the cap. One side finished, the other is treated in the same manner; and the first length being completed, another and another length is laid, and finished as the first; until the other end of the ridge be reached. He then cuts off the tails of the straw, square and neatly with a pair of shears, level with the uppermost butts of the reed; above which the cap (or most properly the *rooflet*) shows an eaves, of about six inches thick. And lastly, he sweeps the sides of the main roof with a bough of holly; when the work is completed."

THAPES, a term applied provincially to gooseberries.

THEAK, provincially to thatch.

THEAKER, provincially a thatcher.

THEAVE, a term applied to an ewe of the first year. It is sometimes written thave, and also thief.

THETCHES, a term signifying vetches. See *Vetches*.

THICKET, a close knot or tuft of trees; a close wood.

THIGH, in *Horsemanship*, that part of a horse which reaches from the huckle or whirl-bone, to the stiffle or knee-pan.

THIGHT, a term provincially applied to turnip, or other crops which are thick or closely set. It also signifies impervious, when applied to roofs or vessels.

THILLER, a term signifying a thill-horse.

THILL-*Horse*, the last horse in a team; or the horse that goes between the thills or shafts.

THINNING, a term signifying the practice of pulling out such plants among crops as are too thickly or closely placed together, as in turnips or other similar crops. It is also sometimes applied to plants of the tree kind.

THINNING OUT, a term implying the practice of thinning plantations of trees so as to let them have more room as they advance in growth. It is mostly the custom to begin to thin them at about seven years from the time of planting, and to repeat it every seven years afterwards, when the planting has been performed in the proportion of from six to eight hundred trees to the acre, they may be made to stand in the first thinning, at about one tree to each rod of ground, or nine trees to eight rods.

In the second thinning a rather larger proportion of trees should be taken out, as rather more than one to each rod; and in the third thinning the proportion may be made still in a larger ratio so as to leave the trees about a rod square each.

In all these thinnings the worst trees should be removed so as to leave the straightest and best to stand for timber.

Thinnings of this kind in extensive plantations turn to much profit. See *Planting of Trees*, and *Plantation*.

THIRLAGE, a power authorized by law, to prevent the tenants of certain districts from carrying their corn to be ground any where else but at a particular mill. It was a practice which formerly prevailed, and it was too often used as an engine of oppression, that proved extremely galling to those who were obliged to submit to it, but which at present is nearly if not wholly done away. Doctor Anderson observes that "it is a monopoly of a grievous sort, which ought, if it exists any where, to be most certainly abolished. This could, perhaps, be best done by authorizing the owners of such lands as are restricted or *thirled* to a mill belonging to another proprietor, to buy off that restriction, whenever he should so incline, at the rate of some certain number of years purchase, of the annual value which should be found by an impartial jury of honest men to have been the average amount of such millers for such a number of years past. A full and curious account of this ancient custom may be seen in the Agricultural Survey of the county of East Lothian in Scotland.

THISTLE, a well known prickly weed, common in corn-fields. It is observed that wherever thistles grow naturally it is a sure sign that the land is strong, and of a tolerable good quality; but they are at the same time a great annoyance to every plant intended to be cultivated.

By an excellent regulation in France, a farmer may sue his neighbour who neglects to thistle his land at the proper seasons, or may employ people to do it at the other's expense. And it were to be wished that a similar law was enacted here, to prevent the wide-spreading mischief occasioned by the seeding of this pernicious weed; among which may be reckoned, besides its choking the young corn, that if wheat in particular be not well thistled, the reapers take up the grip so tenderly, lest they should prick themselves, that, by their loose handling of them, they sometimes leave upon the ground corn enough to sow the whole field.

It has been well observed that there are no plants over which the economical farmer ought to keep a more watchful eye than the thistle tribe, as they are not only useless but occupy much ground, and being furnished with downy seeds are capable of being multiplied and carried almost to any distance. Besides they do much mischief by impeding the work both in handling hay and corn crops. It is of course a matter of much consequence to be well acquainted with the qualities of each kind, in order to enable us to judge with certainty how far and by what means their destruction may be effected in the most certain and ready manner.

There are many sorts of thistles, but those which

chiefly deserve the attention of the farmer are either of the *annual*, *biennial*, or *perennial* kinds.

There are four of the first sort, as 1st. the *musk-thistle*, (*carduus nutans*) which grows to the height of two or three feet, the heads hang down, and the flowers smell somewhat like musk. It is frequently found occupying whole fields, particularly where the lands are chalky or barren; and sending forth flowers in July and August in great abundance. 2d. The *milk-thistle*, (*carduus marianus*) which is found plentiful in most waste places, and upon old banks, being well known by its beautiful large leaves, which are variegated with white spots and veins, as if they had been sprinkled with milk. The flowering season is in August.

3d. The *welted* or *curled thistle*, (*carduus acanthaides*), which is frequently met with on banks, and by road sides, but seldom intruding itself into fields or pastures. Its time of flowering is June and July.

4th. The *common sow-thistle* (*sonchus oleraceus*), which is a very troublesome weed in fields and gardens; it is found on some situations that the plant is smooth, but in others it is rough, being prickly on the margins and mid-ribs of the leaves, and also on the peduncles and calices of the flowers, and the stems or stalks abound with a lactescent or milky juice.

And of the second or biennial kind there are three sorts, as

1st. The *spear* or *bull-thistle* (*carduus lanceolatus*), which rises about three or four feet in height, the extremity of each leaf running out into a long sharp point, remarkably prickly: hence, in some places it is called by the name of the bull-thistle. It has large heads of flowers, and commonly grows by the sides of roads, near dunghills, and not unfrequently in fields and pastures, flowering in June and September.

2d. The *marsh-thistle* (*carduus palustris*), which grows very tall and prickly, having numerous heads of flowers, small and of a red colour, growing abundantly in wet meadows and in woods, flowering in July and August.

3d. The *cotton-thistle*, (*onopordum acantheum*,) which is found plentifully in uncultivated places in many parts. The roots are long and fibrous, and send forth several oblong sharp-pointed whitish-green sinuated leaves, covered with a cottony down, and set with spines on their edges. In the middle of these shoots up a stalk, to the height of five or six feet, divided towards the top into diverse branches, set with leaves at their joints, and having jagged, leafy borders running along them, edged with spires, as has the main stalk also. Each branch terminates with a scaly head of reddish purple hermaphrodite florets, having narrow tubes, and cut at their brim into five teeth. They contain five hairy stamina and one style, and are succeeded by small oblong seeds, crowned with down. It flowers in July.

But of the third sort there are only two, as

1st. The *corn sow-thistle*, (*sonchus arvensis*) which is a very troublesome weed in arable land, flowering in July and August.

2d. The *common* or *field-thistle*, (*carduus arvensis*) which has many provincial names in different places, as the *horse-thistle*, the *cursed thistle*, &c. It is a thistle which is more general in its growth than any of the others, being found not only by the sides of roads, but also in arable and pasture lands, and it is remarkably prickly, growing from two to three feet in height, but the heads of the flowers are small, and of a purplish colour, though sometimes white; it flowers in July.

It is obvious that the annual and biennial sorts of thistles may be readily removed, by preventing their running to seed and disseminating themselves, which is best effected by carefully eradicating them, or frequently mowing them over closely by the surface, and rolling. But in the perennial sorts, from their roots continuing in the earth, increasing and throwing out new shoots or stems every year, there is much difficulty in extirpating them, and they perhaps can be no other way destroyed than by rooting them out on arable land by deep ploughing and frequent harrowings, or by fallowing or laying the land down to pasture; for the first of these sorts seldom appears in pasture lands. But for destroying the common thistles the best method is by cutting them over in the bleeding season frequently by proper implements. See *Thistle-cutter*.

It has been suggested by the writer of the Experienced Farmer, that the sow thistle may be a plant of considerable fattening properties when properly cultivated.

"When taken young, and cut or broken, it produces something like cream; and he has observed many animals to eat it in preference to every other plant now in vogue. Sheep, when in clover, &c. will feed upon it so greedily as to eat the very roots. Pigs likewise prefer it to almost any other green food. Rabbits will breed more speedily when fed with sow-thistles, than with any other food he knows of, except dandelion; which is of the same nature: and is now sold in Covent Garden market to the breeders of tame rabbits, to make the does take the buck more readily. A man of his acquaintance, who was allowed better skill with stallions, than the generality of people, used to search for sow-thistles, and give them to his horse to make him serve mares more readily. When he could not get sow-thistles, he fed him with new laid eggs and milk, or cream if he could get it; but he preferred sow-thistles or dandelion."

And there is, he says, "a well known and remarkable proof of the nourishing quality of the sow-thistle in the fat wether-sheep, fed to an amazing size by Mr. Trimnel, of Bicker-fen near Boston, upon fen-land. This sheep was bred by Mr. Hutchinson, in Hail-fen, from a ram bred by Mr. Robinson of Kirby, near Sleaford. He never ate any corn, oil-cake, &c. but fed wholly on grass and herbage. Being turned with many other sheep into a field of clover, he was observed first to search for the sow-thistles, and would eat no other food while any of these could be found in the part of the field that was hurdled off successively, a little at a time. None of the

other sheep that fed with him shewed any liking for the sow-thistle. A small hut was built for him in the field, to repose under in hot weather: and when the part that was hurdled off became bare of food, his attendants, on account of his liking for sow-thistles, gathered a quantity of them for him, which they gave him at particular hours, three times a day, from two to five pounds at a meal."

It is added, that "when standing on his feet he measured only two feet six inches high, he was weighed once a month, and weighed alive twenty-six stone, at fourteen pounds to the stone. He gained only one pound the last month: and as it was judged therefore that he was quite ripe and would not increase any more, but might possibly lose weight the next month, he was killed on the 13th of October 1791, by Mr. Isaac Lumby of Bicker, being then a four-shear, or four-year-old sheep."

The writer states that "the skin, hung up by the nose, measured ten feet two inches from the point of the nose to the tip of the tail, and was sold for 7*s*. 6*d*. in the common course of business. And that the carcass measured five feet from the nose to the tail; the rump, or cushion, eight inches and a half in depth; plate or fore flank the same thickness; breast end seven inches: one yard $5\frac{1}{2}$ inches round the collar, and its total weight was $67\frac{1}{4}$ pounds. And the legs were reckoned at 40lbs. each; but if cut haunch of venison fashion they would have weighed 50lbs. each. Mr. Lumby was offered 2*s*. a pound for them, so that he could have sold the two legs alone for 10*l*."

This is a remarkable instance of fatness, but it might probably depend more on the disposition of the animal to take on fat than the fattening quality of the thistle or food on which the sheep was fed.

Thistle-*Cutter*, a tool of the sward dressing kind, for cutting up thistles and other coarse weeds.

An effective implement of this sort has been invented and described by Mr. Amos, in his useful work on Agriculture and Planting, for the purpose of cutting over thistles, and other injurious weeds in pasture lands. In the execution of the work, he says, it not only greatly reduces the expense, but executes it in a much closer manner than by the common scythe. One man and a horse are said to be capable of cutting over twenty acres in a day.

The plan of the whole machine complete is seen at *fig*. 6, in *Pl*. XXXV, in which A is the leading share, made of cast steel, in the form of an isosceles triangle, whose equal sides are fourteen inches long, and its base twelve inches, about one-eighth of an inch thick in the middle, tapering to a very fine edge on the outsides. BBBB are four pieces of ash wood, three inches square, and two feet four inches long, to which the scythes are fixed, as per figure, and are called the scythe handles. CCCC, are four scythes, three feet long from point to point, four inches broad at the widest part, made of cast steel, and which, the inventor says, are manufactured by Messrs. Hunt and Company, at their cast steel manufactory, Brades, Birmingham. DDDD, are four other pieces of ash wood, three inches square, and two feet five inches long, for throwing the two hindmost scythes to their proper distance, and which are braced two and two together by the four bars, EEEE, which are one by two inches square, and eighteen inches and one-fourth long. And F is a main piece of ash wood, three by four inches square, and five and a half feet long, to which all the other pieces are fixed by hooks, and eye-bolts, by which the scythe handles acting as it were upon hinges, the scythes are thereby made to form the same parallel line with the surface of the land, whether it is concave, convex, or level. For this purpose it is suggested it might be useful to make a joint in the middle of this piece, where the land is uneven. And in the fore part of this piece a saw-gate is made, three-fourths of an inch from the under side, at the hind part of the share, and one inch from the under side at the front of the wood which gives an elevation to the point of the share), to receive the share where it is fixed. GGGG, are four iron braces, one end of which is fixed in the scythe-handles BBBB, and the other ends to the under sides of the scythes by a screw. *a*, is the staple to which the chain and swinging-tree is fixed, by which the machine is drawn. *bb* are two mortice-holes, which receive the tenons of two upright studs, to which pullies are fixed for lifting the scythes off the ground, where there is any thing to obstruct them or retard their progress. At *fig*. 7, is represented by A one of the studs, one and a half by four inches square, and three feet long. BB two small pullies fixed on each side of the upright studs. Through the pullies of the foremost stud, a small rope passes (one end of which is fixed to the outsides of the iron braces), and likewise through the pullies of the hindmost stud, and then the two ropes unite at about two or three feet behind the whole machine; and through the pullies of the hindmost stud pass two other small ropes (one end of each being fixed to the outside of the hindmost iron braces), and then the four ropes unite together, where the manager holds them as a coachman does the reins of four horses. By these ropes the scythes may be lifted to any degree of elevation, by which means any unevenness of the ground, or other obstructions on its surface, such as stones, roots, ant-hills, &c. &c. may be easily avoided and passed by.

At *fig*. 8, the swinging-tree, thirty-three inches long, is shown by A; and B represents the chain, thirty inches long, which hooks into the staple *a* of *fig*. 6, for drawing the machine by.

And *fig*. 9, represents one of the scythes by itself, in which A is the scythe, B the part by which it is fixed to the scythe handle, three quarters of an inch from the under side, where a saw-gate is made to receive it, so that the whole of the scythe projects beyond the wood, and cuts the thistles three quarters of an inch above the surface of the ground.

In cases where the scythes want sharpening it is observed that they may be reared perpendicularly, or taken off entirely, at the same time the horses should be ungeared and taken away.

In using the machine it is advised by the ingenious inventor that as soon as the thistles are in full flower

it must be set to work, the length way of the ridges; and if the scythes are kept very sharp it will make excellent work. And when the thistles have been cut, they should lie a day or two to perish by the loss of sap-juice, the ground must then be cleared, and the close or field rolled the cross way of the ridges, with a very heavy roller, which so crushes the hollow stumps and renders them so pervious to water, that their roots soon rot and are destroyed. But to expedite the operation of the implement and the destruction of the weeds, the land should be cleaned of all kinds of rubbish, the latter end of March or beginning of April, being dressed with the *sward-dresser*, and then rolled the cross way of the land, or ridges, with a weighty roller as just mentioned. See *Sward-dresser*.

THISTLE-*Drawer*, an useful implement of the forceps kind, which is extremely beneficial in drawing up the common field-thistle and some other strong sorts of weeds. It may be constructed either of wood or iron, in the latter case having sockets for receiving wooden handles. When made of wood it should be of the hard and less brittle kind, as good tough ash. It is usually formed from two to three feet in length, having six notches or blunt teeth cut in each blade, at the bottom part, where it bites or seizes the plants, and each arm well fitted to the other, turning upon a strong pivot or pin. In its operation the thistle is seized close to the ground and firmly held, so as to be drawn out with considerable length of root. It is shown in *Plate* XXXV. *fig.* 10. It has been long in use in the northern parts of Lancashire; and is said to have been lately introduced from Wiltshire into the county of Gloucestershire, in the report of that district. It is an useful and effective tool for the above purpose, and only costs about two shillings when made of wood, and three or four when of iron.

THISTLING, the act of cutting or pulling up thistles from among corn or other crops, in order to destroy them. In the northern districts this is performed in a very careful manner, the thistles being drawn up by an implement of the forceps kind, by the roots. And in every situation this should be performed in a careful and exact manner. See *Weeding*.

THONE, a term signifying somewhat damp and cold, not thoroughly dry. Also limber, as undried hay.

THORN, a plant of the common hedge kind, of which there are different sorts, but the white thorn is mostly made use of.

THORN, *effects of*, in *Farriery*, the diseases produced by its puncture in the skin and flesh in animals. See *Pricking*, *Puncture*, and *Wound*.

Where a thorn is found in a part, it must either be carefully drawn out by a pair of sharp-pointed forceps, or a small incision must be made into the skin, so as to enable the operator to dislodge it; and the sooner this is done after the accident the better, as it will be rendered much more difficult when the inflammation, always consequent on the violence done to the part, is come on. Where it cannot be removed, suppuration in the part must be encouraged by emollient poultices, &c. See *Poultice*.

THORN-*Hedges*, such as are made of that plant. See *Fence*.

THOROUGH, an inter-furrow between two ridges.

THREAF, a term signifying a handful, a bundle, or a pottle.

THREAVE, a quantity of grain consisting of twenty-four sheaves. It is sometimes written thrave.

THRESHER, the person employed in threshing out grain and other seed crops by means of the flail. This is a sort of farm-workman, that should be chosen from the labourers with considerable attention and care, as without this the farmer may suffer much by their dishonest practices, as they have many opportunities of putting them in execution. They should be such therefore as can be perfectly confided in, and who have been long known by the employer.

But this mode of threshing out crops is perhaps becoming much two expensive to be performed in this way, except in so far as the foddering of store cattle, &c. by the straw may be concerned, which should always be had as fresh from the flail as possible.

In different views the threshing machine therefore becomes an object of much importance, and would be still much more so if it could be so contrived as to be applicable to small arable farms, which the ingenuity of the agricultural mechanic may perhaps accomplish at no very distant period. See *Threshing Machine*.

THRESHING, the act of beating out the corn from grain or other crops: the flail was the implement formerly used for threshing corn, and which separate the grain from the straw and husks very effectually and expeditiously; but as it is now become expensive and always bruises, a great many seeds, it has been attempted to avoid these inconveniences, by proper machines provided with a number of flails, or other parts answering the same purpose, made to move by the power of water, wind, or horses. By this means the business of threshing is found to be performed cheaper, more expeditiously, and with less damage to the health of the thresher, which is frequently thought to be injured by the dust, &c. which arises in the common way of threshing, as well as by the very great laboriousness of the work. Various machines for effecting the purpose of threshing have been lately invented. See *Threshing Machine*.

It was supposed by Mortimer a day's labour, with the flail, for a man to thresh four bushels of wheat or rye, six bushels of barley, five bushels of oats, or five bushels of beans, and peas, when the corn threshed well. But Mr. Lisle says that twelve bushels of oats or barley are only reckoned a good day's threshing by a good thresher, and that five or six bushels of wheat are a very good day's thrashing; and if the corn be clung, and yield ill, sometimes three bushels are as much as can be thrashed in a day. And further observes, that six bushels of wheat of the growth of a warm gravelly vale are as easily threshed in a day as four bushels of the produce of cold hilly land; because the

stroke of the flail must be forced down stronger to beat out the grain of this last, than it need be for the former: and also that as the straw of corn of the growth of a light soil is shorter than that of a strong clayey ground, more sheaves, and consequently more ears of the first sort, may be laid together on a floor, of equal extent, than can be of the last, whose longer straw requires proportionably more room.

Though there are many different methods made use of in separating the grain from the ear of the corn that by the flail is the most general with the wheat crops; in some districts where the straw is much wanted for the purpose of being employed as thatch for farm or other buildings it is sometimes the practice to have it whipped or lashed out over a strong-wattled hurdle stone, or other similar contrivance. But in almost all other cases this sort of crop, as well as all the other kinds, are threshed out either by means of the flail or the threshing machine, though the former is much more common, the expense of machines being great.

In respect to the threshing of corn by the flail, it is stated by a late writer "to be the practice in some districts for only one person to be employed upon a floor, but as two can thresh together with equal if not greater expedition and dispatch, it must be an uneconomical and disadvantageous mode. But where more than two labourers thresh together, which is sometimes the case, there must be frequent interruptions, and a consequent loss of time." It is suggested that "the tool by which this sort of business is performed should be well adapted to the size and strength of the person who makes use of it, as when disproportionately heavy in that part which acts upon the grain, it much sooner fatigues the labourer, without any advantage being gained in the beating out of the grain." The best method of attaching the different parts of the implement together is probably by means of caps and thongs of good tough leather. Iron is however sometimes employed. In threshing most sorts of corn, but particularly wheat, the operators should wear thin light shoes, in order to avoid bruising the grains as much as possible. In the execution of the work, when the corn is bound into sheaves, it is usual for the threshers to begin at the ear-ends, and proceed regularly to the others, then turning the sheaves in a quick manner by means of the flail, to proceed in the same way with the other side, thus finishing the work."

It is observed by the author of the Experienced Farmer, that threshing with the flail is uncertain at the best, even supposing the thresher inclined to do his work well, for he may beat a long time and not meet with every head, which with the machine it is hardly possible to miss. And that the grain wasted by the use of the flail is beyond belief. One circumstance struck him forcibly as to the waste of wheat by bad threshing, which was, on viewing the Prince's of Wales's stud on the princess's lying-in the straw, then drawing in for the purpose of littering the yards being so badly threshed, as from the beating of carriages over it, on being taken up, to leave the ground covered with grain.

In short he is of opinion that the corn lost by threshing with the flail is more than would pay for threshing it by the machine all over the kingdom.

In regard to the quantity of corn that a labourer is now capable of threshing out in any given period of time, it is impossible to ascertain it, as it is obvious that much must depend on the nature of the grain, the freeness with which it threshes, and the exertions of the labourer; in general it may be of wheat, from one to one and an half quarter, of barley from one and an half to two quarters; and of oats mostly about two in the day. The exertions of labourers in this sort of work in the northern districts of the kingdom are however much greater than in those of the south; of course a much larger proportion of labour must be performed. In some places it is the practice to thresh by the measure of grain, as the bushel, quarter, &c. while in others it is done by the threave of twenty-four sheaves, and in some by the day.

It is remarked in the Survey of the County of Kent by Mr. Boys, that before the late rise in the price of labour it was usual to pay from two shillings and sixpence to three shillings the quarter for the first of the sorts of grain mentioned above; two shillings the quarter for the second, and one shilling the quarter for the third. And in the midland and northern districts the prices are in general nearly the same, or perhaps a little lower in the latter kind of corn. In the same county beans are likewise threshed at one shilling the quarter, and peas from one shilling and sixpence to two shillings the quarter, but in other districts the prices vary. In Gloucestershire threshing wheat is 2*s.* 6*d.* the quarter, barley 2*s.* oats 1*s.* 3*d.* beans 1*s.* 4*d.* and in the county of Norfolk (per comb) wheat 1*s.* rye 9*d.* oats 6*d.* and barleys 7*d.* See *Work*.

It has, however, been remarked, that in whatever way the farmer has this sort of business performed in, there is always much necessity for his constant inspection, in order to prevent the frauds and impositions that are too freequently practised upon him by the persons engaged in the execution of it.

But the flail practice from its being so extremely slow, tedious, and expensive, and at the same time requiring a great number of labourers, is perhaps only capable of being had recourse to with advantage on the smaller kinds of grain-farms, that are cheaply situated in regard to the command of workmen, and where the expense of having large machines would be much too great for the quantity of grain which they produce. But it has been observed, that "even in these cases, if the small horse or hand threshing engines that are constructed on cheap simple principles, and which occupy but little room, should be brought to perform the business in any easy, expeditious, and effectual manner, which seems not improbable from the improvements that have been recently made in this sort of machinery, it will most probably be to the advantage of such farmers to abandon it, as the saving in various ways must soon repay them the expense of the machine, and at the same time afford them a considerable profit." And in addition, it is stated, that "where the threshing is performed by the flail, expensive barn-floors,

either of the fixed or moveable kind, will constantly be necessary; but that the latter sort may sometimes be capable of being converted to other purposes which may render it useful in other views.

In the flail mode, too, the produce is constantly exposed to the depredations of the persons that are employed in executing the business, which is a great objection, and in many cases proves a source of great loss to the farmer, as he cannot by any means prevent the impositions to which it is liable. It has been observed by Mr. Middleton, in his Survey of Middlesex, that "where threshers are employed by the day, they frequently do not perform half the work that ought to be done in the time, nor even that in a perfectly clean manner." And that if "it be executed by the quarter, or by the truss, the freest corn is threshed out, and the rest left in the ear." And it has been supposed that the same thing takes place in a greater or less degree in every other mode that can be devised for having the work performed by the hand; and that "it is consequently only by the general introduction and use of the threshing machine that the property and interest of the farmer can be fully secured, and the work be executed with that degree of economy which the greatly increased price of labour demands."

It is stated by the author of Practical Agriculture, that "the superiority of the method by machinery over that of the flail is very considerable in many other respects, besides those of its executing the work in a much more clean and perfect manner, and with infinitely greater dispatch, so as to admit of the farmer being present during the process."

The writer of the account of the State of Agriculture in the County of Kent, found, on having different parcels of wheat-straw of thirty-six pounds each threshed out clean by the flail by different farmers, and the same weight of straw threshed after it came from the machine, the average produce of corn left in the straw by the common modes of threshing was half a pint in every thirty-six pounds of straw, more than that left in the machine method.

And "besides, sufficient supplies of both corn and straw may at any time be almost immediately provided, either for the purposes of seed, the market, or the feeding of animals, without the other operations of the farm being in any degree interrupted. It is likewise obtained with much less waste of the grain, and with less danger of its being injured by being bruised."

And that from "the increasing scarcity of labourers, the great advances in the price of labour in all the well-cultivated districts, and the impossibility of having this sort of work performed in a clean and exact manner by the flail, the necessity as well as utility of the machines is established." And it is further stated by the same writer, that the "principal obstacles to machines of this nature being more generally made use of, are those of expense in their construction and erection, and the littering slovenly practice which prevails in some of the more southern districts, of harvesting or securing the grain crops in a loose uneven manner." But it is supposed that the first of these objections may probably be obviated by the construction and introduction of hand, or one-horse, or ox-threshing machines; and the latter by the daily discoveries that are making in the improvement of this sort of machinery.

It is conceived that the opposition that has been raised against this practice, on the ground of its being calculated to deprive and prevent "the labourers of employment during the winter season, are scarcely deserving of notice, as experience has fully shown that no injurious consequences can result from it, as there must always be work enough of other kinds at such periods, where farms are under a judicious mode of cultivation." And that "the inconveniences that may attend the largeness of the quantity of straw that must be at once produced in this method, may be easily obviated, either by placing it immediately in close stacks, or by having a part of it cut into chaff and laid up in a well ventilated granary, as in this way there can be little doubt but that it will keep well, provided the operation has been performed while the straw is dry." Besides, by the use of one-horse or hand-machines, the work may proceed without this trouble, as the straw is wanted for the uses of the farmer, which in the case of store-cattle being fed with it may be a more advantageous practice. But where the fold-yard and cattle-stalls are kept properly littered, and as frequently changed as may be necessary for promoting its conversion into manure, the farmer will seldom be much encumbered with straw.

And it is stated by Mr. Young as the practice of the best farmers in Norfolk, not to wish to have a mouthful of their straw eaten, but all to be trodden into manure, which he conceives to do away the objection in respect to too much straw being at once on hand.

It is supposed that the saving of expense in this mode of threshing over that of the flail must differ much according to the nature and manner of constructing the machinery, the power by which it is wrought, and also on the state and condition of the grain at the time of performing the operation, as well as the regularity with which it is supplied and managed. By some farmers it is considered as nearly, if not quite, one half, while others make it much less than that proportion. But with the best constructed machinery there can be little doubt but that it will be performed on an average of different sorts of grain, and different states of them, at less than one-third the expense of the flail method, without taking in to the account any thing for the vast saving in grain, in which some reckon a profit of at least five *per cent.*; others, as equal to the seed and prices of threshing, which is somewhat more than half the price in the flail method; or either the other operations that may be performed at the same time with the same machinery, such as those of winnowing or cleaning the corn, cutting straw into chaff,

bruising and grinding the grain for cattle food, and various other purposes.

But in addition to the advantages that have been chiefly considered, in respect to these machines, there is another, which in the present scarcity of procuring labourers, and indeed at all seasons, must be of great importance to the farmer, which is that of their enabling him to perform his work with fewer hands.

It has been stated by a writer in the Agricultural Magazine, that with a machine, two labourers on a farm will be equal to four without it; as they are left at liberty, during the winter months, for performing various sorts of farm labour, such as repairing fences, clearing and preparing land, and various other necessary purposes.

It has been already noticed that the charge of this sort of work with these machines will vary considerably, according to the manner in which they are constructed. In the Agricultural Survey of Kent, the expenses and produce of threshing per day, in different sorts of corn, with an engine of the common construction, without the late improvements, are stated in the following manner:

Estimate of Expenses, &c.

Expenses of Wheat:

	L.	s.	d.
Eight men, at 1s. 4d. each	0	13	4
Four boys, at 1s. each	0	4	0
Four horses, at 2s. 6d. each	0	10	0
Cleaning and measuring twenty-four quarters, at 3d. each	0	6	0
L.	1	13	4

which is about one shilling and four-pence per quarter, or nearly one half the price of the flail method.

Expenses of Barley:

	L.	s.	d.
Cleaning and measuring thirty-two quarters, at 3d. each	0	8	0
Other expenses, as above	1	7	4
L.	1	15	4

which is somewhat more than half the price of the flail method, this sort of grain having of late been usually threshed at about 1s. 6d. the quarter.

Expenses of Oats:

	L.	s.	d.
Cleaning and measuring forty quarters at 1d. each	0	3	4
Other expenses, as before	1	7	4
L.	1	10	8

or a little more than half the price of that by the flail; this sort of grain being commonly threshed at about 1s. 3d. per quarter.

In the improved machinery of this kind fewer hands are required, and a number of other operations are performed at the same time, which greatly lessens the expenses of executing the work.

In some of the northern districts the execution of this sort of business by the machine is sometimes undertaken by labourers, the farmer finding horses. In this method in Yorkshire the work costs for wheat 1s. the quarter, and oats 6d.

In Northumberland they make use of a machine which threshes at the rate of thirty-three bushels per hour, or 264 in the day of eight hours. In this machine the expenses in the attendance of the threshing and dressing parts of it being merely that of three women; one to feed in, another to hand the sheaves to the feeder, and a third to take away and riddle the corn after it is winnowed, consequently the threshing and dressing the above number of bushels only costs 1s. 6d. while the threshing the same quantity by the flail would be 1-25th part or ten and a half bushels, which at two shillings the bushel is twenty-one shillings; to which must be added 2s. for the expense of a man and two women to assist in winnowing, which makes in all twenty-three shillings.

It is stated, however, in the Survey of the County of Norfolk, that the expense of threshing with the machine in comparison with that of the flail is as below. The machine was built by a person from Leith in Scotland, for Mr. Bevan, and cost 100*l.* and strongly shows that bad machines are worse than the old method of the flail.

To Threshing by Flails.

	£.	s.	d.
Forty combs barley, at 7d. come to	1	3	4
To dressing of ditto	0	2	0
L.	1	5	4
Fifty combs oats, at 6d.	1	5	0
Dressing ditto, at 1s. per score	0	2	6
L.	1	7	6
Forty combs rye, at 9d.	1	10	0
Dressing ditto, at 1s. per score	0	2	0
L.	1	12	0
Forty combs wheat, at 1s.	2	0	0
Dressing ditto	0	2	0
L.	2	2	0

Threshing by Mill:

	L.	s.	d.
Forty combs barley take eight horses, at 2s. 6d.	1	0	0
Ten men, at 1s. 6d. each	0	15	0
To dressing ditto, five men one day	0	7	6
L.	2	2	6

Barley costs more by 17s. 2d.

	L.	s.	d.
Fifty combs oats take eight horses, at 2s. 6d.	1	0	0
Ten men, at 1s. 6d. each	0	15	0
To dressing ditto	0	7	6
L.	2	2	6

Oats cost more by 15s.

	L.	s.	d.
Forty combs rye take eight horses, at 2s. 6d.	1	0	0
Ten men, at 1s. 6d. each	0	15	0
To five ditto, at 1s. 6d. one day dressing	0	7	6
L.	2	2	6

Rye costs more by 10s. 6d.

	L.	s.	d.
Forty combs wheat take 8 horses at 2s. 6d.	1	0	0
Ten men, at 1s. 6d. each	0	15	0
Five ditto to dressing	0	7	6
L.	2	2	6

Wheat costs more by 6d.

And it is supposed that the flails thresh much cleaner, as the thatching of the stacks proves; so that if this article were brought to account, it would go much further against the mill. Nor is there any thing reckoned for repairs, which have always amounted to from 6l. to 8l. a year.

It is further stated that the proprietor has had the machine several years, "and thinks the material object is the power of getting out a crop to sell for seed, or to employ the men and horses in a wet day; but it is clear that if he had it not, he would not build one, unless he was certain of its threshing barley cleaner than his does."

This should lead the farmer to be careful in putting up these machines; and to be certain of their being constructed in such a way, as to answer the purpose in a perfect manner.

It is observed by Mr. Somerville, in calling the attention of the public to the unrewarded merits of Mr. Mickle in bringing the threshing-machine to a state of perfection, that it is computed, by those who have paid every possible attention to the subject, that in Britain about seven millions, five hundred thousand acres are annually employed in raising grain, the produce of which, if averaged at three quarters per acre, amounts to twenty-two millions five hundred thousand quarters; and, as it is admitted that the surplus quantity gained by the use of threshing machines is, at least, a twentieth part more than when the flail is used, it will appear that one million one hundred and twelve thousand five hundred quarters would be saved annually were the whole of the grain in the kingdom threshed in that way, the value of which, if only calculated at 32*s.* per quarter, is *L.* 1,781,250

To which add savings of expense at 1*s.* per quarter, upon 22,500,000 quarters	1,125,000

Making, in all, the enormous sum of *L.*2,906,250 sterling, a fact almost incredible to any but those who have turned their attention to the subject, and are well acquainted with the great difference between the threshing machine and the flail. Had it been intended to swell this calculation, it might, without any over-colouring, he says, have been greatly increased, as the additional quantity gained by the use of these machines may safely be stated at one half more than is here set down; and the savings in point of labour, especially when wind, water, or steam, are employed, is greatly more than one shilling per boll."

In all cases where threshing machines are made use of they should be well suited to the extent of the farms, and be erected in such a manner as to be convenient for having the contents of the stacks brought to them. In this view it has been suggested, in the Report on Agriculture for the West Riding of Yorkshire "that, the barns to which they are attached should extend into the yards in which the stacks are contained, as in that way the labour will be considerably lessened of supplying them with corn in the straw for being threshed. And it has been remarked by the able, intelligent, and indefatigable promoter of Agricultural Improvements, Mr. Arthur Young, that "this machine has not been attended with one half of the advantages which might have flowed from so useful a discovery, for want of combining the use of it with the various connected circumstances of the farm-yard. This business of stacking corn, for instance, must, he says, receive an entirely new arrangement in consequence of building a threshing-mill. By means of no other additional expense than of an iron rail-way, and placing the stacks on frames resting on block-wheels, two feet diameter, a very considerable annual expense in labour is saved in carting stacks to the barns, in loss of corn, and in waiting for weather, as well as in the saving of threshing by flails, and all the attendant evils of pilfering and leaving corn in the straw. This is a material object, which he thinks cannot receive too much attention from both landlord and tenant."

He thinks there is not the smallest doubt of the propriety or profit of having one of these machines fixed in the principal farm yard. But that where

the farm is large and stacks consequently scattered over various fields of it, then it may be right to have a moveable one, also but so many operations are wanting at home that one should certainly be fixed. The circular form of the railway on which the stacks are brought to the mill is necessary, as being the only one which permits a choice of any particular stack to thresh, without waiting for all or many others being done before it can be got at; but a straight line leading to and past the mill is admissible, except for this circumstance, though inferior in some other points, to the circular form.

In *Plate* XXXVIII, this plan is fully explained, a sort of rail-way is so contrived as that a horse or two may be sufficient to draw all common stacks to the mill. And it is directed that the wooden stumps on which the frame rests should be tinned in the common manner with brass latten, which is more durable than common tin, to keep, out rats. And that as the power applied to the threshing mill is at hand, and applicable also to this work, it may be used; the method is represented in the plate.

It is advised that the road should be made on a slight declivity, from the left side of the wind-mill quite round to the right, that is to say the whole way in which a stack-frame moves while the corn is on it. When emptied, it will have a short ascent to rise to fix it where it is to receive the straw, but this will not amount to any difficulty of consequence.

The posts, in the arms of which are large pullies, are necessary in order for allowing a straight line of draught, though the general movement be in a circle. This would not do in a very small circle, but will in one large enough to contain the stacks of a middling farm, if the road is not exactly circular.

The threshing mill being fixed on the side of the circular road, admits the stack being drawn to it where a shed is erected, under which the stack rests. This shed, which may be a roof on four posts, is not represented in the plate, to avoid indistinctness in the engraving: "the stack is there unthatched, and the corn thrown at once to the mill without being for a moment exposed to the rain, and without any labour of men, or horses or carriages to move it. The straw, as fast as threshed, is piled on the stack-frame last cleared, or any other way disposed of. Adjoining the mill there is a granary, and a wheel and pulley may easily be added, for drawing up the sacks from the spout which fills them from the dressing machine."

At "A. *fig.* 1, in the circular ground-plot, is the position of the mill, on one side of which is the circular road, the path of the stacks on the other, and contiguous but below the sails, are the granary and chaff-house.

"B. is the granary, into which corn is *hoisted*, as ground and dressed by the machinery, and containing also the meal of barley or peas and beans, if there is an apparatus for grinding them, in order to feed cattle, also oil-cake, with a breaking cylinder, turned by the power of wind, in order for feeding cattle.

"C. is the receptacle for chaff; and the scite of a cutter, to work also by a cog-wheel from the first movement. Here are various essentials in feeding cattle, chaff, meal, and oil-cake.

"D. the corn-stands.

"E. are hay-stacks, which form another essential, whatever may be the system of feeding.

"F. are the cattle-sheds: in building which there are various methods pursued by different graziers and breeders. The idea here sketched is no limit to any, as it is only proposed to connect them (whatever the plan of stall may be) in the most convenient manner with the hay, corn, straw, oil-cake, &c. By means of a projection at the height of 5 feet in the wall, against the heads of the cattle, the hay may be put at once into the racks: if it is eaten out of a manger, a door against every beast or pair of beast will admit of hay, chaff, meal, or cake, being given through the wall without any necessity of going among the cattle. But with such a mill ready to cut without expense, it would probably be most adviseable to cut all the hay and straw into chaff, whatever beasts they were given to, a circumstance which makes it always necessary to have the hay stacks disposed very near to the fixed moving power. Between the line of the stacks and the wall of the cattle-sheds, there may be just room enough left for a one-horse cart to pass to unload turnips, cabbages, or potatoes, also through those doors for feeding, as well as green food in summer soiling. The circular shed for cattle should contain not only the fattening beasts but also the cows, young cattle, ox and horse teams, since all equally demand the vicinity of the hay, straw, granary and conveniency of feeding.

"The area within the sheds, in the centre of which are the hay stacks, need not be lost; for if the space occupied by the stacks is paled in a hay-rack *forming a part of the pale* and covered by a low shed, the whole is well adapted to the use of a standing sheep-fold, quite sheltered, and conveniently situated both for straw and hay and any other food that may be given.

"The dunghill, which is in the outward circumference of the several circles, admits of variations. If the scite of the whole system is on the elevation of a very gentle *knowle* or hill, the best way would be to have a pavement six feet wide beyond the cattle shed, and then a perpendicular cut of four or five feet deep, walled, which would receive the directed litter, drainings and sweepings of the stalls, in the cleanest and neatest manner, and with the least labour; and in order that the dung might not be drained of its urine, the cavity should be sloped *against* the declivity of the hill down to the bottom of that perpendicular well. This is more clearly explained at *fig.* 4.

"1, 2. The iron tracks in which the stacks move.

"3. The space for carting to the cattle sheds.

"4. The projection of the racks.

"5. The door which opens to receive hay and green food into the racks.

"6. The manger, against which a door for chaff, oilcake, meal, &c.

"7. The platform on which the cattle stand, with a step at their heels six inches perpendicular.

"8. A pavement six feet wide.

"9. Posts, and one rail at top to keep cattle from

falling into the dung pit when driving to or from the sheds.

"10. A wall, perpendicular, 4, 5 or 6 feet deep, forming to 11, the dung receptacle.

"12 to 13. The crown of the elevation of the hill on which the farm-yard is built.

"Supposing the situation is on a flat, then the dung-pit wall (10) should still be made perpendicular, and a trench dug out of a certain breadth at bottom, sloped away on the contrary side; by mixing the earth with the dung till the excavation is brought to the farmer's mind, and by a reservoir at one point of the circle with a pump, and heaps of marl or earth to receive the fluid, the dung may be kept in a due degree of moisture.

"The annexed elevation of the sheds, &c. in which the cattle are seen, represents the dung piled up in a circular clump, which is a favourite method with many graziers, and it has the advantage of giving shelter, which in some cases may save the expence of a front wall to the cattle-sheds, but the question of warmth for cattle bears on this part of the scheme."

It is observed that this plan of stack and farm yard is not only adapted to large farms, but smaller ones also, whether the moving power, be wind, water, or horses.

It is a remark of Lisle's, founded on his own experience, that wheat threshed in damp weather generally yields but little flour, with a great deal of bran, when it is ground; and that if it be put into sacks, it will grow musty in less than three weeks, let the weather be ever so dry afterwards: but if it be threshed when the air is perfectly clear and dry, it will keep well in sacks, for a long time; especially if these are laid upon tressels high enough to secure them from the dampness of the ground or floor.

For the keeping of meal in general, there is no better way than first to bolt, and clean it from the bran, which is apt to make it musty, and then to tread it down as hard as possible, and head it up closely, in clean, dry, tight, and well bound casks, which must be laid in a cool dry place.

The beards of barley come off best, in threshing, when the swarths of this corn have taken the dew before their being housed. It will keep well in the mow, unthreshed, for one year; and for making it into malt, which must be done before the heat of the summer comes on, it should not be kept above a year and a half, or at most two years: otherwise it will be filled with wevils; unless it has been previously cured in a stove or kiln.

Oats being defended with a double husk, are the grain least subject to harbour vermin. The best way to keep them after they are threshed, is to dry them well on a kiln, and then to barrel them up in clean close casks.

Beans and peas always thresh best after they have sweated in the mow, which they are very apt to do; as the whole crop of either of them never ripens all together, the green parts heat and communicate their ferment to the whole heap. The danger to be guarded against is, that they do not heat too much. For this reason farmers generally choose to stack them without doors, rather than to house them; that they may be the more thoroughly dried by the sun and air. As beans are a very large seed and consequently full of moisture, it is found best to let those that are intended for keeping sweat in the mow till March, when they may be threshed without danger, for beans never give again, after they have once been thoroughly dried.

Vetches wanted for sowing immediately after they are cut, may be threshed very well on a hurdle, with a cloth; though they may then be too soft, notwithstanding their being ripe, to be threshed on a floor, where the flail and the threshers feet would bruise and break them.

In the business of threshing, as the work proceeds, it will from time to time be necessary to remove all the long straw from the corn beaten out of it, which last always lies underneath, with a prong or fork, and then the pieces of straw, broken ears, &c. with a wooden rake.

The remaining grain should then be shovelled up on one side of the floor, and the work be repeated till enough be threshed out to make what is commonly called a clearing.

The heap should then be passed through a wide sieve, which retains only the bits of straw, and such fragments or ends of the ears as have escaped the flail. These frequently contain some good corn, and form an useful fodder for most sort of animals.

Much labour may be saved in the use of the sieve by fastening a loop to its rim, and resting it thereby on a hook suspended by a rope. This will sustain half the weight of the corn, and the necessary circular motion may easily be given.

After much threshed grain has thus accumulated on the threshing-floor, and the short straw and chaffy matter been separated from it, as just noticed, by passing it through a wide riddle or sieve for the purpose, which should always be done before too much grain has been collected, as in that way the bruising of it is more effectually prevented; it must be put by to afford more room. The short chaffy substance thus separated from the grain is in some districts denominated *cavings*, or *caving chaff*, and is capable of being employed with advantage, as seen above in the feeding of horses or neat cattle and sheep. When this has been done, the loose grain should be thrown into a chamber conveniently formed for receiving it, where it should remain till a sufficient quantity has been collected to render the clearing of it by some machine for the purpose requisite. But the improved threshing machines render this unnecessary, as they dress or clean it at the time it is threshing out. See *Winnowing Machine*.

Threshing-*Floor*, the floor on which grain is threshed. Floors of this sort should be well formed and constructed, of whatever materials they are formed, as without it they soon give way. See *Barn-Floor*.

It is well remarked, in the East Lothian Survey, that "the barns where grain is threshed by the hand are still numerous, and of these many are very imfectly, as well as improperly situated, being upon a damp bottom, with scarce any other floor than what the surface originally had before the barn was built;

independent of the risk of the floors being flooded during heavy falls of rain, which many of them are, it is obvious that, even in the best of seasons, the grain will become damp after it is brought into the barn, and, if threshed out in the slow way by the hand, by the time the whole is ready for the market, it will have its value considerably diminished; a circumstance of the truth of which every farmer of observation is now convinced, as grain that is threshed out by machinery, from the circumstance of its being separated from the straw immediately, and not permitted to remain upon the floor for above an hour or two, when brought to market is always much drier, looks better, and brings a higher price than that which is threshed by the hand, and suffered to remain upon the floor for weeks, where it becomes musty, loses its colour, and is so raw that much of it is bruised and rendered useless in the working." Therefore, when, notwithstanding the introduction of threshing machines, the flail mode of threshing is still pursued, it is supposed, "the inconveniencies above-mentioned may, in some degree, be remedied by paying proper attention to the materials of which the floor is made, and raising it sufficiently above the reach of moisture. Where new barns are intended to be built, this can always be done; but where the barns are old, and the bottom damp, if the walls are of a sufficient height, laying sleepers about eighteen inches above the original floor, and constructing one with wood immediately above them, will have immediate effect in rendering the barn dry; or, if the roof is so low as not to admit of constructing a floor of the kind mentioned, the whole earth within the walls to the depth of eighteen or twenty inches may be dug out, and a floor raised of the same height as the old one, which in that way will be a considerable height above the bottom; but where the barns are very extensive, and the price of wood uncommonly high, as is the case at present, a very good and durable floor may be made by laying a uniform stratum of round gravel, covering it with a coat of well tempered clay, above which a mixture of clay, brick-dust, forge-ashes, and a small proportion of lime, will make a hard uniform floor" for the purpose of threshing upon.

It is observed that "the brick-dust and forge ashes should previously be beaten very small, and well incorporated with the clay, using a sufficiency of water to bring the whole to the consistence of mortar; in that state the lime having been previously slacked should be incorporated with the other ingredients; the whole smoothed over with the back of a spade, and allowed to remain in a round heap for two or three weeks, at the end of which it should be turned over in the same manner as plaster lime, and after being rendered sufficiently soft with water, it may be spread upon the floor, an operation that will require some pains on the part of the workman. The floor, in the first instance, should have the coat of clay, that is laid immediately above the gravel, rendered perfectly smooth and uniform, by rolling, beating, or otherwise; the finishing coat, composed of the mixture above-mentioned, may then be applied, taking care to break the surface of the clay with shallow lines, in the way practised by plasterers for the purpose of making one coat adhere to another" in a firm and perfect manner.

It is stated as the custom with some farmers, after they have laid these floors, in place of exposing them to the air, and suffering them to dry slowly, to hasten the process by other means. "The common way is to cover the floor thinly either with chopt brush wood or straw, which is set on fire and allowed to consume. In that way the floor, though it has the appearance of dryness, upon examination is found to be only crusted on the top, cracked in many places, and instead of being durably useful, is continually breaking out into holes; whereas, when it is allowed to dry gradually, the whole is firmly united and bound together, and forms a floor that, with ordinary care, will last for ages," and be perfectly firm and solid.

The following plan is suggested as the means of excluding rats and mice from the barns:

"1st. When the floor is entirely of wood, the space between the sleepers, upon which the boards are laid, should be entirely filled with washed gravel well beat down, an operation which, when properly done, will effectually prevent the entrance of either rats or mice; where this precaution is not taken, when the floor is laid, openings should be made at the bottom of the wall large enough to admit cats, a contrivance that will have the two-fold effect of destroying the vermin, and affording a free circulation of air.

"2d. When the floor is of clay, the vermin generally burrow under the foundation, and have the entry to their retreats at the bottom of the wall; in such cases their access into the barn will be, in some measure, if not entirely prevented, by mixing a considerable quantity of broken glass with the materials with which the floor is made. It does not appear necessary to mix the glass with the clay over the whole floor, perhaps two feet from the wall quite round will be sufficient.

"3d. The top of the wall, as furnishing at least a temporary retreat for vermin, deserves also to be noticed; in every instance it is customary for the mason to level the top of the wall previous to the roof being put on, which, when the building is finished, is left in that state, by which a considerable space remains for the shelter of rats and other vermin; to prevent this, as soon as the roof is finished, the building of the wall on the inside should be continued upwards till it joins the roof, to which it should be closely united by hard plastering." It is supposed, by these precautions and smooth plastering, the walls of barns may be preserved free from vermin.

Threshing *Machine*, an engine of the mill kind, contrived for the purpose of threshing grain, seeds, and pulse. This useful invention has long been pretty generally employed in the more northern parts of the kingdom, and lately many have been put up on the larger arable farms in the southern dis-

tricts. The great expense and difficulty of bringing these machines to thresh all sorts of grain in a perfect manner, has considerably retarded the introduction and general application of this almost invaluable discovery. In all cases of large corn farms, and in all situations where it is difficult to procure a sufficient supply of hands for the performance of the necessary farm work, they may however, be had recourse to with much benefit and convenience.

It is a sort of mill or machine that has been chiefly constructed on the same principles as those of the flax mill, and which is capable of being wrought by different powers, as those of horses, oxen, wind, water, and steam; but those of water and animals are the most proper: in some cases, the grain being beaten or swingled out of the ears by means of beaters attached to a cylinder that has much velocity, while in others it is rubbed out against confined cylinders, as will be more fully seen below.

It is stated by Mr. Somerville, in his valuable Survey of the County of East Lothian, that, "till of late years, the operation of separating the grain from the straw was performed by the flail, to the manifest injury of both the farmer and the community; for though in some cases the work was tolerably well performed, yet in a great majority of instances it was otherwise. A quantity, perhaps equal to the seed over the county, was, he says, lost even in the best cases; but where the allowance to the thresher was either a proportion of the produce, known by the name of lot, generally a 25th part; or when he was paid in money, at so much per boll, the temptation to do the work in a slovenly manner was so great, that a quantity, perhaps double what was required for seed, was lost upon many farms; an evil that did not escape the notice of intelligent men, by several of whom attempts were made to construct machines that would do the work more perfectly; this, therefore, seems to have led to the construction and use of this valuable machine. The first of these was, he says, invented by a Mr. Menzies, brother to the then sheriff depute of the county; the machinery was driven by a water-wheel, which put in motion a number of flails of the same kind with those used in threshing by the hand. Trials made with these machines were so far satisfactory, that a great deal of work was done in a given time, but owing to the velocity required to do the work perfectly, they soon broke, and the invention fell into disgrace."

But "some time in the year 1758, another attempt was, he says, made by a farmer in the parish of Dumblane, in Perthshire. His machine was constructed upon principles similar to the flax-mill, having an upright shaft with four arms inclosed in a cylinder, $3\frac{1}{2}$ feet in height and eight in diameter, within which the shaft and its arms were turned with considerable velocity by a water wheel.—The sheaves, being presented by the hand, were let down from the top upon the arms, by which the grain was beat out, and together with the straw descended through an opening in the floor, where they were separated by riddles and fanners, also turned by the water wheel."

He adds that, "about twenty years after, a third attempt was made by a Mr. Elderton, near Alnwick, and a Mr. Smart, at Wark, both nearly about the same time. Their machine was so constructed as to act by rubbing, in place of beating out the grain. The sheaves were carried between an indented drum about 6 feet in diameter, and a number of rollers of the same description ranged round the drum, towards which they are pressed by springs, in such a way as to rub out the grain, when the drum was turned round. Upon trial this machine was also found defective, as along with its doing very little work in a given time, it bruised the grain, and so materially hurt its appearance, as to lessen its value considerably in the market."

It is further stated that "the machine, in its then imperfect state, was seen by the late Sir Francis Kinloch, Bart. of Gilmerton, a gentleman well acquainted with mechanics, and who had paid much attention to country affairs; it occurred to him, that the machine might be rendered more perfect, by inclosing the drum in a fluted cover, and fixing on the outside of it four fluted pieces of wood, capable of being raised a little from the circumference by springs, in such a way as to press against the fluted cover, and to rub out the grain as the sheaves passed between them; but after repeated trials, it was found to bruise the grain nearly as much as the model, from which it was copied. In that state it remained for some time, and was afterwards sent by Sir Francis to a very worthy and ingenious character, Mr. Mickle of Know Mill, in his neighbourhood, (a millwright by profession,) who had for a considerable time employed his thoughts upon the same subject. After much consideration and several trials, it appeared to Mr. Mickle that the purpose of separating the grain from the straw might be accomplished upon a principle different from any that had hitherto been attempted, namely, by skutches acting upon the sheaves by their velocity, and beating out the grain, in place of pressing, or rubbing it out; accordingly a model was constructed at Know Mill, in which the grain was beat out by the drum, to which it was presented through two plain feeding rollers, which were afterwards altered for fluted ones. The first machine, on a large scale, executed upon this principle, was done by a son of Mr. Mickle's, for a Mr. Stein of Kilbagie, in the year 1786, which, when finished, performed the work to the satisfaction of all parties. A patent was afterwards applied for and obtained in 1788." Since the introduction of these machines, many improvements have been made on them; a screen has been added for the grain to pass through into a winnowing machine, and a circular rake to remove the straw from it; as before this addition the straw was forced out from the beater upon the upper barn floor, and required much time and labour in shaking and putting it into order, which by this contrivance is saved. And it is found that a point upon which the clean threshing of all sorts of grain depends in the use of this machine, is the management of the iron covering, under which the beating wheel, having six beaters, moves: in some machines this is fixed, while the

beating wheel is capable of being raised or depressed at pleasure; but a late improvement is to render the iron roof moveable and the wheel fixed, the iron being placed so close to the beaters that the grain is rubbed as well as shaken out of the ear. And in some cases the beaters are somewhat rounded, but the flat form is probably better.

It is stated in the Essex Report, by the Secretary to the Board of Agriculture, that "Mr. Newman of Hornchurch has a threshing-mill built by two young mill-wrights from Somersetshire, who are paid 50 guineas for work and iron, he finding timber. And it is added that there are two new circumstances in this machine: there is a movement prepared, by which the person who feeds the mill, by putting his foot on a pedal, lifts one of the fluted cylinders out of its work, so that wheat ears having been advanced far enough to be threshed, the straw may be drawn back again and prevented from breaking. The other is a click, or iron, which admits the horses to be stopped suddenly without stopping the beaters; the connection is removed for a moment, so that one operates without the other: this is of capital importance. These different improvements are shown in *Plate* XL, in which *fig.* 2, exhibits the movements by which breaking the straw is avoided.

From	1	to 2	9 feet	0 inches
	1	3	16	0
	1	7	5	6
	7	4	8	0
	5	6	5	0
	10	11	1	6
	11	12	3	6

step for the foot to bear on, which divides the iron rollers, and enables the workmen to draw back the straw.

A	2	feet 9 inches	diam.	45 teeth.
B	0	8	diam.	11 teeth.
Drum	3	6	long.	
	2	6	diam.	

And *fig.* 1, shews the catch or click, by means of which the horses may be suddenly stopped without danger.

From	1	to 2	5 feet	0 inches	
	3	4	24	0	
	5	6	1	1	
	7	8	18	0	
	9	10	10	0	diameter
	13	14	7	0	
Diameter	11	12	0	10	

A the click.

These machines are of two descriptions, the large and small kinds, the former of which probably not only perform their work more expeditiously but in a more perfect manner, but their expense is an objection to them on small farms. They require different strengths of teams or other powers in working them, according to their size and the nature of their construction.

It is observed by the author of the Experienced Farmer, that "if the farm is so large as to employ a machine worked with *five* horses, it is very likely that on such a farm there must be brood mares kept entirely for the purpose of breeding, and it would be good management to use these when the foals are taken from them, which is usually done in the threshing season. Such a practice would encourage the breeding of horses, and the mares so used would raise their foals well and lose no time. But, says he, the farmer is not confined to the use of horses; oxen or young growing steers might be employed with advantage, as in that case they would earn their meat. It is certainly pleasant to the farmer to derive a reasonable profit from all the animals he keeps," which might be the case in this instance.

It is stated that in some large machines of this kind the rollers take in about three hundred inches of grain in a minute. The medium length of the straw being estimated at about thirty inches, and supposing half a sheaf to be introduced into the machine at a time, the whole sheaf will be equal to sixty inches, and the machine when supplied with a middling quantity of water will thresh five sheaves in a minute. But in respect to the performance of these mills, much must depend on the attention with which they are fed, as a small neglect in this point will make a very considerable difference in the quantity of work that is performed in a given time.

In regard to the expense of these machines, it must depend upon the size and power which they possess of performing work, the number of other operations which they perform at the same time, and whether they be fixed or moveable. According to Mr. Young a fixed mill that requires the power of two or three horses, is from 60 to 100 guineas. This will thresh about 15 quarters of wheat, and from that to 20 of barley, oats, peas or beans in the course of eight or nine hours.

Barley is the sort of grain that they thresh the worst of any kind, but there are several that thresh this as well as other corn, as those constructed by Asbey, of Bligborough in the county of Suffolk, which when fixed cost 100l. and when moveable 150 guineas. There are also many others that do their work equally well, as will be seen below.

It is stated in the East Lothian Report, that "a horse machine of the first powers, with its appendages of rakes, fanners, &c., a few years ago could be erected there for the sum of 100l. or 120l. sterling; but owing to the present high price of materials and workmanship, the expence will now be considerably more. A wind machine costs about 250l. independent of the buildings: these, however, cannot, with propriety, be included in the expense, as, upon almost every farm, barns to a considerable extent are required, even when the grain is thrashed by the hand."

"The only defect of machines worked by wind, upon their first introduction, consisted, Mr. Somerville

says, in the risk to which they were exposed, by stopping them to take in the sails, which could scarcely be done during a brisk gale: in that way it sometimes happened that when the wind freshened considerably after the machine was set agoing, either the sails were torn to pieces, or the arms broken off. That defect however is now remedied by a late invention of Mr. Mickle, by which the whole sails can be taken in, or let out, in less than half a minute, merely by a person pulling a rope, within the house; by this contrivance the sails are, with ease and expedition, proportioned to any degree of wind, a uniform motion is produced, and all danger of straining or hurting the machine is avoided."

It is observed that the number of hands required for working one of these machines, is from five to six; but that this depends greatly on the construction of the machine, some of them being so contrived, that the work can be performed with much fewer hands. The manner in which these people are employed is this: One finds constant work in carrying the sheaves to the man who feeds or puts the unthreshed corn into the machine, and in loosening the bands; another is required to feed the machine; a third to carry off the straw; a fourth to attend the fanners, and lay aside the cleaned grain; and a fifth, where horses are made use of, to take care that they go regularly; and that by means of five men and four horses they will thresh at the rate of five quarters in the hour on a medium, and when the crop is rich, and easily threshed, considerably more: consequently if a threshing-mill was to be employed for a whole day, or nine hours, it would thresh forty-five quarters; but in that case it would be necessary to employ two sets of horses. The expense is calculated in the following manner:

	L.	*s.*	*d.*
" Hire of eight horses, at 2s. 6d. each per day	1	0	0
Five men's wages at 1s. 6d. each	0	7	6
	L. 1	7	6

" In this account the hire of the men and horses are, it is conceived, charged at the highest rate, and that the expense of threshing forty-five quarters of grain would cost 1l. 7s. 6d. about 7d. each quarter. But that taking the average expenses of threshing 45 quarters of grain with the flail, throughout the whole kingdom, including an equal proportion of all kinds, cannot be, it is supposed, estimated at less than 1l. 7s. 6d., or 1s. 6d. each quarter, which makes a difference of about 11d. per quarter." It is remarked by Mr. Young in his Survey of Norfolk, that " a machine erected by Mr. Johnson, at Lempston, appears to be one of the best he has seen, if not the very best of the larger kind. The movements, says he, are uncommonly smooth. It requires from six to eight horses, six men, and one woman; threshes, without any question, much cleaner than the flail, and, without any doubt, cheaper. To bring it to its present perfection, as he was determined to carry his point, he never stopped till it worked to his mind; and having completed it, the repairs have been quite trifling. He attributes the common complaints of their being always out of order, to original errors or inattention in the construction. The arrangement is excellent, for disposing of the chaff, colder, straw, and corn, at once, in their respective places, without any confusion or removals; and it takes up a very small part of a barn. It was built by Mr. Wigful, of Lynn." The expenses of Mr. Drozier's, built by the same person in 1729, is thus stated:

	L.
" Machine	70
Blacksmith, Carpenter } including repairs	25
	25
Workmen's wages and board, 25 weeks, 4 men	105
Timber and deals	40
	L. 265

Including a granary over the wheel, of 26 feet by 24.

The threshing-mill, with dressing addition, would have cost about 120l.

A repair now in hand will cost 10l. at least.

Expense of Threshing.

				L.	*s.*	*d.*
Four strong horses, at 5s.				1	0	0
One boy to drive				0	1	0
Three women, to hand and untie sheaves	0	2	0			
One man with ditto	0	1	6			
One man to feed the machine	0	2	0			
One man clears the machine, and throws the foul corn to the riddle	0	2	0			
One man to carry away straw	0	1	6			
				0	9	0
Repairs and oil, calculated at 10 per cent. on 120l. 12l. At 60 days work				0	4	0
				1	14	0

" The mill will thresh 40 comb of wheat in eight hours, 50 comb of barley, 60 of oats and pease, and threshes pease better than any thing. The same men while the horses bait, dress the corn with the winnowing machine.

40 comb of wheat, 34s. at 10d. a comb.
50 comb of barley, 34s. at 8d.
60 comb of oats and pease, 34s. at 6¼d.

" He is confident that the machine threshes much cleaner than any flails. Every man that has examin-

ed the straw, admits this without a shadow of doubt, and barley equally with any other sort."

And it is added that "Mr. Whiting, of Fring, has a large threshing-mill, built by an engineer from Scotland, Mr. Fordyce. It cost him 200l.; is worked by six horses; threshes 24 comb of wheat in the day, 55 of barley, and from 63 to 84 of oats. It has five beaters on the drum-wheel, and the fluted segment of a cylinder which covers the drum in two parts, with an unfluted plate between them, which is raised or sunk by a short lever; this as a guard against stones getting in. In another circumstance also it is singular; there is a long platform, with a rolling cloth bottom: the whole raised or sunk at pleasure, for delivering the corn, across the floor space of the barn, from the goff in which the corn is stacked, to the other end in which the mill is built; which saves much labour, and works to his satisfaction."

Expense of Threshing.

	L.	s.	d.
"Five men; one to feed, one to hand the corn, two at the straw, and one to drive	0	7	0
One boy at the straw	0	0	10
One woman	0	0	8
Six horses	0	12	0
	1	0	6
Repairs have been considerable, but 10 per cent. a large estimate, or 20l.: if it works 80 days, this is	0	5	0
L.	1	5	6

"This may, he says, be called 1s. a comb for wheat, 5½d. for barley, and 4d. for pease and oats." As to its performance, the owner "is well satisfied with it; no flails in common management equal it for cleanness, and with barley as well as all other sorts of corn.

"The horse-wheel is upon a different construction from the common ones, working by a cogged-wheel of small diameter below, instead of above the horses; and the communicating spindle under their path; but he says it is hard work."

And Mr. Coke, of Holkham, is stated to have "a very large machine, which cost about 600l. Besides threshing, it grinds corn, works two chaff-cutters, and breaks oil-cake.

Expenses.	L.	s.	d.
Two men to feed	0	3	0
Three men to remove straw	0	4	6
One sacking the corn	0	1	6
Three to hand the sheaves	0	4	6
Two drivers	0	2	3
One looker-on, to oil, and see all in order	0	2	6
Eight horses	1	4	0
Interest of 600l. at 10 per cent. 80 days	0	15	0
	2	17	3

It is however remarked, that "its work has not been tried with sufficient accuracy with any thing but wheat, of which it threshes 64 combs a-day: it has sacked 13 combs in an hour; but no rule, as it was a mere exertion: 64 combs, at 52s. 3d. is 9¾d. per comb. The common price is 1s.; here, therefore, is a saving; no flails equal it for cleanness in every sort of corn; and it dresses better than any method whatever that has been yet tried." It is observed that "it occupies too great a space in one of the finest barns in England: it prevents the stowing of near 300 quarters of barley. The more of these machines the writer sees, the more he is convinced of the saving that would attend the moveable stacks shown in the preceding article."

And "Mr. Reeves, of Heverland, has a threshing mill, which is, the writer thinks, nearer to perfection than any other he has seen; it was made by Asbey, works with two or three horses, and cost 100 guineas. He found it at work, threshing oats; it does for barley as well as for any other grain, threshing 32 combs in a day, of 7½ hours; more of oats; 40 of pease, and 30 of wheat; its day's work of wheat, threshed the day before he was there, was 31 combs, standing sacked in the barn. It varies considerably in the beating drum cylinder from the others he has seen, it being of a much larger diameter, and has 11 beaters. The owner is perfectly well satisfied with it; and the men all agreed that it does the work much better than the flail. It has had no repairs in the threshing one crop; nor does he, from the simplicity of the movements, expect that it will be in that repect the least expensive."

It is perhaps only in places situated in the immediate vicinity of a colliery, and where, from the cheapness of fuel, they are capable of being worked at a very trifling expense, that steam can be had recourse to. See *Steam Engine*.

It is observed in the East Lothian Report in regard to small machines, that "they have been introduced there, upon a reduced scale, at a price so low as 40l.: these small machines, having little work to do, and that little being, in general, done slowly, answer the purpose tolerably well; but though cheaper in the first instance, they are, in the end, more expensive than larger ones, a certain degree of strength being absolutely requisite to doing the work perfectly. If the parts of the machine are below that degree of strength, the work is either ill done, or the machine is destroyed by being exerted above what it is able to bear."

And it is stated by the writer of the Essex Survey, that in that district at present "many are made by Balls of Norfolk, the price 50 guineas, and do their work very clean and well for all sorts of corn, but do not dress. They have been applied for white clover, and done it to the satisfaction of the growers, by passing through twice or thrice.

In one erected by Mr. Vaizey which is worked by 4 horses, one man feeds, two supply, a boy drives, and two men clear away the straw. He has threshed sixty quarters of wheat with it in eighteen hours. It cost 52*l.* 10*s.* and 10*l.* putting up; the shed added, about 20*l.* two winnowing machines 15*l.* 15*s.* in all, complete, about 100*l.* He has no fault to find with

its performance, but is very well satisfied. He has applied it to cobbing white clover with great success; by passing it thrice through the mill, he got from three jags, seven bushels of clean seed, in four hours.

And one built by Dickson of Ipswich for Mr. Sanxter, goes with two or four horses, and costs fifty guineas. He thinks it will thresh twenty quarters of wheat *per diem*. But it is now fifty-five guineas, put up and ready to work. Two horses work it, and not hard labour. Last year's wheat, which was very badly threshed at 7*s*. per quarter, was done by the machine perfectly well.

At Little Wakering, Dr. Asplin has a machine which the writer saw working with one horse, which moved with great ease, driven by a little girl, and did not sweat a hair; one man and two boys work it, and it does three quarters of wheat in a day. He examined the straw for about a quarter of an hour, and did not find a single kernel in it. The price sixty guineas. The construction varies from the others he has seen, in the wheels, which communicate the motion. The doctor threshes only wheat with it, though it will do for all grain. He thinks it answers greatly, and is perfectly satisfied with it. This machine was made by Turbot, Bankside, Westminster, but they are now made by Jones, Clement's Lane, Clare Market.

There are many others who put up these machines equally reasonable, and so as to work with much perfection.

The plan, elevation, and section of a threshing machine of the large kind, capable of being wrought by wind, horses, oxen, &c. as there may be occasion, are shown in *Plate* XXXIX. in which at *fig*. 1. AA is seen, the circular house that contains the machinery driven by wind, and from which motion is conveyed to the threshing part of the machine; BB, the shaft or axle that carries the vanes or sails; on which is also fixed the wheel No. 2. containing eighty-four teeth or cogs to turn the wheel No. 3. having 34 teeth, which is fastened upon an axle, on which is likewise fixed the wheel No. 4. that contains seventy-two teeth taken into a pinion placed upon the axle HH, having twenty-four teeth, as shown in *fig*. 2. And upon the axle H is also fastened the wheel NN, containing sixty teeth, to drive the pinion No 6. having fourteen teeth, which is fixed on the gudgeon in the axle of the threshing *drum* or *scutch*. CC is a wheel laid upon rollers, as 7, 8, 9, 10, that turn on their pivots, in frames placed on the tops of the walls; on the wheel CC is fixed with screw bolts the frame EE; on which shaft BB, carrying the vanes, revolves. To the under sides of the frame E E is likewise fastened the wheel No. 5. having teeth in its inner edge on which a pinion acts to move it, and of course the wheel CC, round upon its rollers, with the frame EE, and axle BB; by which means the vanes are turned to face the wind in any direction. DD, upright rollers that turn on their pivots in frames fixed in the walls; and on these rollers the circumference of the wheel No. 5. bears when moved round, to prevent the wheel CC and frame E from going off to any side when moving round. GG, the pillars that support the platform or gangway placed round the walls of the mill-house or place where the mill is constructed.

At I I, K K, *fig*. 2. are seen the walls of the circular house, that carry the machinery driven by wind, to turn the threshing machine L L, shaft or axle, upon which are fixed the arms of the wind vanes M M; and on which arms are placed the rollers V V, on the gudgeons of which are small wheels, turned by the wheel D, which is fixed upon an iron rod that passes through a hole in the middle of the axle L, and centre of its gudgeon; on the other end of this iron rod, is fastened the sheeve or barrel C, to which two cords are attached such as B. By pulling one of these cords the rollers V V are turned, and *spread* the sails or canvass, and pulling the other, the sails are *furled* up, or wrapt round the rollers at any time when the machine is to be stopped. U U ropes fastened to the extremity of the vanes to assist them in bearing the pressure of the wind. No. 2 is a wheel fixed upon the shaft L L, containing 84 teeth or cogs to turn the pinion, No. 3 having 34 teeth, which is fastened on the shaft O O. Upon this shaft is also fixed the wheel No. 4. containing 72 teeth, to drive the pinion No. 5, having 24 teeth, which is placed upon the horizontal axle P P; on this axle is likewise fastened the wheel No. 9, containing 60 teeth, to turn the pinion No. 10, in which are 14 teeth, and is fixed on the gudgeon in the axle of the threshing scutch E F, as shown at *fig*. 4. I I, is a half wheel suspended in a frame and let down at pleasure to bear on the upper half of the wheel No. 2, at any time when the machine is to be stopped. W W rollers that turn on their gudgeons in frames placed on the top of the walls; on these rollers are laid the wheel Y Y, which is easily moved round, carrying the roof N N, and frame that carries the shaft L L with the vanes M. In one end of the axle L is fixed a gudgeon which turns in the frame, and its neck rolls round upon the friction roller X, which also turns on its gudgeons in the frame. T T, an iron spindle with a handle or crank to turn it round; and on this spindle is a perpetual screw that acts on the wheel No. 6, placed upon the perpendicular axle R R, on the upper end of which is also fixed a pinion that takes into the teeth in the inner edge of the wheel S S, which is fastened to the frame and wheel Y Y. By this means the wheel and frame are easily moved round, so that the vanes may be turned to face the wind in any direction. Z Z, are rollers that keep the wheel S S, and of course the frame and wheel Y Y from going aside when moved round; which is plainly seen in *fig*. 1. HH, bearers which support the shaft O O, and one end of the axle P. G G, the doors in the walls, and Q a window to light the house by.

At *fig*. 3. S S S the pillars that support the beams T T, and roof of the course in which the horses or other animals walk to work the threshing machine at any time when the wind fails. A A A are the arms or poles fixed in the shaft or axle C, by which

the horses, &c. pull or draw. And upon the arms A, are placed the wheel B B, containing 208 teeth or cogs to turn the pinion No. 2, having 36 teeth, which is placed upon the shaft D D, on which axle is also fixed the wheel No. 3, containing 84 teeth, to drive the pinion No. 4, of 20 teeth, which is fastened upon the axle K. On the same axle is likewise fixed the wheel No. 5, containing 60 teeth, to turn the pinion O of 14 teeth, which is fastened on the axis of the threshing *drum* or *scutch* F F. No. 7, a sheeve or *whorl* fastened upon the axle K. Upon this whorl is put the leather belt or band M that turns the barrel No. 8, which is fixed on the iron axle L. There is also fastened on the axle L, a sheeve No. 9, upon which goes a leather belt, to drive the whorl No. 10, placed on an iron rod that takes hold of the gudgeon in one of the rollers E E, and turns the roller to feed the unthreshed corn into the machine. G H, are two straw shakers turned by the leather belts M and N. H, a platform upon which the corn is spread and introduced betwixt the feeding rollers. R R, the frames that support the threshing part of the machine. W W, the barn walls, and V V doors in the side walls of the house, for admitting light.

And at *fig.* 4. A A is the shaft or axle, in which are fixed the arms C C, and on these arms are fastened with screw bolts the ears or hanging pieces D D, to which the horses or other animals are yoked to work the machine. B B, is a wheel fixed upon the arms C C, containing 208 teeth, to act on the pinion No. 2, having 34 teeth, which is fastened on the axle E. On this axle is also fixed the wheel No. 3, containing 84 teeth, to turn the pinion No. 4, having 20 teeth, which is placed on the axle H. On this axle is likewise fastened the wheel No. 5, containing 60 teeth, to drive the pinion No. 6 of 14 teeth, which is fixed upon the gudgeon in the axle of the threshing *scutch* F F. V V are two iron rollers fluted or having small teeth to feed the corn into the scutch. No. 8 a sheeve fixed on the spindle of the feeding rollers turned by a leather belt, clearly seen in *fig.* 3. No. 7 a whorl on which is a band going round the sheeve I, to turn the fanners G G, that clear the grain as it falls from the threshing scutch. H H frames in which the rollers, threshing scutch and straw shaker turn. K K the side walls of the barn. L, the couples or frames of the roof. N N, windows to light the barn. R R, are pillars that support the beams S S, and the couples or roof T T, of the course in which the horses or other animals walk to turn the machine.

Where the machine is driven by wind No. 3 must be disengaged from No. 4; and when driven by horses No. 9 is cleared of No. 10, by the bearer of the axle P, being dropt a little down, which is done in a very easy manner.

This threshing machine may be readily made to be wrought by other powers, as those of water or the steam engine.

In the use of these machines, though their expense is very considerable at the first, there is unquestionably much advantage to the farmer, in the expedition of having the work done, in the cleanness with which it is executed in respect to the grain, and in the preventing of all sorts of depredations on the corn.

The expensive machines of this sort which have rollers for rubbing out the grain instead of beaters, are said to perform the business in the most perfect manner, though they require more power to work them.

Where machines of this sort cost about one hundred guineas, the annual expense in interest of capital and repairs cannot be more than from ten to twelve pounds, except in the expenses of team and the labour of the persons employed in the execution of the business.

THROATING, the act of mowing beans against their bending, which is never done but in a thin crop.

THROATWORT, the name of a perennial weed common in pasture grounds. The stalk is cornered and undivided. The flowers grow in bunches at the top of the stalk. They are erect, of a beautiful purple colour, and divided in the middle into five acute segments.

THROO, a term signifying a slip or width of corn, which a set of reapers, &c. drive before them at once, whether it consist of one or more lands or ridges.

THRUSH, in *Farriery*, a disease in the foot of a horse, arising from an inflammation of the sensible frog, occasioned either by contracted heels, the want of cleanliness in the part, or shoeing on erroneous principles; but most frequently the last See *Shoeing*.

It may be known by a tenderness felt on pressing the frog, which is also accompanied with a discharge of matter.

And the cure consists in removing the shoe, and lowering the heels, so much as that the frog may come in contact with the ground. After which the horse should stand without shoes for several days; and the part should be washed two or three times a day with a brush and soap lather, and afterwards, according to Mr. Denny, be dressed with the following ointment.

" Take of Vitriolated zinc,
Armenian bole,
Alum, of each, in powder, one ounce;
Tar, sufficient to form an ointment.
Mix.

This is to be applied on lint between the cleft of the frog, and renewed as there may be occasion."

It is also advised by the same writer that " all the diseased parts should be removed with the drawing knife. If the animal be not allowed rest, bar-shoes must be applied until the disease is removed. If there be much inflammation, we may take away three or four pints of blood, and give a mash, with nitre every evening. A rowel may likewise be placed in the chest, and continued for two or three weeks. A diuretic ball may be occasionally given, and the foot fomented in warm water, in which a handful of salt is dissolved, previous to the use of the dressings."

Where the disease proceeds from contracted heels, the only certain remedy is probably that of the use of the artificial frog invented by Mr. Coleman. See *Frog*.

THROUGH-STONE, a term signifying a stone which passes the whole breadth of the wall in making fences of that kind, and which binds them together.

THROW, provincially a turner's lathe.

TICK, an animal of the louse kind.

It is a small brownish, and flat insect, often infesting sheep, and which if not speedily destroyed, materially injures both the flesh and wool into which it insinuates itself. When these vermin have settled, scabs are found on the surface, whence a small quantity of matter issues; as the insects increase in growth, the scab becomes proportionally larger, and its full size nearly resembles a middling sized horse-bean.

In order to remove these noxious vermin, (which spread very rapidly), it has been recommended to separate the wool, and to wash the diseased spots two or three times, or oftener, if necessary, with a liquid preparation, consisting of one ounce of cream of tartar, and a quarter of a pound of bay-salt, (both finely powdered and sifted), and one ounce of corrosive sublimate, mixed together in two quarts of soft water; or four pounds of soft soap, and two pounds of arsenic may be steeped in thirty gallons of water, and the animals be immersed in the infusion, their heads being carefully kept above water and the sheep being sheltered from rain for one or two days. The wool must be closely pressed, and the liquor that runs off be caught in a tub, or other vessel, for future use. The proportion above specified is sufficient to bathe forty lambs.

But the preparation in use at Holkham in Norfolk consists of two pounds of tobacco, two pounds and an half of soft soap, and one pound of the white calx of mercury well reduced into powder, the whole being boiled in eight gallons of water for an hour. This is sufficient for dressing sixty sheep, being applied by parting the wool down the shoulders and breast, and twice on each of the sides of the sheep, then pouring it in very carefully. See *Sheep*.

TICHING, the setting up the turfs or sods in such a manner as that they may be dried by the sun, and fit for being burnt for their ashes upon the land.

TIDE-*Mill*, an useful sort of mill formed by running a dam across an inlet so as to leave a narrow passage open for placing it in on one side. It also signifies a mill for raising and clearing lands from tide water in fen situations and where injury is done by the overflowing of the tides. See *Watering of Land*.

TIKE, a name applied to an insect found in sheep, cows, &c. See *Tick*.

TILE, a material made use of for covering buildings with. It is much preferable to thatch for this purpose, though in some respects exceptionable. See *Roof*.

TILL, provincially to sow and harrow in the seed, or to seminate. It also signifies a stiff cohesive clayey soil.

TILLABLE, arable, fit for the plough.

TILLAGE, the act or practice of tilling, or cultivating land, especially the arable kind, or the means of bringing it into a state of preparation for the growth of different sorts of arable crops.

The most proper sorts of soils for tillage cultivation are all those of the more dry and friable kinds, whether the depth of mould, or what is termed staple, be only slight or considerable; as under different circumstances these differences fit them for the raising of different kinds of crops, such as all those of the grain, root, and plant description, the methods of cultivating which, have been fully explained under their proper heads.

In this view all the various denominations of light soils, such as gravels, sands, chalk, and thin loamy lands, are well adapted in most cases to the purposes of tillage, from their being in general pretty well suited to the raising of such green or root crops as are necessary in the support of live stock. The more deep, loamy, chalky, and gravelly sorts of land, where they can be kept sufficiently dry during the winter season, may likewise in many cases be well employed in tillage cultivation, and especially where they do not produce an useful sort of herbage for the keeping of animals. All the lands in the state of sward which are liable to be infested with the moss plant, or to be overrun with a mossy covering, may in common be managed under the tillage system with much advantage.

In some cases, though they are not by any means so numerous as writers on husbandry have supposed, lands may be suited to convertible tillage with vast benefit to the farmer. It has been remarked on this sort of tillage by a late writer, that land may in this way often be turned to better account by ploughing eight or ten years, and then laying it down in order to take up another part, than by the common method, "especially where the land is subject to ant hills; as the paring and burning destroys the ant hills, and such land is sure to bring abundant crops." But that "there are very few situations that have dry land and soil fit for the plough, but what would bring more profit under tillage than by lying in old grass; for when such good land as this is well laid down with plenty of good seeds, an acre of it will keep as much stock as four acres would by nature, and this is what makes its value. Let, says he, any body only look at a garden under proper management, and consider how many mouths it fills daily; and good farming is similar to gardening, for a hundred acres of good land perfectly tilled, will send more useful food to market than four hundred acres will do in grass. This therefore proves the great advantage of tillage on all lands that are proper for it; and if a man has a farm of four hundred acres, he may crop three hundred, and have one hundred in fresh seeds; by laying down twenty-five to thirty-three acres every year for eating the seeds three or four years, according to the quality of the land. If it is good land, the seeds will be good for four years, and if thin or poor land, perhaps it will pay him better to lay fifty acres down every year, and eat the seeds but two years, and this method of keeping such abundance of stock by the seeds for three or four months in the spring, till some stubbles begin to get cleared, is like having double the number of acres, and will keep more stock and better, for the three hundred acres that are cropped will give them plenty of winter support, which is the great object in all farming, as it causes the farmer to have fat stock when meat is the dear-

est. Such land as this is worth more money than the finest grass land in the kingdom; as on the fine marshes so much boasted of, the earliest of the summer stock comes to market at the very time when all sorts of vegetables are in plenty (such as peas, beans, &c.) and when meat therefore is sure to fall in price; and great numbers of grass fed sheep and cattle come together. Besides, the very best grass lands sends only two sheep in the months of April and May from an acre; but the best tillage land will send ten from an acre, and have them ready any time in the winter, when meat is the dearest. Thus, says he, ten acres of turnips will send one hundred sheep in the dearest time, but it will take fifty acres of the best land in grass to send that number."

He therefore concludes that "in this way the tillage farmer sends three hundred acres of corn to market, and as many fat sheep besides, (acre for acre) as the best grazing land; and that by other improved methods of management, as that of the culture of flax for the use of the seed in fattening live stock, the tillage farmer may derive greater profit than by the turnip practice, from the large quantity of winter fattened animals and the vast supply of dung thus raised. See *Husbandry*.

The necessity of good tillage in the preparation of land for cropping, is now so well understood by the practical farmer, and has been so often noticed under other heads, that it requires but little to be said on the subject in this place. It has been observed in the Survey of Herefordshire, after noticing that the Romans were convinced of the good effects of this sort of preparation, as Pliny remarked the advantages of frequent ploughing in Tuscany, and Evelyn suggests its power of so altering "a soil from its former nature, as to render the harshest and most uncivil clay obsequious to the husbandman" that "tillage also destroys weeds, and reduces the earth to small particles, thus rendering it sufficiently loose and porous to admit of the easy growth and extension of the roots and fibres of the grain to be cultivated in it."

And that "the spade is well adapted to these purposes, because it moves the ground eight or ten inches deep, turns it upside down, and covers the weeds with a quantity of earth, under which they rot, and contribute towards its fertilization; and this mode is founded on the just idea of the Flemings, that a farm should resemble a garden as nearly as possible." But that "the spade is too tedious, laborious, and expensive, to be practised on the larger scale of a farm; the plough is therefore substituted as cheaper and more expeditious, but in general it does not stir the earth so deeply, and often moves it in large bodies without sufficiently breaking it into pieces. To remedy this inconvenience, the celebrated Mr. Tull recommended a plough of his own invention, which had four coulters instead of one, and thus divided the earth raised by the shares into several narrow slips; but the resistance occasioned by the additional coulters was found to require a greater strength in horses, than the profits of the experiment would warrant. It was afterwards ascertained by a celebrated foreigner, M. De Chateauvieux, that the breadth of the furrow should be proportioned to the stiffness of the soil; and thus the resistance may be regulated on all kinds of land. But the operation of repeated cross-ploughing, as now generally practised, aided as it is by exposure to frost and rain, so effectually breaks the hardest soils, that other measures are rendered less necessary."

And that "M. Duhamel has observed in his Elements of Agriculture, 'that it is more advantageous to increase the fertility of land by frequent ploughings than by dung; because in general, only a certain quantity of dung can be procured, as twenty acres of land will, in common cases, scarce produce as much dung as are necessary for five; whereas the particles of the earth may be divided and subdivided almost to infinity. The aids, therefore, which are derived from dung, must be limited, whilst no bounds can be set to the benefits that may accrue from ploughing." This, appears, the writer thinks, to be over-rating the advantages of ploughing; but it is certain, that, when the particles of land adhere so closely together as to impede the extension of the roots of plants, in search of the nourishment they require, the plants themselves cannot grow with proper vigour, nor yield a proper produce. This is therefore to be corrected by frequent ploughings." And that "lastly, repeated ploughings enable the land to receive and retain all the benefits to be derived from the floating vapours and dews of the atmosphere, which falling on hard ground, where it cannot penetrate, is readily exhaled by the next day's sun."

These are therefore some of the ways in which tillage is so effectual in promoting the fertility of land, but there are others, as may be seen under the heads of *Fallowing of Land*, and *Ploughing*.

The best and most effectual methods of breaking down and bringing lands into the state of proper tillage is by the use of the plough and that of various implements of the harrow kind, such as drags, scufflers, and scarifiers, suited to the intention of the cultivator and the peculiar nature of the land. The plough tillage should always be performed according to the nature of the soil, and that of the crop which is to be sown, or the operations which are afterwards to be executed upon it. But to whatever depth this is to be done it is of much consequence to have it accomplished in an exact and effectual manner; as on this often depends the difference between a good and bad crop, as well as that between the animals employed in the labour moving with ease and difficulty. The repetitions of this sort of tillage must be constantly directed by the circumstances of the land and the intentions of the farmer, as some sorts and cases of land require much more tillage than others. This is decidedly shown in the following account from the Survey of Gloucestershire. "On the Cotswolds, it is the practice, the writer says, to sow their crops on one ploughing, experience having proved, that frequent ploughings on these light soil weakens the staple, and is productive of injury. Mr. John Haines of Baunton, near Cirencester, manured and ploughed up, in No.

vember, a small parcel of wheat stubble, and left another portion in the same field untouched till the 5th of February, when that was broke up, and the first parcel re-ploughed at the same time. Both received the same proportion of manure in quantity and quality. In June, the distinction was visible at a considerable distance; the crop of that which had been twice ploughed appeared sickly and weak in the stem or blade, while the other wore a healthy appearance, was strong and vigorous, and at harvest superior in the quality of the grain and abundance of crop."

The following plan of tillage has been advised in the Survey of the County of Salop, for the lighter sort of friable lands: "The wheat stubble is harrowed by drawing the harrows one way, which lays the stubble, and returning back along the same stroke, draws up the greatest part of the stubble, which is gathered by the harrows; and a person following them with a fork, unloads them, and lays it upon heaps to be disposed of as below.

"From the middle of November to the end of December this stubble ground is ploughed; at the latter end of February or beginning of March cross-ploughed, and when dry, harrowed; and if the weather proves suitable, much of the couch grass is got out and burnt; but if not so, by this method, it is checked in its growth during the seed time, and the business is more easily performed, which is to be done in the months of May, June, and July, in which months the fallows have three ploughings and sufficient harrowings to prepare for turnips, for which eight cubic yards of reduced dung, or 72 bushels of clod-lime is laid upon each acre; which is ploughed in at the last ploughing, though sooner would be better, if the dung is reduced enough by that time, or the land so clean as not to require much harrowing. Turnip-seed, one pound to the acre, sowed from the 7th of June to the 14th of July, the plants twice hoed; average produce from two pounds to two pounds fifteen shillings."

"As the land becomes cleared of its crop of turnips, it is ploughed and harrowed, preparative for a crop of barley: and being again ploughed up in buts or lands, five yards wide, from the latter end of March to the latter end of April, is sowed with $3\frac{1}{2}$ statute bushels of barley, 14lb. of common red clover-seed, and one peck of fine rye-grass seed to each acre; the average produce about 40 statute bushels of barley.

"The young clover not eaten between December and May, the part mowed, on an average produces about two waggon-loads, or a ton and an half to the acre. In the next month of October, ploughed in nine-inch furrows and six inches deep, and sowed with $2\frac{1}{2}$ bushels of wheat; produce about seventeen bushels.

"The turnip-crop is disposed of generally in the following manner: first, by drawing home at the beginning of November, those under the hedges, and some of the largest over the rest of the field; taking all up where the horses and carts are to pass. When the tops and roots are cut off, carry them home, and place them in heaps of about 12 cart loads each, in form of the cone of a wheat-rick; cover a foot thick with straw and thatch. These serve as a resource in time of frost and snow, for the beasts that are stall-fed, of which there is generally 20 yearly, and a man and boy, with one horse and cart, supplies them; leaving as many turnips to be eaten upon the land with sheep, as to ensure fertility enough for the crops of barley, &c. for the barley being too rank, generally spoils the young clover growing with it. Another advantage obtained by stall feeding with turnips, is making a large quantity of straw into manure at home; which is the best use that can be made of it, as straw food is not an improver.

"The stubble straw, mentioned above, is made into manure, by being carried and ricked up for litter by the side of a sheep-fold in the centre of these 400 acres, in which the sheep feeding upon turnips in the winter are lodged every night, from the middle of November to the beginning of March, where a servant goes every morning before five o'clock, with a small quantity of hay or clover, which is laid in a narrow cratch fixed to the pales all round the fold; by this method, when any are disordered, they are sure to be found and slaughtered, and the loss is but trifling. But since this method was used that loss has been but seldom the case, as the comfort the sheep receive by their being lodged in a warm fold upon the stubble, and each taking a bit of dry meat in the morning, are reasons, it is believed, to operate against the bad effects of the cold food taken into the empty stomach; and which is supposed to destroy many every year, to such a degree as to occasion some people to decline pasturing sheep upon turnips. The turnip sheep are generally bought in the autumn from Leicestershire."

This method of tillage or cultivating dry lands, is recommended to those who have been in the custom of long tillages, and without the use of general turniping, to be continued for so long as two courses of tillage, that is, eight years, by which time their land will be clean, and more fit for what is conceived to be a more beneficial mode of husbandry, and which mode is now pursued, namely, first turnips, managed and manured as before; second, barley; third, pease in rows, one foot asunder, hand-hoed and weeded; fourth, barley, with 10lb. of common clover, 4lb. of white Dutch clover-seed, 2lb. of trefoil-seed, and 1 peck of fine rye-grass, 8 cubic yards of rotten dung, or 72 bushels of lime laid upon the young clover in November; fifth year mow or graze; the sixth graze till October; and the seventh plough and sow with wheat as before; the land mucked for turnips, and lime, or compost of lime and earth or mud, &c. on the young clover in the autumn. This is believed to be a more profitable course than that which was heretofore practised, affording a greater change (and thereby obviating the failure both of turnips and clover) and occasioning more grass-land, which for many years has exceeded the tillage in point of profit."

And as an improvement of wheat lands, or mixt soil upon clay, the following mode of tillage is recommended.

"The turf being well ploughed and laid dry be-

fore Christmas, in the following month of April sow with 4½ statute bushels of oats; plough and lay dry in the autumn, and in the months of May, June, and July, give it three good ploughings and harrowings, rollings, &c. so as to reduce it; being drawn up and laid dry, continuing in that state to the middle of September, though made both fine and clean, gets an adhesive and binding quality, and consequently works lumpy, and therefore has the texture and quality which the farmer, by mistake, is afraid of losing by making his land clean. It is in the months of May, June, and July, when the sun is powerful, that land is to be cleaned; a ploughing in August is seldom of much worth.

"If manured with lime, lay 80 bushels upon an acre; if with dung, 10 cubical yards to each acre, either ploughed under at the July ploughing. From the 20th of September to the 10th of October, sow wheat 9 statute pecks to the acre, after having soaked the same not more than eight hours in mild brine, and dried with lime to prevent the smut. The next autumn plough the corn stubble, and at the end of March plant beans or pease in rows one foot asunder, hand-hoe and weed them. Plough in the autumn, and sow oats in the spring, and lay down with 10lb. of red, 4lb. of white Dutch clover-seed, and one peck of rye-grass seed to each acre. Manure the seeds in the autumn, let it lie in sward two or three years, as it may be required. At next breaking up plant with beans, hand-hoe and weed; next autumn sow with wheat, then with beans in rows, hand-hoe and weed that crop; oats and lay down with seeds as before. In lieu of one of the hoeing crops, if the land is not too wet, potatoes may be planted, which would be found very profitable to the wheat-land farmer; being very useful food for feeding or milking cows in the winter, as they produce much sweet milk. Should fallow for the first crop in one tillage, and hoe the next, and so proceed alternately; the summer sun to wheat-lands is certainly useful, the manuring with dung or lime also alternately. Where marl is to be procured at convenient distances, nothing turns to more profit; upon open soils, with either clay or dry bottom, marl laid upon the sward in the autumn, and to lie one year, is generally best; particularly if the marl is not perfectly good. Lime is sure to pay well the next tillage."

On this it is remarked, that "good farmers on light soils will entertain this prescription with caution, and their apprehensions of a crop of couch will outweigh their hopes of a crop of clover. Pease are precarious; one week's hot weather whilst in blow, is fatal to the crop."

And it is added on the authority of Mr. Harries, after noticing the insufficiency of some of the fallow lands, that "there are many active farmers who begin their fallows in January, and by repeated ploughings, harrowings, and rollings, bring them in very good order for wheat. Others graze the second year's clover till about Midsummer, and sometimes mow it at that time: if the soil is dry and the summer favourable, they bring it into very good order by seed-time. It would be better husbandry to raise a crop of turnips on such lands, after wheat or barley. If this was done, at least in every other course, a good crop of wheat would be grown upon clover leys, upon one ploughing, at a light expense. He frequently breaks up his clover leys of the first or second year, if they are tolerably clean, upon one ploughing, and puts an instrument upon the plough which we call a *fay* or *flay*, that cuts the turf, and lays it in the bottom of the furrow. Last year he had a clover ley worked with this instrument upon the plough, and after the seed was harrowed in, scarce any of the turf came upon the surface, and the field looked as well, and appeared as clean as though it had been sown upon a fallow. He has taken to plough a wheat, barley, or pease brush, from which the crop is early got in, and to sow on it about a bushel of rye and a pound of turnip-seed per acre; with these seeds the charlock and other seeds will vegetate, without perfecting their seeds: it is eat down in March and April, when it is of great use for sheep and yearlings, and two years old calves. If a principal crop of turnips follows, it may be eat till the middle of May." See *Fallowing of Land.*

It is remarked by Mr. Young in his able Survey of Norfolk, that "for the last four or five and thirty years that he has examined West Norfolk with the eye of a farmer, the change in the tillage system has not been great. At that period the course was, 1. Turnips; 2. Barley; 3. Grasses for two, or, in a few cases, three years; 4. White-corn; on the better soils, wheat; on others, rye, &c. The only change that has occurred has been in the grasses; the variation, which he believes first took place from forty to fifty years ago, was shortening the duration, from three years to two; in both cases giving what may be called a bastard fallow the last year, by a half ploughing, soon after Midsummer. Above thirty years ago, he contended, both in print and in conversation, against it, but was held cheap for entertaining any doubts of the propriety of the practice. He has lived, however, he observes, to see this change also in a great measure take place amongst the best farmers, who now give only one ploughing for the winter corn, whether wheat or tares; or in the spring for pease. That it is an improvement, cannot be questioned. The argument for it, founded on the invention of the drill roller, and on the introduction of the drill-plough, is good but not singular, as the practice of dibbling is likewise far more adapted to a whole than to a broken furrow; and for broad-cast common sowing, if we are able to cover the seed by harrowing on stiff soils, once ploughed, assuredly the same practice might be better followed on sand. The other reason for the former system, spear grass getting ahead in a layer, is quite inadmissible, for he must agree entirely with Mr. Overman, that no weeds, the seeds of which are not carried by the wind, will be *found* in a layer if they were not *left* there."

He contends that "the variations which have taken place in the crop put in upon layers, are neither great nor are they peculiar to Norfolk; the principal one

is taking pease on the flag, and then the wheat, &c. an admirable system, which has long been practised by good farmers in Suffolk, and he believes earlier still in Kent. Mr. Purdis's substitution of tares, holds on the same principle. Considering the very great value of white-pea straw, well got as sheep food (no where better understood than in Kent) there is no husbandry better adapted to a sheep-farm, than this of pease or tares preceding the wheat crop."

But he adds that "a great and a very important change has taken place in the application of crops to sheep instead of bullocks and cows. Formerly the farmers consumed much of their straw by cattle; now the best tread it all into dung. Sheep are the main grazing stock, and no more cattle kept than for treading, not eating straw, while feeding on oil-cake, &c. This is, says he, an important change, which has had considerable effect, and has depended not a little on the introduction of South Down sheep." But he conceives "the grand object in the whole system, is the singular steadiness with which the farmers of West Norfolk have adhered to the well-grounded antipathy to taking two crops of white corn in succession; this is talked of elsewhere, but no where so steadily adhered to as in this district. It is this maxim which has preserved the effect of their marle, on thin-skinned wheat lands, in such a manner that the district continues highly productive, under an almost regularly increasing rent, for more than 60 years, or three leases, each of 21; and by means of which great tracts have been marled a second, and even a third time with much advantage. This system, he thinks, has been that to which the title of Norfolk husbandry has been long, and is now peculiarly appropriated; and by no means the management of the very rich district of East Norfolk, where the soil is naturally among the finest in the kingdom, and consequently where the merit of the farmer must be of an inferior stamp; barley there very generally follows wheat; an incorrect husbandry, deserving no praise. The celebrity of the county in general was not heard of, till the vast improvements of heaths, wastes, sheep-walks, and warrens, by enclosure, and marling took place from the exertions of Mr. Allen, of Lyng House, Lord Townshend, and Mr. Morley, which were in the first thirty years of the preceding century. They were happily imitated by many others; an excellent system of management introduced, and such improvements wrought, that estates which were heretofore too insignificant to be known, became objects of public attention in the capital. The fame of Norfolk gradually expanded, and the husbandry of the county celebrated before East Norfolk was heard of beyond the conversation of Norwich and Yarmouth." He however asserts, that "without a continuance of cautious management and persevering exertions, West Norfolk would again become the residence of poverty and rabbits. But, says he, let the meadows be improved; irrigation practised wherever it is applicable; the remaining wastes cultivated, and this district will become a garden." See *Husbandry*.

It has been observed in the Herefordshire Report, that the importance of the tillage farmer cannot be disputed; and yet perhaps no branch of husbandry is clogged with so many obstacles to its improvement and success.

The advantages of the grazing system over that of tillage cultivation, hold out a great inducement to the farmer to convert his tillage land into pasture, the immediate effect of which must be felt in the reduced quantity and increased price of grain of every description.

"But unfortunately, this is not the only obstacle to the tillage farmer: the tax on horses used in agriculture operates also against the proper culture of the ground.

"It has probably been supposed by the framers of this tax, that the number of horses will thus be diminished, and that of oxen increased: but it should be recollected that oxen, valuable as they are as *auxiliaries*, can never be made the *substitute* of horses for tillage; their constitution and habits will not admit of it; and the shoe with which they are occasionally furnished, affords but an imperfect protection on hard or stony roads."

Tillage *Farm*, that sort of farm which is mostly cultivated under the arable system. See *Farm* and *Husbandry*.

Tillage *Husbandry*, that kind of husbandry which is chiefly performed by the plough. See *Husbandry*.

Tillage *Land*, that sort of land which is suited to the purposes of tillage, or calculated for the raising of grain, root, plant, and other similar crops. See *Tillage*.

TILLER, a term applied to the branching of the stems of corn from the roots.

TILLERING, spreading or shooting out as corn in the spring.

TILLS, a term signifying tares or vetches.

TILT, a term signifying the covering of a cart, &c.

TILTH, the condition of the earth after ploughing, &c. or the state of the soil in respect to tillage or heart as relating to manure.

TIMBER, that sort of wood which is useful for the purposes of building, &c. or such large trees of different sorts as have reached their full state of growth, and which are in a state fit for being cut down for use. The kinds of trees most useful in this intention have been considered in speaking of the nature of plantations and planting, but they are chiefly the different sorts of pines, the larch, the birch, the common ash, the mountain ash, the beech, the sycamore, the elm, the oak, the horse chesnut, and the poplar. However the oak, ash, elm, Scotch pine, and larch are by much the most valuable for the various purposes of this sort.

The fir or Scots pine is not well suited to very elevated situations, as the sharpness of such exposures quickly brings it into a state of decay and death. The intelligent writer of a Survey of one of the northern districts has remarked that "there is a kind of laminated clay, much disposed to dissolve with water, not favourable for this, or any of the pine tribe. It

succeeds very well, however, in most parts of the clay ground in the county, if care be taken to prevent stagnant water. It does exceedingly well on land covering the free-stone rock; but the best timber is produced on hard dry gravelly soils."

But "the Siberian pine, and some others of a similar nature, have been introduced with very little success. The short intervals of mild weather which happen in the beginning of the spring, excite them to vegetate too early, and the next cold blast destroys the young buds. The New England pine thrives, in a tolorable soil, from twelve to twenty years, in proportion to the exposure, after which it generally begins to decay."

And "the spruce is also unfit to weather the storm on the greatest heights. It succeeds on the hard dry rock, where the Scots pine dies, but frequently decays at the end of eighteen or twenty years, on stiff wet clay. Its most favourite soil is that which is dry and gravelly. The silver fir thrives in clay soils, where the spruce fails; nor is it averse either to the hard rock or gravelly soil; but it makes no progress on any soil that is very poor. Unfortunately it frequently suffers severely from the frosty mildews of the spring, particularly in its youth," or more early growth.

But "the *larix* or larch is now found to be the most hardy alpine plant. In most places it makes greater progress than almost any other tree; and there is scarcely any soil, that is not drowned with water, on which it will not succeed. It suffers most in too luxurious situations, where its soft shoots, unable to keep erect, bend away from the slightest gale." But "the severe frosts in May 1802 and 1803 succeeding some mild weather in the month of April, which had brought on the vegetation of the larix, killed many of the young plants of this kind, particularly those planted in low sheltered situations, and deterred people from continuing to plant this tree; but such as had escaped having continued to succeed, it is again become a favourite plant. It sometimes is seized with disease, and dies when placed on miry clay."

It is added that "the birch is next to the larix in the progress of its growth, and equal to it, in ability to stand the blast in alpine situations. The birch is superior in the plain. But in whatever situation it is placed, it delights most in a light soil and dry bottom. Notwithstanding, it thrives in moist soils, with very moderate draining."

But "the ash, when it enjoys a sufficient depth of good soil, is capable of braving the storm, and pushing up its head in the most exposed situations; however, in a thin soil covering a stiff, argillaceous bottom, it can make no progress. It thrives well, notwithstanding, in marshy soils where the banks are steep, so that the water flows away without stagnating. This is perhaps the most important wood in the country, being useful in all its ages and for most purposes."

And "the mountain ash is a hard native which grows freely in almost all soils and exposures; but its favourite situation seems to be in hanging banks among woods and coppices. It and the gean tree, or wild cherry, propagate themselves much when left at liberty, by putting up suckers from their roots."

It is added that "the beech comes near to the ash in capacity of braving the storm, and has much the advantage of it in thriving in poor or stiffer soils; but there are some barren argillaceous bottoms too much even for the beech, and it is most successful in friable soils. Its young shoots are soon affected by frost, but it quickly recovers."

But "the sicamore and elm require a light soil and a dry, open under-stratum: and when this is the case, they thrive in a situation pretty much exposed."

In regard to "the oak is less patient of the blast than most of the trees of the forest. Being late in putting forth its leaves, it continues to grow till the season is far advanced; and the immature wood of its late shoots, unable to resist the piercing effects of the cold wind in exposed situations, withers before the next spring; so that, like Penelope's web, the progress of one season is undone in the following. The most favourable situation for the oak, therefore, are hollows or hanging slopes, where the sharp winds are broken by the neighbouring heights. In such situations, if stagnant water be avoided, it will thrive in the stiffest soils, and with its strong roots penetrate the densest bottoms. Some plants of this kind form the bud on the top of the branch, preparatory to the following year's growth, early in autumn, and are less subject to be injured by the winter's cold. It is doubtful whether this be a seminal distinction or an accidental variety; but such forward plants have always the bark of their young shoots of a dull purple colour. In planting oaks, it would be proper to choose these till the matter be better known.

"Though its growth is slow in infancy, when it is placed in a favourable situation, it will make a progress in the course of fifty years, little inferior to many other kinds, and arrive at length to a great size."

It is found that "the horse chesnut tree thrives well on the lower grounds, and deep soil only. The sweet chesnut, which quickly becomes a timber tree in districts more northern, does not exceed here. Its seasons of growth are too early, or too late, for the climate. In its first, it bears some resemblance to the Siberian pine, &c.; in its last, to the oak; its early growths being almost as early as the former, and its latter being nearly as late as those of the latter, and still more soft and susceptible of the cold. Hence its shoots are alternately put forth and destroyed, and it generally becomes a low stunted shrub. But this does not seem to have always been the case. The fate of the walnut, which may be considered as much a timber tree as a fruit one, is nearly the same with that of the sweet chesnut."

But "the poplar delights most in water-formed soils but is averse to marsh, and, when happily situated, makes quicker progress than any other tree."

The following judicious remarks have been made by Mr. Salmon on the management of fir, timber,

in a late volume of the Transactions of the Society for the Encouragement of Arts, &c. and which are explained by engraved representations.

"Considering, says he, the purposes that fir timber is generally applied to, and having some knowledge of plantations of this sort, it must occur that clearness of knots, straightness, length, and equal size of its trunk, constitute its perfection; and if deficient in all these, it is of no value but for the fire. Next to these considerations, and the prospect of an improved knowledge of cultivating this article, it may be a fair question, if our own country is not capable of producing fir timber little or not at all inferior to the foreign fir. At present fir in this country appears, he thinks, not for any period to have been considered much otherwise than as ornamental. For this purpose they serve but for a certain time, which past it has been their fate to be cut down long before having attained maturity. But from the vast plantations now established, it is to be hoped that another century may obtain to English fir some of the character of the English oak; towards such end, if attainable, every means should be used, and towards which nothing appears more likely to succeed, than a well-grounded general practical mode of management, from the time of their being planted out, to their greatest imaginable age of improvement. That a knowledge of such may by perseverance be gained is not much to be doubted: and by inspecting and considering the specimens herein referred to, there appears, he says, great reason to conclude, that early and proper pruning and thinning will form a considerable feature in the system to be adopted."

And "now, continues he, as forms are first instruments in good systems, and that proceedings on fundamental principles (though in the essay they may a little err) are better, in a general view, than occasional success by hazard; so it may be warrantable that a system for general management may be laid down, although he cannot possibly have lived to prove all by experience; so the rules hereafter submitted are given, being the result of only a few years' observations."

In the raising or planting of this sort of timber, from every authority or observation, there can be no doubt, he thinks, that all firs should be planted thick; not more than four or five feet apart. And that "where firs of the same kind are planted together, there is less loss of plants from one sort overgrowing and destroying the others; consequently it appears advisable that all the different sorts be planted by themselves. If any admixture be at all admitted, the Scotch and larch may best succeed; but this is not certain, and they will certainly be best separate on two accounts; first, because they are not so likely to injure each other; and secondly, the larch may be put in the ground best suited to them, and the Scotch the same."

Further that "in making plantations of any particular sort, it may be right to have a few spruce, or other sorts on the outside, to prevent mischief from sudden gusts of wind; but if the situation is not subject to such gusts, the spruce had better be omitted, being mechanical agents only, and by excluding the sun and air they act against the operation of nature." But "in these hints ornament is not, he says, considered; if such be wanted and profit also, then the spruce, larch, silver, and some other may be combined."

He states that "from some years' observations on pruning and the effects thereof, it appears certain that fir trees, at a certain age, should be pruned to a certain height; and for regulating thereof, the following simple rule is recommended: The pruning to commence when the trees are six years old, or when there is discernible five tier of boughs and the shoot; the three lower tier of boughs are then to be taken off. After the first pruning, the trees to be let alone for four or five years, and then, and at every succeeding four or five years the pruning to be repeated, till the stem of the tree be clear to forty feet high, after which, as to pruning, it may be left to nature. The rule for the height of pruning, after the first time, to be half the extreme height of the tree, till they attain twenty years growth; and after that time, half the height of the tree, and as many feet more as it is inches in diameter at four feet from the ground. This pruning is known, from repeated observations, not to be excessive; and the rule is calculated to check the too tapering top, and strengthen the slender bottom, by carrying the pruning to a greater proportionate degree, in a ratio compounded of the height and bottom bulk; and by this rule it may be observed, that the trees will be at top cloathed with somewhat less than half their branches. The proper time for pruning, is between September and April, and the tool to be used, the saw."

And he adds, "that orderly thinning the trees at certain periods is the next essential to pruning, and for this purpose observations have been made on the most orderly and thriving plantations, and the following simple rule is recommended. Keep the distance of the trees from each other equal to one-fifth of their height. In the application of this rule for thinning, it is evident that each individual tree can never be made to comply, for the original distance (even if planted in the most regular order) will allow only for certain modifications, by taking out every other tree, and so on; but even if the obtaining such equal distance was practicable, experience would show that another way should be preferred, of which the eye must be the judge, by taking out such trees as are least thriving, stand nearest another good tree, &c. &c.; at the same time keeping in view the rule prescribed: the following of which rules may easily be proved by measuring a chain square, or any quantity of the land, and counting the trees thereon; then by trying the height of two or three trees in that quarter, and taking one fifth of such for the distance, it would be readily seen how many trees should be contained in the piece measured: or the practice may more simply be regulated, by taking the distance of eight or ten trees added together, the average of which should be equal to a fifth of the height of the trees."

It is observed that in these rules nothing impracticable or complicate is proposed. He further states that he "has for years known the expense and produce

from trimming only, and finds in Bedfordshire the produce doubly repays the expense; and although some experimentalists may differ from him, or time may show some reason for deviating somewhat from his rule, yet it is presumed all will agree that some simple system is advisable, instead of having plantations and woods mismanaged, to the great loss of the community and the proprietors. If such a system as proposed, be generally promulgated; if not perfect, it will most likely, in time, become so, and thereby have its advantage; and that some advantage may be had in speculation, the following concluding remarks are introduced. „In the common course of gardening, it is understood that pruning invigorates the tree; that trimming off the side branches makes the upright ones shoot the stronger, and by cutting out the dead and decayed wood the tree is kept alive; some of this doctrine will certainly apply to the tribe of firs; it will certainly substitute clean wood for knots, and of all this treatment, from their particular uses, they of all other trees stand in most need, and will be most improved by it. And should it be admitted that like treatment would on the fir, as well as other trees, produce the like effect, it would lead to a well grounded expectation that, as well as producing clearness from knots, straightness and length, the same operation would advance the quality nearer to that of foreign fir; for it may be traced, that where trees are tall and clear of boughs or knots, the whole substance of the wood is better and of finer grain, and it appears likely that such will always be the case; the reason may probably be inferred from the sap having farther to rise and descend, and having no boughs to divert or delay it, the circulation must be more fine and rapid, most increase be left in the neighbourhood of the boughs at the top of the tree, and least on the sides at the lower part, consequently adding to the length of the head, and rendering more fine each annual increase to the body; thereby producing a close-grained, clean, long, and regular, easy-tapering useful piece of timber; instead of a coarse-grained, short, sudden-tapering trunk, with a quantity of boughs and knots."

The writer further remarks, that "the foregoing observations and rules are meant to apply to fir timber only, but to a certain degree they may be applied to other timber; though by no means to the same extent or age. But if applied as far as the first fourteen years of their growth, and then the pruning altogether omitted, and the thinning out very much increased, any plantation would be rendered much more valuable than if left entirely to nature."

The pruning and thinning of timber trees of the deciduous kinds, should be practised in some measure on the above principles, but, according to the particular circumstances and growth of the trees, being constantly performed in such a way as to prevent any injury being done by the too extensive growth of the lateral branches without the tree being left too naked and exposed. The foul dead stumps and small branches, should be constantly taken off in the young growth of the trees, but the large branches in full grown trees should be left untouched. And in all the prunings the branches should be carefully taken off upwards in a clean manner without the stumps being left in the least degree rugged or uneven, as where the contrary is the case, by detaining the wet and moisture they have the effect of conductors of it to the heart of the trees, by which they are soon destroyed.

And the thinnings should be executed about every seven or ten years as the growth may be, so as to prevent the trees from crouding each other too much, and so as to afford proper room for their full growth and increase.

The periods of making *falls* of timber or of cutting it down must be in some degree regulated by the circumstances of the growth of the trees. In large woods they may mostly be made from twenty to forty years, as will be more fully seen in considering the management of woods. See *Wood*.

In speaking of the age of the oak in Bagot Park, Mr. Marshall in his Midland Counties remarks in respect to this point, that "there has been lately a fall of timber in these woods; including some large trees. He counted the rings of one which was sound at the butt: the number, as nearly as he could ascertain it, two hundred. But the last forty or fifty years growths are so thin, he could not count them with certainty; though with sufficient accuracy to ground the following calculations. The girt of this tree, in the girting place, is nine feet, the diameter of which is somewhat more than thirty-four inches."

And "the estimated growth, in this part, is thirty inches diameter, during the first hundred and fifty years, and four inches (two inches thick) in the last fifty years. The length of the stem is twenty-two feet. The contents of the whole, 110 feet of timber. The contents, of the first 150 years growths, 85 feet; leaving 25 feet for the growth of the last 50 years.

"Therefore, says he, although the increase of diameter has been comparatively small, during the last fifty years, the increase of timber has been nearly as great, as in the first stages.

"But supposing this tree had been taken down at one hundred and fifty years old, it would, at two shillings a foot, have produced eight pounds ten shillings, the interest of which would have amounted, in the course of fifty years, to more than 20 pounds; beside the use of the land, during that time. Whereas the tree, at that rate, is now worth only eleven pounds."

It is added that "these calculations, and inferences, are not intended to excite a spirit of felling timber, prematurely; a spirit which is already too prevalent; but to endeavour to ascertain the *proper age* of *felling*; it being an incontrovertible fact, that, in point of utility, public and private, the crime of suffering timber to stand too long, is infinitely greater, than that of cutting it down, before it has attained its full growth.

"In the latter case, there is no waste; the interest of money, and the succeeding shoots, or the use of

the land, stand against the loss of growth of timber. But, in the former, the principal, interest, aftershoot and use of the land are all thrown away: so that the community, as well as the proprietor, are losers by the management. In the one case, cutting part before it be fit, may save other trees which are more fully grown; but, in the other, the whole is lost."

Leaving, says he, the preservation and management of ship timber to those to whom it properly belongs, "it does not follow, that, because it s wrong to suffer timber to stand to waste, it is right to take it down, before it be sufficiently grown, for the purpose of ship building. It is not overgrown, but stout growing timber, which is fit for that purpose. Timber is seldom cut down prematurely but by the necessitous; or by those who have only temporary possession of their respective estates. And what argument can prevail, with this class of proprietors? Another class (and he trusts by much the largest) is composed of those who, considering their timber, merely, as a profitable part of their several estates, take it down, whenever it becomes *full grown*, and a *fair* opportunity offers."

And "a third class of proprietors of timber consists of those, who, through false pride, false fear, or false economy, suffer their timber to stand till it be *overgrown*: and if he have any other motive for publishing the foregoing Minutes, on the ages of timber trees, than that of recording facts, it is the desire of placing in its proper light, the improvident management of this class of proprietors; and, at the same time, to endeavour to form just ideas of a subject, which has not, heretofore, been brought before the public; but which is pre-eminently entitled to a public discussion.

"This subject having been rendered, in a considerable degree, familiar to him by many years observation and practice, he will here set down what appears to him the *proper ages* of felling the four following species of timber:

1st. "Poplar, from thirty to fifty years old.
2d. "Elm, from fifty to a hundred.
3d. "Ash, from fifty to a hundred.
4h. "Oak, from one hundred to two hundred."

But he adds that "very much depends on situation; —on the soil and subsoil—in which trees are rooted. On dry absorbent soils, the oak and the elm, at least, are observed to go off much sooner, than in cooler more retentive situations. And in Merevale wood,—a dry loam, with a rocky subsoil,—he finds the oak going fast to decay, at two hundred years old. In Bagot's Park, a cooler situation, it is sound, but unprofitable, at that age. In Statfold wood, perhaps a still cooler spot, it is sound, profitable, and wearing every appearance of being in a fit state to be taken down, at the age of a hundred and fifty years."

Timber is disposed of in various ways according to the nature of the situation and the customs usually followed in the district.

In selling of timber in the county of Norfolk, "the prevailing practice is, the same writer says, to sell it standing, at so much a ton when fallen; measuring the timber, down to six inches timber girt; the *topwood* and the *bark* (of oak) becoming the property of the purchaser; who is usually at the expense of taking it down. And it is likewise customary for the purchaser to dispose of the bark (of oak), and sometimes the topwood, by the same admeasurement.

In the taking down of timber, three methods are practised, Mr. Marshall says, in the midland districts, as *stocking*, *axe-grubbing*, and *axe-falling*. The first, he says, is a kind of partial grubbing. The roots are cut through, a foot or more from the stem; and, again, a foot or more from the inner cutting; taking up a short length of the thickest part of the roots, and digging a trench round the tree wide enough to come at the downward roots.

"The second or axe-grubbing, which is similar to the Norfolk method of grub-felling, except that the end of the butt is left larger in this district than is the case there."

And the third or "axe-falling is the common method of Yorkshire and other places, of cutting off above ground, with the axe:—a method which is seldom, he says, practised; except in some few cases, where another crop of timber, or of coppice wood, is intended to be taken. Stocking is the prevailing method;—the price for taking down varying with the size of the tree: for a tree of two feet diameter, the price is about a shilling; and about four pence more for cutting off the butt; the stocking and butting being generally let together.

But there are other modes practised in performing this business in other districts, as that of sawing the trees off in a horizontal manner close by the surface of the ground, by means of a long saw with one or both handles fixed on the upper side, the trees being first dipped in by the axe on the falling side.

The method of falling practised in the county of Norfolk, is, Mr. Marshall says, "uniform and, perhaps, peculiar to the country. It is called very aptly, grub-felling; the operation partaking both of grubbing and of felling with the axe,—in the common way above ground; a method which is wasteful of timber. The Norfolk woodman, therefore, fells below the surface of the ground; by cutting off the horizontal roots close to the stem; which, instead of shortening, he, in effect, lengthens, by adding to it a conical point, cut out of the crown of the root; so that by this way of proceeding, a greater length of timber is obtained, than by, first, grubbing, and, afterward, cutting off the butt with a saw. Grub-felling is, no doubt, the most eligible way, he thinks, of taking down hedge-row timber; and this accounts for its being the established practice in Norfolk." See *Wood* and *Plantation*.

In the midland districts, the arms, or boughs of the trees, are cut up into posts, rails and cordwood, for charcoal. And the *spray* mostly made up into fagots.

The great demand for timber on account of the increasing scarcity, should induce the proprietors of land to attend as much as possible to this object of rural economy.

TIMBER-*Carriage*, a sort of wheel carriage contrived for the purpose of conveying heavy timber.

These carriages, Mr. Marshall says, "are in Norfolk, as in most other places, of two kinds, the four-wheeled carriage—provincially, "a *drug*;"—and the pair of wheels—provincially, "a *gill*."—The last is most in use. The construction of the Norfolk gill is, he says, similar to that of the timber wheels of most other countries; namely, a pair of tall wheels, with a crooked axletree, surmounted by a block; to which axle is fixed a pair of shafts, or sometimes a single pole only."

But he adds, that "the method of using them there, is different from that which he has observed in other places; where the only use they are put to is to raise the butt end of a large timber to be drawn a short distance; the top end being suffered to drag behind upon the ground, to the injury of the turf, or the road it is drawn upon.

"In Norfolk, however, a large stick of timber, or perhaps three or four smaller ones, are, he observes, entirely slung to the axle; so that, in drawing, no part of them whatever touches the ground; the top end being generally drawn foremost, and the end toward the horses always the heaviest."

And that "the method of taking up a piece of timber is this; the horses being taken off, the wheels are run, by hand, astride the timber to be slung, until the axle is judged to be a few inches behind the balance-point: or, which is better, a chain is first put round the timber, and the wheels run up to it. It is difficult to ascertain the exact place of fixing the chain, by the eye; nevertheless, a person accustomed to sling timber in this manner, will come very near the truth. The chain hooked, and the axle brought into its proper situation, the shafts, or pole, is thrown back in the usual manner; the chain carried over the block; brought round the pole; its ends made fast; and the shafts or pole drawn down again by the horses; by which means the timber is lifted from the ground, and suspended to the axle. If the required point of balance be not hit upon the first trial, the shafts are suffered to rise again, the chain is unhooked, and shifted to its proper situation: the shafts being again pulled down, are bound by an iron trace or small chain, close down to the timber; while another small chain or trace is fastened round the foremost end to hook the horses to; the team drawing by the timber, not by the pole or shafts."

He supposes "the utility of having a superbalance of weight forward is two-fold:—if the piece were slung in exact equilibrium, it would, upon the road, be in perpetual vibration; thereby rendering the pull unsteady, and extremely inconvenient to the horses; whereas by throwing the balance forward, the traces are constantly kept down in their proper place, and the pull becomes uniform: if, however, too much weight were to be thrown forward, the draught of the horses would not raise the point from the ground; the friction would, of course, increase the draught, and the road be at the same time hurt. It therefore follows, that the proper weight to be thrown forward is enough to prevent a vibration, but not so much as to prevent the point from being raised from the road by the draught of the horses upon level ground." And that "the other advantage by a superbalance forward, is gained in going down a hill; in which case, the draught not being wanted, the point, of course, falls to the ground, and serves as a pall to regulate the motion of the carriage; if the superbalance alone be not sufficient to check the too great rapidity of the motion, the driver adds his own weight. Likewise, if, in ascending a hill, the balance be lost; he, in like manner, seats himself upon the fore part of the load, thereby keeping it down to its proper level."

He adds, that "this method of conveying timber may, it is possible, be in use in other districts; but he has not seen it practised any where except in Norfolk. He knows it to be an excellent, but not a common practice.

Hedge-row TIMBER, such timber trees as are raised in hedge-rows. It has been a disputed point among agriculturists, whether it be admissible or not to have trees in hedge-rows; some contending for its utility on the grounds of the shelter and timber afforded by the practice; while others oppose it on the score of the injury afforded to the crops and the hedges below them. But in many situations there can be no doubt of the advantages of having hedge-row timber.

Mr. Marshall, in his Yorkshire Economy, considers it, "an interesting subject to the proprietors of inclosed estates. The old inclosed parts of this neighbourhood, when seen at some distance, have, says he, the appearance of woodlands; the inclosures being mostly narrow, and full of hedge-row timber. The age, on a par, is about fifty years. In half a century more, the value of the timber, of some parts of it, if suffered to stand, will probably be equal to the value of the land: a circumstance, he supposes, of no small import to the owner. But the detriment to the occupier requires to be considered.

"In this county, it seems, says he, to be a general idea, founded perhaps on experience, that lofty hedge-rows are beneficial to grass land; increasing its productiveness, by their warmth, and giving shelter and shade to pasturing-stock. The roots, even of the ash, are considered as inoffensive to land, in a state of grass; in which state, the grounds thus loaded with hedges and timber trees, is almost universally kept. Indeed, it would be impossible, in their present state, to occupy them as arable land. They are entire enclosures, every foot of the areas of which must necessarily be occupied by ashen roots; nevertheless, they give an ample supply of hay and pasturage. One to two tons of hay an acre. And, in many of them, three acres will afford sufficient pasturage, for two cows, of the largest size. The rent, from thirty to forty shillings an acre. Strong evidences, these, he says, that the roots of the ash are not very injurious to grass land."

He thinks "it is evident, however, that the oak, when suffered to thrust its low spreading head into

the inclosure, is injurious to the herbage beneath it; that the leaves of the ash are very detrimental to aftergrass; and that the hedges are annually receiving irreparable damage;—no general plan of training up the trees, with tall stems, having, he believes, in any instance been adopted" so as completely to prevent it.

On these grounds he concludes that "the advantages accruing from the planting of timber trees in the hedges of inclosed common fields, of a soil, and lying in a situation adapted to grass,—are far superior to any disadvantages arising therefrom, even where they have been suffered to grow in a state of almost total neglect." And that, "land which has lain open, and which has been kept in a state of aration, during a succession of ages, is equally productive of grass and trees. And it is generally good management, to let it lie in grass, for some length of time, after inclosure." Besides, he says, "in this neighbourhood, it is evident to common observation, that trees flourish with unusual vigour, in the newly inclosed lands of arable fields; and that their injury to grass land is inconsiderable, when compared with the value of the timber they produce. The low spreading heads of the oak, and the leaves of the ash, appear to be the chief inconveniencies of these two species of trees to grass land.

"But an alternacy of corn and grass is, he thinks, generally eligible, on lands which our ancestors have made choice of for common fields; and the roots of the ash are not only obstructions to the plow, but the general nature of the plants is, in a singular degree, inimical to corn.

"It is, therefore, necessary to eradicate the ash from the hedgerows, before the land be again broken up for arable; or to preclude this tedious operation, in the first instance, by planting oak in its stead."

It is conceived that "the head of the oak may be raised to such a height, as not to be injurious to grass, nor to the hedge, while yet in a youthful state, even though it were suffered to run up to its natural height."

He adds that, "whenever the inclosures are broken up for corn, the hedges ought, in common good management, to be headed, and kept in a dwarfish state; in which case tall-stemmed oaks would be a valuable source of timber, without being, in almost any degree, injurious, either to the hedges or to the corn growing under them. But the training of young oaks, and the general management of hedgerow timber, cannot, with any degree of prudence, be left to a mere occupier." When intended as nurseries of timber, they should, he conceives, be under the immediate management of a person proper for the purpose. See *Pollard Trees*, and *Fence*.

It is observed, however, in the Survey on Agriculture for Gloucestershire, that "the practice of planting timber trees at all in hedges, is liable to objections; for if the tree is left to take its natural growth, which is the best mode of raising good timber, the lower fence is ruined by its shade and drippings; or if they are cut up and shredded into naked poles, or pollarded for the sake of lop or fire wood, the timber is injured and the beauty of the tree destroyed. A better plan is to assign certain spots on an estate for the purpose of raising timber trees only: this would eventually be no waste of land, because the grass or corn growing near the hedges, which are filled with timber or fruit trees, is worth little or nothing: in these small inclosures at the angles of a field, for instance, the trees might take their natural growth, and this would be more rapid in consequence of their being planted in clumps and protected.

"If, however, the old mode of planting in hedgerows be continued, the ash seems best adapted to the purpose. The timber is in some respects superior to elm, and in various cases, useful where the other cannot be applied: in durability it almost rivals the oak, and its growth is improved by being kept to a single stem, the only mode of treatment in which trees ought to be admitted into hedge rows at all, but which few other trees will bear. The oak and beech particularly, when so large as to become heartwood, seem to be much injured by the loss of their side branches; a retardation of growth is the immediate effect; and it is said, that the oak will not thrive after this operation for ten years; and of the elm, though apparently suffering loss: it is however observed, that the finest and soundest trees are those which have been most left to their natural growth."

TIMOTHY-GRASS, the name of a grass said to be cultivated much in America. The seeds are said to have been carried from Virginia, by Mr. Timothy Hanson, to North Carolina, where it is much grown, from which circumstance it received its name.

It thrives most in low, damp, marshy grounds: as in such soils and situations it will produce a fine turf in a short time. It is very luxuriant, grows to a considerable height, and has in some sort the appearance of wheat or rye, having a broad blade or leaf.

All sorts of cattle are said to be fond of it whilst in the green growing state as well as in the state of hay.

It is very productive but coarse, and flowers late.—All the agriculturists and travellers of America concur in giving this grass the highest commendations, as being the chief support of cattle wherever meadows are found. From the inquiries made by Mr. Strickland at the request of the Board of Agriculture, it appears to be extensively cultivated on the middle and northern states of the American union: he has frequently seen extraordinary crops of it growing as thickly as it could stand on the ground 3 or 4 feet high, and in some instances as coarse as wheat-straw. In this state it is cut before maturity; and as the hay in America is always well cured, however succulent it may be, at the time of cutting, horses prefer it to every other kind of hay, and thrive better upon it. No other grasses approach it in produce, and it is stated to be particularly useful when mixed with red clover, in preventing it from falling too close to the ground. And since his return, by cultivating it in his garden he has ascertained it to be the same as the *cat's tail grass*; but he is doubtful whether, if it were cultivated in the field and should grow with American luxuriance, an English sun would be able to cure it with American perfection. It has however been said by Curtis that it

has no excellence that we are acquainted with, which the meadow fox tail does not possess in an equal degree. In the trials made by the Rev. Mr. Young of keeping it closely fed by sheep, upon a moist loam with a clayey marl bottom, the success was sufficiently encouraging to evince that it is deserving of attention; especially as its seeds may be easily procured in any quantity from America at the price of about one guinea per bushel; which, he observes, is enough, in conjunction with other grasses, for four or five acres of land. He thinks four pounds, the proportion per acre fixed by Rocque who first introduced it into this country, are much *too* little; and is of opinion that timothy is best adapted to moist loams, especially those of the peaty kinds. See *Phleum Pratense*, and *Grass*.

TINE, a tooth or spike placed in any implement, but especially in the harrow kind.

TINING, the act of setting an implement with tines or teeth. It also signifies the performing an operation with the implement; thus the giving two or three tinings, signifies the drawing a harrow twice or thrice over the same spot of ground. In this way we have also a *single* and *double tine or tining*.

TIPE, a trap or device for catching rabbits, &c.

TIT, a provincial term applied to a small horse.

TITHE, the proportion of produce, rent or goods which is paid to the clergy for executing the various duties or functions of religion; and which is usually a tenth part.

It has been observed to be the instruction of natural as well as revealed religion, that a portion of our property is due for the maintenance and support of the worship of God, and that "those who serve at the altar should live by the altar;" but that whether a special proportion of one tenth of our yearly income is due to the clergy by divine and unalterable right is a point that has been warmly agitated and much controverted.

Under the Jewish government, it is well known that tithes were directed to be paid by divine appointment. And it has been observed by Bishop Butler, that "under the Mosaic dispensation God himself assigned to the priests and Levites tithes and other possessions, and in these possessions they had a divine right; a property quite superior to all human laws, ecclesiastical as well as civil. But every donation to the Christian church is that a human donation and no more; and therefore cannot give a divine right, but such a right only as must be subject, in common with all other property, to the regulation of human laws."

How far the claim to tithes on the principle of divine right remains still established in Catholic countries, is not well known; but this sort of claim to tithes has long since ceased in this country. It is remarked by Mr. Donaldson that "the conduct of Henry VIII. of England and of Charles I. of Scotland furnishes indubitable proofs of their holding a different opinion; as these kings, on the abolition of popery, in place of transferring the tithes from the Roman Catholic clergy to their successors in office, assumed the right of granting the greatest part of them to the nobility and great laymen of the time, and in Scotland, in particular, with the burden only of reasonable stipends to the protestant clergy." And that "the grants of tithes made by these kings and their successors having been either directly or indirectly ratified by parliament, are now to all intents and purposes the property of the successors of these original grantees."

It is suggested by Gibbon that "tithes appear to have been common in all ages. The first Christian emperor Constantine the Great was very liberal to the church: and in the year 321, published an edict, granting his subjects full liberty to bequeath any extent of property they chose to the clergy. But this, in place of proving that a tenth of the produce was payable to the clergy in the early ages of Christianity, shows the direct contrary; — that the clergy, in place of having any legal right to tithes, were supported by charitable or gratuitous donations, and not by assessments made either under divine or human laws."

The period when the payment of tithes was established by law is noticed by Montesquieu, in his Spirit of Laws, who says, "no one questions but the clergy opened the Bible before Charlemagne's time, and preached the gifts and offerings of the Leviticus. But he dares say, before that prince's reign, though the tithes might have been preached up, they were never established." And Gibbon not only fixes this period but the reason of it also in the following manner; "the synod of Frankfort, held under Charlemagne in the year 794, furnished, says he, a cogent motive to pay the tithes. A capitulary (statute) was made in that synod; wherein it is said, that in the last famine the ears of corn were found to contain no seed, the infernal spirits having devoured it all; and that those spirits had been heard to reproach the people with not having paid tithes; in consequence of which it was ordained, that all those who were seised of church-lands should pay the tithes; and the next consequence was, the obligation extended to all."

After this brief statement of the origin of tithes, it may be necessary to inquire to what uses they were applied after a legal right to demand them had been obtained, and how far the clergy of the present day follow out in practice the principle on which they were originally made payable.

Mr. Donaldson remarks, that "in regard to the question, whether the tithes in England are now appropriated to the uses for which they were at first paid, whether voluntarily or by compulsion?—it will be necessary to go back to the first introduction of the tithing system in that country. Bede states, that about the year 597 Gregory the Great, then pope, sent a monk of the name of Austin into England, to propagate the gospel, and to introduce a system of church-government among the people. Austin having succeeded to the utmost of his wishes, and having received a grant of land from the then king of Kent, besides donations from private individuals for the support of himself and the priests whom he had brought along with him, he found

it necessary to apply to the pope for directions in regard to the manner in which these royal and private donations should be applied. Gregory solved the monk's question, by replying, that it was the custom of the church to divide such voluntary gifts as christians were pleased to bestow into four parts. To give one to the bishop, another to the inferior clergy, a third to the poor, and to set aside the fourth for erecting and upholding churches or places of worship."

And in confirmation of this, Blackstone has observed that "at the first establishment of parochial clergy the tithes of the parish were distributed in a fourfold division; one for the use of the bishop, another for maintaining the fabric of the church, a third for the poor, and the fourth to provide for the incumbent; but when the sees of the bishops became otherwise amply endowed, the bishops were prohibited from demanding their usual share of these tithes, and the division was in three parts only." And in considering "the state of tithes in the fourteenth century, he takes notice of an act of Richard II. enjoining the bishops to allocate a proper sum out of the tithes of each diocese for the sustenance of poor parishioners;" adding that "it seems the people were frequently sufferers by withholding of those alms for which, among other purposes, the payment of tithes was originally imposed."

The author of Modern Agriculture observes farther that "at what period the superior clergy of England first possessed themselves of the tithes, in defiance of the original destination, and of many statutes made to enforce an application of them to the uses for which they were first made payable, it is unnecessary to enquire. It will not be denied, he thinks, by the keenest stickler for the prerogatives of the church, that in place of one third of them being applied for the use of the officiating clergy, one third for the support of the poor, and the other third for the repairs of the churches, which, when the bishops had acquired land in mortmain, or free alms, sufficient to support their dignity, was the destination originally intended. The tithes payable in England are now very differently, although not so legally, appropriated. Those people, says he, who are most disposed to cry out, 'the church is in danger!' when the real or supposed rights of the clergy are invaded by the slightest attempt to alienate the tithes, ought to reflect that the third of all the tithes in England, whether in possession of the church or of the laity, ought to be allowed for the support of the poor; that another third ought to be expended in the repairs of the churches, the expense of which is now defrayed in almost every instance by an assessment on the parishioners; and that the other third ought to fall to the officiating clergymen, many of whom are the most miserable of the sons of men!"

But it is not, he adds, "intended to censure the present members of the church of England for alienations of rights that took place centuries ago, far less to insinuate that that respectable body have not an unquestionable right to the value of such a proportion of the produce of the soil as will enable them to fill the stations in which they are placed with dignity and honour."

The object here aimed at is "a succinct account of the particulars in which the payment of tithes in kind operates against the introduction of improvements in agriculture and the advancement of religion; and by showing the manner in which the alteration in the tithing system was effected in Scotland, to endeavour to point out a way in which the future payment of tithes in England may be arranged so as most effectually to promote the interests of agriculture, without in the smallest degree, infringing on the rights of the individuals concerned in paying or receiving them.

There are various ways in which the payment of tithes in kind operates unfavourably to the general advancement and prosperity of the husbandry of this country. It is indeed, according to Dr. Anderson, universally considered as a grievance, there being scarcely a Survey of a county in which it is not stated as an evil that ought to be removed. And this, the able writer thinks no wonder, as the drawing of tithes in kind, when it is examined with attention, will, he says, be found to operate directly, in the strictest sense of the word, as a tax upon industry; and to be at the same time more vexatious in the mode of collecting than perhaps any tax that has ever been adopted.

He conceives it a measure that has an unfavourable effect on four different descriptions of society, the farmer, the landholder, the clergyman or impropriator of the tithe, and the public.

In regard to the first or the farmer, he is more or less affected according to the differences of the circumstances and situation of his land. Mr. Donaldson considers it unfortunate, though certainly the case, "that the payment of tithes in kind operates more against the spirited improver than against the slovenly and indolent." And adds "that tithes, as the law now stands, cannot be considered so much the tenth of the natural produce of the soil, as a tenth of the capital employed by the farmer in its cultivation and improvement. For instance, says he, if a farmer pays his ploughman ten pounds a-year of wages, his labourer ten pence a day for his labour, or the landlord a hundred pounds of rent, he must consider himself as advancing one tenth part of these sums for the purpose of promoting the interest of the tithe-owner, who not only receives annually a sum equivalent to the tenth part of this capital, but that tenth part improved to the highest degree which the unremitting exertion of the tenant is able to effect. Mr. Locke, continues he, in his Treatise on Civil Government, says, "it is labour which puts the greatest part of the value upon land, without which it would scarcely be worth any thing. It is to that we owe the greatest part of all its useful products; for all that the produce of an acre of wheat is more worth than the produce of an acre of as good land which lies waste is the effect of labour." Hence, he thinks, the farmer not only furnishes a fund to purchase the necessary labour, whereby an acre of land is rendered so productive, as to afford six, or eight, or ten shillings per annum of clear revenue to the tithe-owner, which, but for the application of that labour,

would have remained unproductive for ever, in so far at least as he was concerned. So much is this, says he, he case, that if a farmer expends one hundred pounds on the purchase of manure, the improvement and cultivation of his farm, and the payment of rent, and if the value of the crop when sold amounts to one hundred and ten pounds, he is actually a loser to the extent of five pounds, or what may be the interest of 100*l.* for a year. He, indeed, gets his capital of 100*l.* returned, but the tithe-owner draws the ten pounds or rather more, or, which is the same thing, the value; so that the farmer has employed his capital to enable the tithe-owner to draw a dividend of ten per cent. on that capital: whereas had he lent it on mortgage, or placed it in the funds, he would have benefited himself and his family to the extent of the interest or the dividend which he, in either of these cases, would have himself received. So much, says he, for the absurdity of attempting to improve lands under such circumstances." And the able author of Essays on Rural Affairs, after stating different ways in which tithes operate against the tillage or corn farmer, strongly remarks that "in this country, besides commons and wastes, much very fine land is allowed to remain in grass in a very unproductive state which with a very moderate degree of industry and outlay of money upon it, might be made to yield abundant crops of corn: and the reason universally assigned for this disgraceful state of management (he calls it disgraceful, because, were it altered, even the grass land might be easily made twice as productive as it is, by a judicious use of the plough,) is, that the tithe of corn-land is so very heavy, as deters the farmer from having recourse to the plough: whereas in Scotland, where a corn-tithe is never drawn in kind, immense tracts of country, which thirty years ago were covered with heath, and totally unproductive even of grass itself, are now converted into fertile fields that yield abundant crops of corn and grass; and which, if the tithe-laws had there existed, must, in all probability, have continued unproductive till the end of time. This is a contrast that is very striking to every one who travels these countries; and it brings forward a practical fact, which ought, he thinks, to outweigh a million of speculative arguments."

It is further stated by the author of the Present State of Husbandry in Great Britain, that "another grievance to which farmers are subjected in the payment of tithes in kind arises from the harsh and oppressive manner in which the payments are exacted. The nature and extent of this grievance may, he says, be learned by a perusal of the following extract from his Report of Northamptonshire, where it is stated, that "it has happened, though, to the credit of the tithe-owners be it said, the instances are very rare, where, when the tithes have been let for the purpose of oppression, the tithing man has been known to exert that authority with which he was invested; and has not only taken the tenth shock of corn and the tenth cole of hay, but also the tenth lamb, pig, hen, egg, &c.; nay, has even gone into the garden, and taken not only the tenth part of the fruit, but also the tenth of the produce of the kitchen-garden. Under such circumstances as these, it may be asked who is the farmer that would not feel himself aggrieved?" From this it must appear, he thinks, obvious, that whether the farmer's interest or happiness be considered, it must be equally his desire, that some arrangement should be effected, whereby the payment of tithes in kind should be for ever abolished; for, as the writer of the Report of the County of Buckingham very justly observes, "it may be laid down as a proposition, that whatever profit arises to the cultivator of the soil, by the force of superior ingenuity and industry, should be held sacred by the church and government. If it be otherwise, it discourages the improvement of the soil; and thereby the church prevents the future increase of her tithes, and the government the future increase of its taxes."

It has been ably contended by Dr. Anderson, that though "the tithe-laws are hurtful to the farmer, they are perhaps still more so to the proprietor or landholder. Whatever checks, says he, the industry of the farmer, must, in a direct manner, diminish the income of the landlord; and as the energy of a farmer, when once excited, is well known to augment in proportion to the advances he has made, whatever checks that energy in the bud, occasions in time a diminution of income to the proprietor, much greater than can easily be conceived." And that, as he supposes "the proportion of rent which can be afforded for arable land, increases with the productiveness of that land in a much higher degree than in the ratio of the quantum of the crop; whatever tends to render land permanently more productive than before, if no deduction be made from it, tends, at the same time, to augment the income of the proprietor in a still higher degree than that of its produce. But as it is obvious, that the tithe operates as a dead bar to the commencing improvements in agriculture upon a soil of no great degree of fertility, so as to prevent the beginning of that motion, from the acceleration of which alone the proprietor can hope to derive considerable increase of rent; in all cases, his rent is diminished in a much higher ratio than one tenth, as it might seem to do by those who take only a slight view of the matter." He adds that, "should the proprietor of poor lands, seeing the impossibility of the tenants improving them, attempt to render these more permanently fertile by the outlay of stock upon it, that he never expected to draw back; but would content himself with a reasonable return of interest of the capital in name of rent, he would not find the case much altered. He sets out, we shall, says the doctor, suppose with this principle, that if he can secure a permanent rent, equal to five per cent. of the money expended upon it, he will be very well satisfied with it. Let us say, then, that twelve bushels was the neat expence of culture, &c. which, on an average of all sorts of corn, was valued at 4*s.* per bushel; and that he had expended 20*l.* per acre, the interest of which at five per cent. is twenty shillings, or in other words, five bushels. But before he

can draw this rent free of tithe, the average produce must be, at least, eighteen bushels, out of which must be taken one bushel and nine tenths; so that instead of five, his rent will be reduced to three per cent. nearly; while the tithe-owner will be entitled to draw nearly two per cent. for ever, on the capital the improver had thus expended. It is needless to add, that under such circumstances it is vain to look for a general spirit of agriculture, either among proprietors or tenants, to both of which descriptions of men, the operation of the tithe laws are, he contends, highly oppressive."

And he states another instance of very material importance, in which "tithe becomes singularly pernicious to proprietors of land. The importance of preserving the whole produce of the ground upon the farm where it was reared, for the purpose of making dung, seems, says he, to be very generally understood; as he finds a clause to that effect is universally inserted in the leases in every county of England, wherever leases are granted at all. What punishment would, he asks, the proprietors of these lands deem adequate to the crime of selling off the whole produce of the farm every tenth year? Yet great as this crime would be, it would not be adequate, in point of damage, to them, to the right of drawing tithe in kind from their arable lands; because the farmer who sold the produce, would at least become possessed of money to replace, in some degree, by means of extraneous manures, the loss he had incurred by the abstraction of the home-dung. Those who are intitled to draw the tithe in kind, are, in fact, by this means, vested with a power of enriching their own private property, if they be so inclined, at the expence of every other proprietor around them. In this point of view, therefore, tithes are singularly pernicious to proprietors of land." This is certainly an objection to the drawing of tithes in kind that can never be got over by any of the sticklers for the tithing system. It strikes at the very vitals of all our improvements in husbandry.

The writer of the Present State of Husbandry considers that as the spirit of improvement is depressed and checked, the land-holder must be injured; and that as there are no regulations or laws existing in this county which have such a tendency to impede the introduction of new or improved modes of husbandry as those of exacting the payment of tithes in kind, there are, of course none that operate so decidedly against the landed interest of the kingdom. If, says he, the farmer be restrained from inclosing, draining, purchasing manure, in short, from cultivating and improving his land to the highest degree, who will deny that the interest of the owner is affected? And that this is the case in a variety of instances, from the operation of the tithe laws, is admitted by every one who is perfectly acquainted with the present state of agriculture in the country.

In regard to the impropriators of tithes, it may be observed that if the interests of religion and the clergy be considered, it will be found that the system of taking tithes in kind is equally productive of bad consequences. It will be discovered to disturb the harmony of society, and to be often the means of creating such disputes and divisions between the clergyman and his parishioners as renders the religious instructions of the former of little avail. Among the many instances which might be mentioned of the teasing and vexations circumstances of this nature that occur to disturb the harmony that ought to subsist between the clergyman and his parishioners, the following, from the Report on Agriculture of the County of Hampshire, may be sufficient. In this case the "clergyman and the farmer were at variance; and the farmer, determined to be even with the clergyman, gave him notice that he was going to draw a field of turnips on a certain day. The clergyman accordingly sent his team and servant at the time appointed, when the farmer drew ten turnips, and desired the other to take one of them; saying, he should not draw any more that day, but would let him know when he did."

And in a political view it is injurious, as tending to loosen that chain of intercourse and connection which it is considered of so much importance to keep united. The interest of the clergy would also be greatly promoted, were they to receive an equitable compensation for their tithes, in place of drawing them in kind, or of making annual arrangements with the farmers.

But it is the lay proprietors that are most blameable in respect to the rigorous manner in which the tithes are collected. Mr. Donaldson says, that "clergymen, who act up to the character in which they stand in the scale of society (and the most violent declaimer against them will not pretend that a very great majority of that respectable body do not so) very generally sacrifice so great a portion of their just demands for the sake of peace and quiet, that, if the expense of collecting be added, there is scarcely any composition that can be proposed which it would not be for their interest to accept. Some instances there no doubt are, he adds, where the clergyman, being of a turbulent avaricious disposition, lays hold of every advantage, and collects his tithes to the value of the uttermost farthing: but it ought to be remembered, that a clergyman who does so, nay, that a clergyman who submits to the drudgery of collecting tithes in kind, must lose, in the opinion of the parishioners, a great share of that respectability of character which it is his indispensable duty to support and keep up."

And in regard to the *public*, the effect which this injudicious regulation has, is equally prejudicial and mischievous. It comes in, the author of Modern Agriculture says, "for its share of the loss arising from the effect which the tithe-laws have on the husbandry of the country, as, by their operation, the quantity of corn that might be cultivated, did no such laws exist, is diminished to an immense degree," and other branches of the art are greatly impeded. "Besides, they check industry, by depressing the farmer's spirit, and by preventing the circulation of money that would be expended in improvements and

in the purchase of the manufactures of the country. Were no such laws in force, the proprietors and farmers, in consequence of the success of the improvements which in that event would be undertaken, would be enabled to purchase more of the manufactures of the country, pay a greater share of taxes for the support of the state, and after all live in greater ease and comfort than under the existing circumstances they are able to do. In short, he considers the abolition of these laws as the only measure that can be adopted with any probability of success, at least the one that ought first to be attended to, with a view of again bringing the corn-trade to turn once more in favour of this country."

It is added that "when all these various circumstances are conjoined, and when it is further considered that, except in Spain and Portugal, there is scarcely a civilized nation in the world where this system of church-slavery is allowed to exist, and that even in Russia tithes are abolished, it may be reasonably hoped the period is not far distant when England will be relieved by legal and constitutional means, and in consequence of arrangements made on liberal principles, from this almost Egyptian bondage."

And further that "it appears, from the accounts given by several writers on the subject of tithes, that they were paid in the latter ages of the Romish church with great reluctance." And even in this country during the reign of Henry the eighth.

Therefore, says the writer, "if, when improvements in agriculture were in their infancy, and at a period too when men's minds were held in slavish servitude by the clergy, the payment of tithes in kind could hardly be enforced, can it be supposed wonderful, that in these enlightened days it should be considered as a grievance? At a period when the principles of religion and of real genuine liberty are better ascertained, and more generally known, than in any former age, it is not surprising that laws compelling the payment of tithes in kind, laws which originated in edicts issued by bigoted kings under the influence of designing priests, should now be found inimical to the best interests of the country, and to the happiness of so many thousands. That this is the case, every inhabitant of this island has ample opportunities of satisfying himself by a perusal of the Reports of the different Counties in England and Wales, as published under the direction of the Board of Agriculture." And as these Reports, after having been circulated among the proprietors and farmers for their correction and amendment, still contain, in their republication, the same or similar complaints in respect to the hardships which the farmers are subjected to, and the injury which agriculture sustains, by the continuance of the payment of tithes in kind, such complaints may justly be deemed the voice of the people proclaimed in a constitutional way; and as such merit the most serious and speedy attention of the legislature and of the clergy.

Some of the injurious effects of the system of paying of tithes in kind have been shown above, and other hardships arising from it have been noticed in the different Surveys just mentioned.

And the necessity of something effectual being done, in order to the removal of this inconvenient and oppressive regulation, has been strongly shown by the writings of Mr. Young, the able, persevering and veteran advocate of the improvement of British husbandry, as well as many other intelligent writers on the subject.

As therefore a reform in the mode of paying tithes in this country, must be admitted as indispensably necessary, it is to be wished that the legislature would devote that attention to the subject which its importance demands, and the clergy come forward with reasonable propositions for an adjustment of the business, as by those means the matter might, and no doubt would soon be settled to the satisfaction of all the parties concerned.

In order to show the means of best effecting this important alteration, Mr. Donaldson takes the following view of the present arrangement in respect to tithes in Scotland, and the circumstances that led to it. On the authority of Mr. Erskine, as stated in his Institutes of the Law of Scotland, he says, "the payment of tithes in kind, was continued for many ages in that kingdom; and, owing to the precariousness of the climate, was attended with more grievous hardships than could have taken place in the southern part of the island. Every Scotch proprietor or farmer who presumed, after reaping their corns, to carry off any part of them from the field, till the person having right to the tithe had drawn his share, were, from the first establishment of this right, subjected to severe penalties. The tithe-owner, on the other hand, either from indolence, a desire to oppress, or with a view of compelling the proprietor or farmer to purchase his tithes annually at a high price, frequently delayed drawing his share till great part of the crop was rotten. Notwithstanding several statutes were enacted with a view of checking the oppressive disposition which so often evinced itself in the conduct of the clergy in this respect, yet these grievances continued to exist, more or less, till the year 1633; when a decree-arbitral, passed by Charles I. in 1629, for arranging and determining a mode, to be afterwards adopted, for the payment of tithes, was ratified by parliament.

"During the struggle for the establishment of this or that form of church government, great alterations had taken place, both in regard to those having right to the tithes, as well as in the manner in which they were exacted. On the Reformation, the benefices of the church fell to the crown, and were, at different periods, gifted for services, or other considerations; such as, for supporting universities, hospitals, &c. And the persons obtaining them were denominated lords of erection, and sometimes titulars of the tithes. They also got, or assumed, the right of nominating officiating clergy on all vacancies.—These alienations were, by act of parliament, 1587, put a stop to, and such tithes as had not been previously disposed of remained with the crown unalienably.

"The tithes which were then annexed to the crown may be valued and leased by the proprietor of

the lands, but cannot be purchased. The officers of the crown are in use to grant leases of this description of tithes for nineteen years, and which are renewed as matters of course on paying a reasonable sum on such renewal. The sum demanded is regulated by the yearly value of the tithes; so that a capital, equal to between five and six years amount of the tithes, laid out at the commencement of the lease, and improved by compound interest, is sufficient to produce such a sum at the expiry as will obtain renewals to perpetuity.

"Some of the clergy remained in possession of their benefices after the Reformation; and the vacancies that happened in such benefices were filled up by those who assumed the right of presentation. An act of parliament was soon afterwards passed, whereby the patrons were deprived of the right of patronage: but in compensation for this supposed hardship, it was enacted, that the right of all tithes, so possessed by the clergy, should be vested in those who had exercised the right of patronage. Patrons having acquired tithes in this way, are compelled by law to sell them at nine years purchase of the yearly value of the tithes.

"The system of tithes and tithing having got into great confusion in consequence of the various alterations that took place in the government of the church of Scotland, those interested found it necessary to submit their several rights and claims to the determination and final award of Charles I. who, on the 2d of September, 1629, pronounced two decrees-arbitral, or judgments, which laid the foundation of that arrangement, respecting tithes and the payment of the established clergy in Scotland, which has been productive of so many good consequences.

"The most important article in these two decrees-arbitral, is that which directs the valuation and sale of tithes; after which the landholder is entitled to the whole crop upon payment to the proprietor of the tithes of a yearly rent, or to purchase them at an easy rate, subject to a reasonable provision to the clergy. The words of this famous decree are, that "*The rate of all tithes, where they are valued jointly with the stock, shall be a fifth part of the constant yearly rent that is paid for the lands.*" Another material circumstance in the valuation of tithes in Scotland is, he says, that the rents of mills, those arising from recent improvements, and some others of less importance, are deducted from the gross amount.

"By these decrees, which were ratified in parliament in 1633, the proprietors of land, not having right to the tithes, were not only found entitled to sue the titular in an action at law to ascertain their value, but, unless vested in the crown, to obtain a purchase of them on established terms, as before mentioned. Thus, ever since 1633, every landholder in Scotland has had it in his power to acquire right to his own tithes, either by purchase or lease, so that they should be no longer payable in kind. Nevertheless, those who neglect to sue for a valuation may still be subjected to all the inconveniences of the former law; as, under such circumstances, those having right to the tithes may draw them in the manner commonly practised in England. The remedy, however, is so easy, that he must be a fool indeed who would subject himself or his tenants to such a slavish servitude, while he has it in his power, by a simple application to the supreme court of the country, to abolish it for ever."

He, however, "recollects some instances where proprietors in the north of Scotland, having also right to the tithes, and being unwilling to forego all the power of harassing their tenants, which attached itself to the ancient feudal barons, still continued to draw the tithes. But they at last became ashamed of such conduct; and there is not now one instance where tithes are paid in kind, or where the tenants have any concern, either directly or indirectly, in the payment of tithes on the north side of the Tweed." How then, it may be asked, are the Scotch clergy provided for? "The answer is easy; the stipends provided by law for the maintenance of the Scotch clergy are still payable out of the tithes. The judges of the court of session, who act as commissioners for the arrangement of tithes, have right to modify reasonable stipends to the parochial clergy. And accordingly in all such cases, where the clergyman can show 'that the parish is a place of more than ordinary resort, that the cure is burdensome, or that the necessaries of life give a high price in that part of the country, or that the scanty allowance of stipend in that parish bears too small a proportion to the weight of the charge,' provided there are free and unappropriated tithes in the parish, the commissioners, on the application of the clergyman, grant an additional stipend either in money, but more generally, where practicable, in grain, as being less fluctuating in value than money." But "owing to the free tithe in the parish having been previously assigned to the clergyman, some instances do occur, where the commissioners have it not in their power to augment his stipend, although too small for the decent maintenance of a numerous family. In all such cases it would, Mr. Donaldson says, be highly proper to apply part of the bishop's tithes, such as are now payable to the crown, for the purpose of rendering the situation of these clergymen, who are so unfortunately situated, more decent and respectable."

In order to the introduction of a suitable arrangement in regard to tythes in this country, the same writer remarks that the question "has been for some time very popular and much agitated; and many difficulties have been invented, seemingly for the purpose of rendering it still more perplexed and complicated. Holding it as a sacred inviolable principle, that tithes, as now payable in England, were formerly appropriated for particular purposes, and although in many instances alienations were made at different periods; yet as these are expressly or virtually confirmed by those laws which protect national and individual property, therefore tithes, as now payable in the southern part of the island, are payable in conformity to the laws of the country. This being granted, no man that has a regard for justice, that venerates the constitution, or that would wish to see the rights of property invaded, but must be

satisfied, that if the present mode of paying tithes is abolished, the clergy and the lay proprietors of tithes are, in law, justice, and equity, entitled to an equivalent. What that equivalent ought to be, and in what manner ascertained, becomes the question."

It is not, the writer observes, "by appeals to quarter-sessions, nor by special acts of parliament for this or that particular diocese or parish, that this great national question can be determined with propriety: it is only by a submission of all rights and claims of both parties to the determination of one respectable individual that the matter can be amicably or equitably determined." And he thinks the most proper person to be made choice of is the sovereign of the country.

"The clergy, says he, need not be afraid to appeal to such an arbiter, as in the course of a long reign, he has in no instance or degree infringed upon their rights. The landholders and lay tithe-owners may keep their minds at ease, as though he has evinced the most sacred regard for religion, yet it has been divested of superstition or bigotry. If, continues he, Charles I. during the anarchy of church-government that prevailed in his time, found no difficulty in passing a decree in a similar case, which, having received the sanction of parliament as a matter of course, laid the foundation for a just and equitable arrangement of tithes, the matter may unquestionably be accomplished with much less difficulty at the present period."

The probable consequences of such a submission, would, he thinks, be, that the "arbiter would no doubt appoint commissioners to ascertain the yearly value of all the landed property in England, the produce of which was subject to the payment of tithes.

"Were the yearly value of the lands ascertained by a corn-rent in place of one in money, and which might be easily done by taking the average price of corn for the last seven or ten years (excluding, however, 1795), the clergy could sustain no loss, nor would after valuations in consequence of the depreciation in the value of money, be rendered necessary.

"This being done, a fifth, a sixth, or any given portion of the free rent, after the payment of parliamentary taxes affecting land, would be declared due to the tithe owner in lieu of the payment of tithes in kind. One clause of the decree would probably be, to compel every lay-owner of tithes to sell his right to the landholder, at a fair and equitable, but regulated price; and another would be, declaring the clergy entitled for ever to a fifth or sixth, or some determinate portion, of the present real free rent of all titheable lands to which they had right, and subjecting the proprietors to the regular payment thereof. Thus, says he, at once, would a load which has for many ages pressed down the spirit of the English farmers, be removed, and while all ranks and degrees must applaud the equity and the propriety of the arrangement, a spirit for agricultural improvements would evince itself superior, he thinks, to any of which the records of this country make mention."

"It is supposed that this mode is the less exceptionable, as it is almost similar to that adopted when acts of parliament are passed for enclosing particular parishes. At the first meeting of the commissioners named in the act they direct, that all having interest may deliver in their claims, and the rights on which they claim, against a certain day. Those being afterwards examined by the commissioners (who are neither more or less than arbiters appointed by the legislature), their decision constitutes the law in regard to the right by which the individual proprietors hold the lands, which by the arbiter's award is assigned to them. In place, therefore, of multiplying acts of parliament respecting the adjustment of tithes *ad infinitum*, one only, and that a very short one, seems necessary, authorising his majesty to arbitrate between the owners of the tithes and the landholders; and whose award, like that of the commissioners appointed under acts of parliament for enclosures, should be final, and have the effect of law. Having laid down the general principle, it will not be expected that any attempt will be made to combat the little difficulties that may be started against the practicability of carrying the measures founded thereon into effect. These the wisdom of the arbiter is fully sufficient to obviate. One thing is certain, viz. that a decree-arbitral, pronounced by such high authority and founded on these principles, would give universal satisfaction to every party concerned."

On so interesting a subject to the British farmer, it may not be improper to bring forward a few other plans for effecting this business.

An intelligent writer, Doctor Anderson, has supposed that "the tithes in England and Wales should be converted, so as to make a payment in money be universally received in lieu of the payments in kind that are exigeable at present; but under such modifications as to prevent the possibility of those who are entitled to draw the tithes from suffering, by that depreciation in the value of money, which we have seen for a long time past has been going on in a regular progression; and may be expected to continue; or may, perhaps, as at this time in France, be sunk almost to nothing by some political shock that cannot at present be foreseen. With these views, might not, he asks, a law be obtained, authorising the valuation of tithes, in every case where either of the parties interested in it should so incline? This might be done by a summons raised against all the parties concerned, either before the sheriff of the county where the property lay, or before any other judge that should be thought more proper for executing this office; who, after hearing parties, should proceed to make a legal inquest to obtain a clear proof of what had been the amount of the tithes, actually paid and drawn, for five, ten, or twenty years past, as should be judged best, out of the several lands in question; specifying distinctly the quantity of each denomination of grain, or other titheable produce. But as it may easily be foreseen, that it would be a matter of great difficulty, in many cases, to get at these facts with precision, might it not be put in the power of the judge, if the parties could not agree as to that particular, to appoint two or more persons of good

character in the neighbourhood, to gather up the tithes in kind themselves, fairly and honestly, for five years next to come, without favour to any person; the amount to be delivered to the person having a right to receive them, after the quantities had been respectively ascertained, so as to admit of the collectors making up an account of the whole, upon oath, to be delivered to the judge; who, from that account so made up, should cause an average to be struck of the quantities of each particular article; which average quantities, after deducting a just proportion for the expense of collecting, and taxes affecting the tithe, should be declared by him to be the legal tithe exigeable from the lands in question in all time to come. But as there is room to suspect, that the money prices of corn, wool, &c. of different denominations, may rise to be much higher in some future period than it is at present; instead of now ascertaining the price of these articles, let it be declared, that the quantities of grain and other articles resulting from the averages respectively are payable out of the respective lands, leaving the average prices of such grain, &c. to be ascertained each year, as shall be specified below; declaring that the money which shall arise from the average prices thus ascertained, should be in lieu of the whole tithe that could be exacted each year; the time of payment to be specified. And to prevent all disputes as to the average prices of these articles, in time to come, let the sheriff of each county be authorised and required to make an inquest at Candlemas or Lady-day each year of what had been the actual ready money selling price of corn of the preceding year's crop, from the time the corns were reaped, till the present time, and of wool, and all other titheable articles for the preceding year, by examining witnesses before a jury to be appointed for that purpose, which prices, after being thus ascertained, should be published, and declared to be those by which the quantity of tithe corn of each particular description, and other titheable articles, contained in any degree of valuation, should be payable for the crop of the preceding year. Thus would the tithe-owner be entitled to receive payment of his tithe, without any extraordinary expense or trouble, or unjust deduction or dispute whatever: the farmer would be allowed to carry on his operations uncramped by those galling restraints which the tithe-laws at present perpetually throw in his way. The proprietor would be at liberty to apply such part of his capital as he might incline, towards promoting agricultural improvements, with a reasonable prospect of being benefited by his exertion; and the public would become possessed of a quantity of surplus produce of land, which it can have no prospect of ever otherwise enjoying, which would be the means of diffusing a perpetual plenty through every corner of the land."

The following observations and plan are given by the Reverend Mr. Duncomb in his useful Report of the State of Agriculture for the County of Hereford. It is stated, that of "the various modes proposed to effect the desirable object of a general commutation of tithes, that of a corn-rent seems to have met with less objection than most others which have yet been proposed; still, however, nothing has been seriously attempted, and the subject remains open to further discussion.

"It has not, perhaps, occurred to every one, that tithes in their present form, have a direct and powerful tendency towards increasing the prices of wheat and every other grain, by creating obstacles to its culture, and thus diminishing the quantity which would otherwise be grown. But the single fact, that an acre of land under the culture of wheat, is liable to a deduction on account of tithe, in nearly a ten-fold proportion to an acre of land grazed by cattle or sheep, is surely sufficient evidence that tithes must operate unfavourably to the culture of grain, and consequently to its abundance and cheapness. How desirable then is such a commutation as would render this payment equally heavy on every acre of land according to its value, whether it be applied to the culture of grain, or to the production of animal food! Under this impression, it is now proposed, that in lieu of tithe, a tax be imposed (on the principle of an equal land tax), on every estate, according to its value, for the support of the clergy. The wisdom of parliament would easily determine how many shillings in every pound of rent would be equal to the revenues to which the clergy have a claim, and the measure would be much facilitated by the investigations occasioned by the income or property act now in force. The tenant might be made liable in the first instance to the payment of the duty proposed as a substitute for the tithe, but in case of his defalcation, the landlord might be made ultimately responsible.

"By this plan, the clergy, it is supposed, would receive (as is their due) a full equivalent for tithe in its present state; the security would still attach to the soil itself; and their revenues would still increase with the increase of the value of land, and its produce. Encouragement would thus be afforded to increase the culture of grain, the industrious farmer would not have to contribute more than his just proportion; the tithe owners would also obtain the fair value of their property; the clergy of the church of England would acquire that degree of respect and esteem, to which few will deny that they are, in the aggregate, entitled; and above all, they would be enabled to fulfil the valuable purposes of their institution: whilst at present, the clergyman who demands but the fair value of his property, becomes hated, and often insulted; and to use the emphatic and elegant language of Mr. Knight, "his integrity becomes suspected; his every action is seen through a false medium; and the pastor is lost in the collector of tithes!" If it be objected, that under this, or any other plan of commutation, the farmer would not eventually be benefited, because the landlord would then receive what is now paid to the tithe owner; and that the farmer has no just ground of complaint, because he engaged his farm subject to the deduction of tithes: let it be understood that the interest of the community at large not that of any one branch of it, is here contended for

"The great object of a commutation, beyond a religious view of it, is, the writer says, to relieve the corn field, and not the farmer. Perhaps, if the subject be well considered, the farmer would gain less in a commutation, than any one class of society. Tithes, in their present form, may check his improvements, may contract his system and his capital, may harass his mind, and lead to personal animosities and expensive litigations; but probably his mere payments in lieu of tithe, would on the whole be as heavy under any commutation, as those to which he is now liable. The public must give that price for grain, at which it will answer the farmer to raise it; and supposing it possible that the farmers throughout the island were to engage in a combination, to convert so much of their present tillage into pasture, as would leave only half the usual number of acres under corn, the inevitable consequence would be, that grain would sell at an enormous price, and the farmer would receive that increase price, at a time when his expenses were diminished in the proportion of his tillage. Thus the consumer (that is the public) and not the farmer, would suffer; and if a tax, such as tithes, added to the increased price of timber, iron-work, and labour, should induce the farmer gradually but materially to contract his tillage, there could be no hope that grain would be sold during any considerable period at a moderate price; nor could there be an adequate supply for the wants of the country, without the aid of large importations, which are always precarious, and sometimes impossible: and as animal food invariably rises in value with the increased value of corn, the farmer might thus be enriched at the expense of every other branch of the community.

"The plan here proposed for a commutation would, it is presumed, counteract or prevent these serious evils; encouragement would be given to an extended culture of grain; and a new motive to industry and exertion would be found in the consideration, that the most indolent farmer must contribute an equal sum with the most active and successful cultivator."

And the writer of the excellent Survey of the County of Stafford suggests that "the subsequent plan should be adopted as the outline of an exchange of tithes for land, as land will always bear a value proportioned to that of its produce, and even the price or value of labour is measured by the same standard. It is that an act of parliament appoint, in every diocese, an equal number of the most respectable clergy and country gentlemen, commissioners and trustees, with a power of nominating surveyors, to value all the tithes belonging either to the clergy or laity within the diocese; and let the act give an option to the land-owners of purchasing their respective tithes, as the valuation fixed on them by such surveyors; the money arising from such redemption might be invested in the funds, or other securities, until a proper opportunity should offer of laying it out in land, and where the land-owners should refuse to purchase such tithes, the commissioners might have the power of mortgaging them, or taking up money on their security, to be invested in the same way, with that arising from tithes, actually sold; or after a given time the trustees might be empowered to set apart an allotment of the land of those owners who refuse to purchase, and which if conveniently situated for the former tithe owner, might be so applied, otherwise sold; and the money arising from such sale invested as before until it could be laid out in the purchase of land. The execution of some such plan would be attended with infinitely less trouble and expense, than that now incurred by the annual valuation of tithes, as should the proposed regulation be once effected, the business would be settled for ever: but under the present system, the surveyor or valuer's business is continued from year to year; and if that system should continue, will be from generation to generation. An equivalent in land, must certainly be a more solid property than tithes. Land may be improved in any degree, by good management and industry; tithes fluctuate or sink in value at the will of the cultivator. He thinks some such commutation as this may be easily effected, and that all parties would be pleased with the alteration."

There cannot be any doubt but that much advantage and improvement would accrue to agriculture, from some measure of this nature being adopted and carried into execution; and though the farmer, on the whole, might not perhaps experience any diminution in the sum which he would have to pay, he would be wholly freed from the trouble and vexation which constantly attends the taking of tithes in kind, and at the same time be left at full liberty to exert his utmost endeavours to promote all sorts of improvements that the nature of his farm will with propriety admit. And thus agriculture would be carried forward to a state of improvement that cannot at present be conceived. Such a measure might also have a considerable effect in promoting the inclosure and cultivation of much land at present in the disgraceful state of waste, which are desirable objects in the present state of the country on various accounts.

TOBACCO, a plant of the herbaceous annual kind, which would probably be capable of being cultivated in this country with advantage, if it were not prohibited.

The sort that has been introduced here in the small attempts that have been made, was mostly, according to Mr. Marshall, the common or English tobacco, *(nicotiana rustica)* which has the stalk seldom rising more than three feet in height; the leaves are smooth and alternate, upon short foot stalks: the flowers are in small loose bunches on the tops of the stalks, and of an herbaceous yellow colour, making their appearance in July. It is termed English tobacco, from its having been the first introduced here, and being much more hardy in its nature than the other kinds.

It is probable, however, that the Virginian sort *(nicotiana tabacum)* which rises to a much greater height in the stem, might also be cultivated in this climate, especially in the southern districts.

In the culture of this sort of crop, a seed bed

should be prepared in the early spring, and made as fine and rich as possible.

Some good fresh seed should then be procured from the seed shops or some other place, and when the weather becomes fine, warm and settled in April it should be sown over the bed in an even regular manner, being lightly covered in. When the plants appear they should be kept free from weeds and properly thinned, so as not to draw up weak, and when they have acquired sufficient growth, be set out where they are to grow, moist weather being chosen for the operation.

For this purpose, the ground should be made perfectly fine by due preparation, and well enriched with manure of the well rotted horse kind.

The method stated by Mr. Marshall in his Rural Economy of Yorkshire, as practised in that district in 1782, was this:

"When the seedling plants were strong enough to bear removing, they were transplanted from the seed-bed to the patch on which they were intended to stand. Being in the practice of one, planted out in the quincunx manner, a foot asunder: in that of another, in rows two feet apart, and one foot asunder in the rows."

But Mr. Parkinson says that they should be set out in the manner of cabbages, but about three feet asunder, which admits of a sufficient quantity of earth or mould being drawn up about the roots of the plants.

"In the two first cases they were carefully hoed, and kept free from weeds, Mr. Marshall says, during the summer.

"In autumn, when the flowers began to drop off, they were cut and dried in the shade." And "when dry, the leaves were picked off, and pressed down close, in casks or other vessels."

It is added that "the spring of 1782 being late, the plants did not, upon weak soils, reach maturity before the frosts began to set in. Hence a rich forcing soil seems, he thinks, to be necessary to the culture of tobacco, in this climate." But "the vegetation may be greatly forwarded by forcing the seedling plants in a hot-bed, and transplanting them out as soon as the frosts of spring are over."

According to the writer just mentioned, "this plant was much cultivated for a few years prior to the year 1782, in the vale of York, about Stillington and Sutton, and also, in a less degree in Ryedale." But that "in this last district it did not excite the notice of legal authority: in the richer parts of the vale, where the greatest quantity was raised, it was cured and manufactured by a man who had formerly been employed upon the tobacco plantations in America; and who not only cured it properly, but gave it the proper cut, and finally prepared it for the pipe." However, "in the vale of York, the cultivators of it, he says, met with less favourable circumstances. Their tobacco was publicly burnt, and themselves severely fined and imprisoned. Penalties, it was said, were laid to the amount of thirty thousand pounds. The penalty, he believes, is 10l. a rod, or 1600l. an acre."

It is added that "this was enough to put a stop to the illegal cultivation of tobacco. But, perhaps rather unfortunately, it has likewise put a stop to the cultivation of that limited quantity which the law allows to be planted for the purposes of 'physic and surgery." And "the quantity of land allowed to be cultivated for these purposes is, he believes, *half a rod*, which is somewhat more than *fifteen square yards* of ground; a patch of ground sufficient, under proper management, to raise tobacco enough for all the medicinal purposes of a farm-house; in which it is, on many occasions, useful. In cutaneous disorders of cattle and sheep, it is universally applied."

It is stated that "since that time it does not appear that any attempts have been made at the cultivation of tobacco. The people, paying obedience to laws passed many ages gone to encourage our tobacco plantations in America, have ceased to cultivate a plant to which our climate seems well adapted, and of which it might now be good policy to promote the cultivation, as we have long since lost the colonies, for the encouragement of which such rigorous laws were enacted, and which now stand on our books the instruments of persecution to the ignorant or unwary, and no longer of supposed public utility."

It is remarked in the Mid Lothian Survey on Agriculture, that this plant "was cultivated in different parts of that county about 15 years ago; but in consequence of an act of parliament prohibiting the culture, it was of course given up. It was propagated with ease, grew luxuriantly, and seemed, indeed, to be congenial with both the climate and the soil, and from the mode of culture, (in drills, hand-hoed and horse-hoed,) had the appearance of being as good a preparative for a crop of wheat as any crop known in this country. There seemed to be one objection alone, to the cultivation of this foliaceous, meliorating plant, that the leaves (the object of culture) were dried with difficulty, owing to the general moistness which prevails at the season of the year (September) in which they were picked; but which, from the inventive and enterprising spirit of our people, might have been obviated had it been left to its natural course."

And in the Report of the State of Agriculture in the County of Perth it is observed that "the culture of tobacco was introduced into that neighbourhood, and probably into other parts of the county, during the latter end of the war with America. It became so dear, says the writer, when our trade with that country was interrupted, that we resolved to try what could be done to supply our demands, by raising it at home.—The habit of using tobacco is like all our other luxurious gratifications, which become more inveterate by indulgence, while the pleasure arising from the sensations they afford, is diminishing every day. He raised, he says, tobacco about that period eighteen inches long in the leaf, and twelve inches broad. But an act of parliament, prohibiting its cultivation, soon put an end to all their experiments relative to the plant."

These statements plainly show that the plant is capable of being grown with advantage in this climate.

The method of curing the leaves in the regular plantations in America is this: "when they are fit for cutting, which is known by the brittleness of the leaves, they are cut with a knife close to the ground; and after laying some time, are carried to the drying shed or house, where the plants are hung up by pairs upon lines, leaving a space between that they may not touch one another. In this state they may remain to sweat and dry. When perfectly dry the leaves are stripped from the stalks, and made into small bundles tied with one of the leaves. These bundles are laid in heaps and covered with blankets. Care is taken not to over-heat, for which reason the heaps are laid open to the air from time to time, and spread abroad. This operation is repeated till no more heat is perceived in the heaps, and the tobacco is then stowed in casks for exportation." But "in China, where the use of tobacco both in snuff and for smoking is very general, buildings are not thought necessary according to Sir George Staunton, as they are in the West Indies, for curing it; there being little apprehension of rain to injure the leaves when plucked. They are hung on cords to dry without any shelter upon the spot in which they grew."

Tobacco-*Water*, the name of a liquor prepared by infusing tobacco in water. Or a better mode of preparing it is by boiling one pound of tobacco in two gallons of strong brine, adding after the liquor has become cool about three ounces of the oil of turpentine. It is likewise sometimes the practice to dissolve fifteen or twenty grains or more of sublimate or muriated quick-silver in the turpentine, and add it to the mixture.

It is a powerful remedy in various cases of the scab kind, in sheep and probably in other animals.

TOD, the name of a certain quantity of wool, but which varies in different districts. The standard tod is twenty-eight pounds.

TOE, in brute animals, the extreme fore part of the foot. The same portion of any thing attached to the foot acquires the same name from its relation. Thus we not only speak of the toe of the foot, and toe of the hoof, in the horse, but also of the toe of the shoe. The point of the frog is also called the toe of the frog.

Toe-*Stick*, the name of the stick or bar which confines that part of carts, which contains the substance conveyed in its place, while drawing, but which on being slipped out, lets the load out. It is of much utility in dung and other carts used for similar purposes. It is observed by Mr. Young in his valuable Survey of Norfolk that "Mr. Overman, of Burnham, made an improvement in his carts, of beautiful simplicity: instead of the toe-stick, as in the common, drawing out to let the buck tilt up, and deliver the load, it turns in the centre on a pivot, and the hooks which confine it at the ends, being each in a position the reverse of the other." This is formed as shown at *fig.* 8, in *Plate* on waggons.

TOOL, the name of an implement of any kind employed in farm labour. It is a matter of great consequence to the farmer to have such tools as are perfectly adapted to the sort of culture which he pursues, as without this he must sustain great inconvenience, and even loss on many occasions.

As it may be necessary for the young farmer to consider well, before he enters upon his farm, the expense of the different tools or other machinery that may be requisite in its cultivation, we shall here introduce a small list of some of the more useful articles of this kind with the prices that they are usually sold at. This list is, however, very liable to variation from different circumstances, as situation, &c.

Ploughs.

	L.	*s.*	*d.*
Improved Rotherham plough	3	13	6
Small's improved swing plough	4	4	0
Do. with chain draught	4	10	0
Best swing plough	4	4	0
Lord Somerville's single swing plough	4	14	6
Do. with chain draught	5	0	0
Norfolk plough	4	4	0
Stout ploughs with wheels, iron	10	10	0
A revolving plough to turn all the furrows one way	11	0	0
Kentish turn-wrest plough	9	9	0
Ducket's skim-coulter plough	6	0	0
Do. skim-coulter	1	1	0
M'Dougale's ditto	1	2	0
Lord Somerville's patent two-furrow swing plough	8	0	0
Radway's double furrow plough	8	8	0
Double mould-board plough with expanding wings	10	0	0
Fen paring plough	4	4	0
Ant-hill plough	4	0	0
Mole plough for draining	3	16	6
Do. with a spare iron and the miner fitted	5	15	0
Mole drain plough with wheel and roller	6	0	0
Duke of Bridgwater's draining plough	7	7	0
Lumbert's improved mole plough	52	10	0

Harrows.

Harrows	10	0	0
Do. smaller	5	0	0
Do. smaller	3	0	0
Perkin's wheel harrow	3	13	6
Potatoe harrow	2	10	0

Cultivators, Drags, Scuffles, &c.

M'Dougale's extirpator, eleven irons	8	8	0
Do. with nine irons	7	12	0
Do. with seven irons	6	16	6
Cultivator with seven irons	7	7	0
Scarificator for grass land	6	6	0
Berkshire shim	2	10	0
Do. with three hoes	3	10	0
Isle of Thanet shim	10	0	0
Scuffler with set of blades for paring	12	12	0
Cook's scuffler	10	10	0

Rollers.

	L.	s.	d.
Arable land roller	8	0	0
Barley roller	4	0	0
Norfolk heavy drill roller	20	0	0
Harries's clod roller	10	0	0
Great iron roller for grass	35	0	0
Smaller iron grass roller	25	0	0

Drills.

Cook's drill and the corresponding tools	40	0	0
Amos's bean drill	4	10	0
Drill, Perkins's	6	16	6
Turnip drill	2	6	0
Do. with drills for cake dust, &c.	9	9	0
M'Dougale's single drill for turnips and pulverized manures	4	4	0

Hoes.

Ducket's hand hoes	0	10	0
Perkins's ditto	0	4	6
M'Dougale's expanding horse hoe, one to two feet wide	4	14	6
——— Do. from eight to eighteen inches	3	10	0
——— Do. for working by hand	2	2	0
Perkins's horse hoe 2*l.* 12*s.* 6*d.* to	4	14	6

Machines.

Threshing machine worked by one horse and two women	25	0	0
Perkins's improved threshing mill	35	0	0
Ball's do. do.	52	10	0
Dickson's of Ipswich do.	52	10	0
Improved ditto with pedal and click for working corn only	52	10	0
Jones's threshing machine, small	63	0	0
Asbey's threshing machine fixed	105	0	0
— — Do. moveable	170	0	0
Machine for weighing cattle alive	20	0	0
Salmon's cage and steelyard for weighing sheep and hogs	8	0	0
Machine for weighing cattle, hay, &c.	100	0	0
——— for bruising beans and oats	5	0	0
——— for breaking oil cake	4	0	0
M'Dougale's bruising machine for all sorts of corn, malt, and pulse	8	8	0
Salmon's machine for ascertaining draught	3	3	0
M'Dougale's index gauge to ascertain the draught of horses in ploughs	5	5	0
Sowing machine for broad cast turnips	0	10	0
Common fan or winnow	1	10	0
Winnowing machine	10	10	0
Do. Do. M'Dougale's	11	11	0
Turnip slicer	2	10	0
M'Dougale's ditto	4	4	0
Potatoe cutter	2	0	0
Salmon's chaff cutter	12	12	0
M'Dougale's straw cutter with three knives to work by horse mill	15	15	0
Ditto to work by hand	11	11	0
Ditto with two knives	10	10	0
Hincks's chaff cutter with three knives 8*l.* 8*s.* to	10	10	0
Villiers's moveable sheep-house	20	0	0
Banks's hay-stacking apparatus	20	0	0
Root steaming apparatus	20	0	0
Wheel hay rake	1	1	0
Hay-drag	4	0	0
Horse dew-rake	5	0	0

Wheel carriages.

One horse cart with side ladders, &c.	12	12	0
Three wheeled small cart 10*l.* to	12	0	0
Waggons common Berkshire, Essex, &c. 25*l.* to	36	0	0
Rood's patent Hampshire waggon	25	0	0

Small tools.

Scythes 5*s.* to	0	7	6
Sickles 2*s.* to	0	2	6
Rakes 1*s.* to	0	1	6
Dung forks each	0	6	0
Hay forks each 2*s.* to	0	3	6
Hay knife	0	5	0
Billhooks each	0	2	6
Casting or corn shovels	0	4	0
Iron shovels	0	5	0
Common spade	0	3	6
Weeding forceps and hooks	0	2	6
Set of under draining spades	1	1	0
Jointed borer	21	0	0
M'Dougale's boring rods for 20 feet deep	5	5	0
Sieve for wheat, barley, oats, &c.	0	3	6
Corn skreen	3	0	0
Sack barrow	1	11	6
Sacks each	0	5	0
Bushel and strike	1	0	0
Corn bin	1	5	0
Corn cribs	1	1	0
Withy ditto	0	10	0
Staddle stones pair	0	3	0

This list may afford some sort of guide, but from the multiplicity of tools for different purposes in husbandry it is almost impossible to come at the exact prices. The machinery which is necessary for different particular sorts of culture will be found under the head to which they more particularly belong and that of utensil. See *Utensil.*

Tool-*House*, a place set apart for the purpose of keeping all sorts of the smaller kind of tools. As in most cases these sorts of tools, as spades, forks, rakes, scythes, &c. are very liable to be lost, a place should be provided for laying them in when not in use. Sacks, ropes, twine, nails, and old iron may also be laid up with them. For this purpose the place need not be large, but it should be dry and free from damps. Of this room, the master of the farm should always keep the key, in order that he may know where readily to find such tools, or other articles, as he

may be in want of. And by such means the little pilferings which are too common are in a great measure prevented and removed. On all farms of any extent a small convenient place should constantly be provided, as much time and trouble will be saved by it.

TONGTREE, the pole of an ox-cart or waggon.

TONKEY, a provincial word signifying short-legged and deep carcased, as in the Chinese breed of swine. It is also a name applied to a breed of swine.

TOP, a term signifying the surface or head of any thing, as a tree, &c.

Top-*Dressing*, a term applied to such manure as is laid upon land without being turned in. And also to the practice of dressing the surface of grass land, or that of other kinds of crops, with some sorts of highly reduced manure, that can be evenly spread out or sown equally over them by the hand.

A great variety of substances are in use for this purpose, such as soot, ashes, the dung of pigeons and other birds, rape dust, gypsum, &c. the benefits of which are noticed under their respective heads.

The advantages which the Hertfordshire farmers derive from the practice of spring or top dressing their crops are fully shown in the statement given in the original Report of Agriculture for that district. "The spring or top dressings are the leading features of the Hertfordshire farming, and consist of soot, ashes, malt-dust and oil cake dust, or pulverized oil cake. The *soot* and *ashes* are brought principally from London, the malt-dust from Ware, Hertford and other places, and the oil-cake dust from the different oil mills in the county and neighbourhood. The soot is generally used on the wheat crops which have had no previous manure. It is laid in heaps on the crops in winter, and sown in the spring. The other top-dressings are housed and kept dry till used."

It is observed in the Essex Report by Mr. Vancouver, "that the application of manure upon the surface or what is generally called top dressing, ought chiefly to be regulated by the following considerations:

"1st, Whether the soil is of such a nature as to require any correction in its temperament, to render it more or less tender, open, or friable."

"2d, Whether the manure proposed to be applied, is capable of operating to that end."

"3d, Whether such manure is incapable of affording nourishment to vegetables, unless it is brought into close and immediate contact, with some other power or patent principle, containing vegetable food in the soil."

"4th, Whether the plant proposed to be fed by such manure, draws its nourishment principally from the ground."

"In the affirmative of all these cases it is but plain, he says, the manure should be covered or lightly ploughed under." "But when the manure is of such a nature, as to apply but lightly to such considerations; when it is capable of being dissolved on the surface, and conveyed by water downwards to the roots of the plants, or by conversion into vapour, to be absorbed by their stems or leaves, and that the plant is equally prone to receive its nourishment in both ways; the economy and effective operation of top dressings is unquestionably the most highly beneficial and greatly to be preferred."

In Herefordshire, "The provident farmer lays in a stock of these sorts of manures to answer contingencies, and provided with this treasure, he can remedy the evils of bad seed times and seasons. These top or spring dressings are peculiarly applicable to poor, light sandy and gravelly lands, and of course to the production of the specifically heaviest corn, and put such lands more on an equality, in point of annual value, with stronger and richer soils.

And in the corrected Report of the above district, it is added that ashes, though they open and loosen the soil, do not feed a crop. At Little Hadham, &c. they lay on 80 bushels an acre on clover, and pay 3*d*. a bushel for it. And about Stevenage, 50 to 60 bushels are given to an acre. But about Hatfield, some lay on 100 bushels per acre at the rate of 3d. and 3½d. and some very good and well kept at 6d. And Mr. Wangford at Bushey sows 90 to 100 bushels per acre on clover.

And about Berkhamsted their use is universal; generally 12 sacks are given an acre; the sack contains 1 bushel heaped and four struck; the price at present amounts to 1s. 6d. a sack at the wharf; but before the Grand Junction canal they cost from 2s. to 2s. 6d. Mr. Rooper has sent his waggons empty to London 26 miles for this manure; but in general hay, or beech plank is carried. Very little clover is to be found which does not receive the dressing of 12 sacks; 1d. a sack is allowed for sowing them. They are supposed to last two crops, and to be of such benefit to the wheat that when a tenant quits a farm, he is allowed half the expense laid out in ashing the clover, which the incoming tenant sows with wheat; some few instances are found of sowing them on wheat. The time is usually January, if the season is mild or moist. And Sir John Seabright destroys moss in his park by ashes; but he thinks they do little good to the wheat that follows the clover on which they are spread, otherwise than by improving the clover. And he is clearly of opinion that it is better husbandry to soot barley than to ash; the soot will do much good to the following clover, whereas the ashes do no more good to the wheat than by increasing the clover. The farmer here sows 10 to 16 sacks on clover.

And about Hitchin ashes are also very beneficial, and being spread on clover, do as much good to the wheat following as a sooting would do. And Mr. Kingsman, at King's Langley, compared ashes sown in November on clover, against ashes sown in February; five lands of one, and five of the other, the quantity being equal. Those used in November produced the best crop by about a quarter of a load of hay per acre. But Mr. Forster, of Royston, does not much approve of ashes except on clay, to sharpen the soil; they do little good, in his opinion, on arable chalk.

But *oil-cake* is the best dressing (*composs*, as it is called in Hertfordshire), which Mr. Byde has ever observed for wheat in top folding even so late as May, with sheep fed with oil-cake in troughs. And rape-cake in dust is used at the Hadhams, at 20*s*. a quarter, which is about equal to 6*l*. 10*s*. or 7*l*. per ton. There are mills that grind it at Ware. Mr. Grey im-

ports large quantities of rape-cake from Ireland; and has attached to his threshing mill a stone for grinding it to dust as a manure, the use of which he much approves. But Mr. Whittington finds that it answers best when spread on wheat.

Of rape-dust brought from Cambridge to Barkway, &c. they lay three quarters or near half a ton, on an acre. And at Barkway, Royston, and Baldock, &c. 11 quarters of rape-dust is called a 1000, and last March cost 20*l.*; much is used all over that country. And Mr. Doo of Byegrave, uses great quantities at 18*l.* per 1000, and has paid 20*l.* And it is stated by a writer in a note that rape-dust is much used in that part of Yorkshire where he resides, between Tadcaster and Doncaster, and as far as Boroughbridge, and in other parts of the West Riding also; he has a mill to grind his own rape-cake, that the dust may not be mixed; and he uses a great deal. His mill has saved him a very considerable sum since he erected it. The erection, including the granary over it, cost him 160*l.* He has paid near 300*l.* for rape-cake within these eight months. It is certainly best for wheat. He lays on from 12 bushels to 24 per acre, according to the goodness of the land: or more properly, its condition. Two, three, and four quarters, have been laid on for barley by his neighbours, for which he very seldom uses it; never, but for want of other manure: because, when they want rain in spring, and the weather is hot and dry, the manure is not of the least advantage, but loses its goodness from the heat of the weather and the want of rain. Six quarters and two bushels make a ton, but with many dust-sellers, as it is said, seven. He has paid this spring, 5*l.* 17*s.* 6*d.* per ton for ten tons; and last winter, he paid 7*l.* and 6*l.* 15*s.* The best use to which this manure can be applied, is in the quantity of 12 or 16 bushels per acre, to add to the richness of the soil, already in tolerable condition. He has gained from 10*s.* to 15*s.* per ton, and more, by grinding his own cake, besides having it unmixed: and he has the advantage of buying it in cakes at any time of the year; for as the two seasons for using it come on, it increases in price, and is again cheaper, when they are past. The cake now is not so good as formerly, for the manufacturers of rape-oil now contrive to press the cake twice, whereas formerly they never pressed it more than once; and they used horses where they now use water, wind, and steam. It cannot be applied as a manure better than for wheat.

But malt dust is sold at 8*s.* or 9*s.* a quarter. At Ware, it used to be 3*s.* or 4*s.* per quarter, now it is sold for 11*s.* And Mr. Marsh, near Hatfield, uses it for wheat, at 12*s.* a quarter; it works much the best on wet lands.

These sorts of dressings are often admirably beneficial in recovering backward crops of various sorts, especially those of the grain and grass kind. See *Manure*, and *Dressing Grass Lands*.

Top-*Dyke*. See *Ditch* and *Fence*.

Top *Folding*, a term applied to the feeding down some sorts of spring crops with sheep. It is a practice in use in some parts of Hertfordshire, and said to be beneficial, but it should be employed with caution. In this district the sheep are sometimes fed with other substances of the fattening kind, as cake, &c. See *Top-dressing*.

Top *up*, a term used to signify the making up a stack of hay or corn; also to finish highly, as fattening bullocks, &c.

TOPPING *of Trees*, the practice of cutting or lopping off the heads of different sorts of hedge-row trees, which is a disgraceful custom that is much on the decline at present. See *Pollard Trees*.

Where this sort of work is to be performed, it should be executed in the autumn or very early in the spring months; and the different boughs should always be taken off, in a close, careful manner, without shattering the parts, as by that means they are more essentially prevented from decay by permitting the water to slide readily off from them.

TOR, a term applied to a ragged pointed hill, thus we have High tor, Brent tor, &c.

TORE, a term applied to preserved rouen or winter grass.

TORMENTING, a term signifying an imperfect sort of hoeing or ploughing, or what is sometimes termed sub-hoeing or sub-ploughing.

TOVET, a term signifying a measure of half a bushel. It is sometimes written *toset*.

TOWN-MANURE, such as is collected in the streets, &c. of large towns. See *Manure*.

TRAMEL, an instrument or device, made sometimes of leather, but more usually of ropes, fitted to the legs of horses to regulate their motion, and teach them to amble.

Tramel also signifies an iron instrument hanging in the chimneys, whereon to suspend pots or kettles over the fire.

TRANSPLANTING, the act of removing trees or plants from the places where they were sowed or raised, and planting them in others. It is practised both with trees and plants of different sorts as the cabbage and other kinds.

The planting out of all the different sorts of plants of the cabbage kind, should be performed as much as possible when the weather is moist, the ground having been previously put in a suitable state of preparation for the purpose, by proper ploughing and harrowing. These sorts of plants are transplanted and placed out at considerable distances, as two and an half, or three feet, or more, according to the nature of the soil. See *Cabbage*, &c.

Wheat plants are likewise sometimes transplanted; but it has been remarked by the author of the Experienced Farmer, that it is a practice which is not likely to become general for setting whole fields; but circumstances may frequently occur where it may be attended with benefit when employed in a partial manner, as in cases where some accidental failure happens to a part of a field, as a careful observer may generally discover spots which have missed, and are thinner than others. In these instances, whatever may have been the cause of the ground's not being regularly covered,—whether from the wheat's having been destroyed by water in the winter, or

any other cause, the cultivator may always find some part of the same field from which he may draw plants without doing any harm; and if he is a neat husbandman, he may fill up the vacancies by transplanting from those spots, where perhaps also, the plants are so thick as to injure each other, and of course render a service to the crop in these places while he is filling the ground in other parts, and rendering the whole more perfect, uniform and regular, by which the appearance will be improved as well as the abundance of the crop.

Transplanting *of Trees.* The practice of removing while young. This is a method constantly adopted in raising wood of the timber or other kinds, in which cases the young plants, as from two to three years growth, are made use of; but by proper management the business may be effected with trees of considerably larger growth with perfect success. It has been observed by Mr. Amos in his useful work on agriculture and planting that, as in various kinds of ornamental planting, "as extensive lawns, and fields interspersed with large plantations of forest trees and flowering shrubs, planted in the wilderness manner, with serpentine walks, &c. running through the whole; the designs often become defective from the want of various sorts of proper large sized trees; in order to supply the defect; "plenty of various kinds of proper-sized trees should be always at command, for the purpose of transplanting them into bare fields, parks, or about new buildings, or into any other places where they would imitate most that charming negligence of nature which is so ravishing to the senses."

And to prepare young trees for being thus transplanted when large, "they should, he says, continue in the *seed-bed* for two years and a half, and then be planted out into greater distances, reducing the tap roots considerably and the lateral roots sparingly. And that as in young trees the root grows faster than the stem; as an oak plant a foot and a half in height, has a root sometimes four feet in length, the necessity is shown of mutilating the root, especially the tap root of the oak, the plant then emitting radicles in every direction, which grow faster than if the root had remained perfect. And if a plant, or tree, be transplanted in this state, it succeeds with greater certainty the more absorbent radicles are preserved with the root." When "they have remained two years in the *nursery-beds*, they should be removed again, dressing their roots as before directed, and increasing the distance between them, where they may remain three or four years more. After this they may be removed into plantations, where they may remain for good, or till they are wanted for transplanting." And that as "in transplanting large trees, some branches of the roots are unavoidably mutilated' and consequently the absorption of nutriment diminished, it is necessary that the boughs answering to the destroyed roots, should be rescinded, in order to diminish the transpiration in proportion to the aliment" that may be taken up.

The most eligible and proper sorts of trees for this purpose are, he conceives, "the different species of elms, of which the English is the best, as it is most aspiring and soonest recovers its wounds. The lime also will bear to be removed at a great size, as its wounds soon heal, and it may be formed into any shape desired." And, "the oak, the beech and the ash, will likewise bear to be removed, but they require more care in removing than the former; those trees whose bark are the thinnest and smoothest are the most proper." Besides these "the hornbeam, the sycamore, or planetree, the large-leaved maple, the sweet chesnut, the horse chesnut, and the laburnum will all bear to be removed, if they do not exceed 15 or 16 years old, and from 20 to 25 feet high; if they are older they will not recover their wounds so perfectly as to become handsome trees," after this has been done.

In addition to these, "the larch and the service, or mountain ash tree, will likewise bear to be removed, but they should not exceed 12 years growth." And "the balsam poplar of Canada, is by far the most beautiful and magnificent plant of all the species of that kind; the leaves are very large, of a light cheerful green, and the bark of a smooth shining brownish colour. It is propagated with much ease, is a hardy plant, a quick grower, and will bear removing at a great size," which is of much advantage in this view.

And further, "the crab tree and white thorn will, he says, also suffer to be removed, provided they are in a healthy growing state. And as few trees exceed them either in beauty or fragrance in the spring, or their rich glow of fruit in autumn, he should recommend them to be planted singly in lawns, fields and parks, where judiciously interspersed with other trees, they would highly decorate those scenes of rural retreat."

It is on the whole observed that "the elevation of stately trees, in parks, clumps, lawns or fields, has a most agreeable effect; but that in new designs and about new built houses, these cannot always be got without much labour and expense, or waiting many years." However, by the help of these directions, and the *transplanting machine*, a gentleman may soon make a figure in a bare field, park, or about a new built house without much labour or expense, or waiting so many years," as must otherwise necessarily be the case, which must be a great inducement to those more advanced in life to attempt the practice.

In the work of transplanting large tall trees, it is advised as proper "to dig a circular trench round them two or three feet deep in the early spring: whence many new roots will shoot from those which have their ends cut off, and thus the ball of earth will be better held together, when the tree is removed in the succeeding autumn, and the tree by having previously produced so many more fine absorbent radicles will be more certain to grow in its new situation." And "the first step to be taken in the succeeding autumn, is to mark out the places where the trees are to be removed to; there to dig pits, three, four, five or six feet wide, and from 24 to 36 inches deep, according to the size of the root and ball of earth which hangs to it. Throw the top soil to that side of the pit where the tree is to come, and the

bottom or poor soil, to the other side. In this situation the pit must remain until the trees are nearly ready for removal, which must be performed in the manner following." After this preparation, "the next thing to be done is carefully to raise the trees (which should be of the most healthy and pyramidical form) with as many roots, herby fibres, and as much earth about them as possible. This is done by digging a trench round about them, two, three, or four feet from the body of the tree according to their size, and about three or four feet deep, sloping it on that side where the machine is to receive the tree. Bend the tree so far to one side, with the assistance of ropes, that the tap roots may be easily come at, then with a sharp hatchet cut them across, and with a sharp hedging bill smooth the extremities that have been shattered, rear the tree upright again, bend it to the other side and dress the roots as before, then raise it up a second time, and it will be ready for removal." When it is directed that "one set of hands, as one, two, or three men, should fill the pits half full of water, the top soil and other fresh mould being mixed with it to the consistence of a thin puddle." And that "another set of hands, as two, four, six, or eight men, according to the size of the tree, should rear up the transplanter against it by means of the rope for the purpose, balancing it properly by the machine, and leaving the fore carriage upon the ground, taking care to surround the parts well with straw, where it rests upon the bars and bolts, to prevent the bark from being galled and rubbed off, which would injure the tree. The whole should then be pulled down together gently by the rope for the purpose; three or four men and a horse, if necessary, may be employed, steadying the motion downwards, at the same time a man or two must guide the waggon bolt into the fore carriage, into which the horses must be put, and the tree transported to the pit, which will by this time be ready to receive it. Drawing the carriage up along that side of it, on which the top soil was laid, running it back, &c., until you get it in such a position, that by rearing the machine and tree upright (as when loaded) the root with its ball of earth may be dropped exactly into the centre of the pit, amongst the puddle, which will so run into all the cavities of the ball of earth hanging to the root, as to surround every fibre."

It is then directed "to fill the pit completely up and raise a mound of earth about a foot higher than the surface all round the tree, two or three feet distant from the centre, observing to hollow it toward the tree, for the easier reception and retention of moisture." It is supposed that after this "the tree will be able to defy the rudest assaults of the wind, even at first planting without any support." This machine or transplanter may be seen in the work mentioned above.

The whole of the work is to proceed and be performed in exactly the same manner.

TRAVELLER'S *Joy*, the name of a plant of the weed kind.

TRAVELLING, the act of going from place to place either for the purpose of business or otherwise.

It is remarked by Mr. Young, that there is no "one circumstance which has, in the last twenty years, advanced the husbandry of this country more than the practice of farmers taking their nags (to use an expression of Bakewell), to see what other people are doing. Men who are confined their whole lives to one spot or vicinity, necessarily contract a too limited range of thought. Their ideas flow so much in the same channel, and dwell so much on the same objects, that new ones, however useful, make too faint an impression, nor can they know what is doing by the best farmers, on soils perhaps exactly similar to their own. To take a ride, for a fortnight, through four or five hundred miles of country, with an eye scrutinizing every thing they see, and calling upon noted farmers to make inquiries about such objects as appear interesting, must necessarily, he says, give a new movement to their minds, a new spring to thought, and remove many prejudices. If only one journey be taken in a year, and that at a vacant time, perhaps June would be the best season; but as he proposes two should be taken, one may as well be in January, as any other month. This season will explain the winter management of live stock, the important objects of the farm yard, fattening beasts, sheep feeding in many branches, winter irrigation, and many other objects, which are truly interesting. A farmer may take such a ride at the expense of as many guineas as he is out days, and he will not find this money the most unproductive that he expends."

In the summer journey he advises, after leaving a trusty person at home, "to view some farms in well cultivated countries, and to introduce himself to the conversation of his intelligent brethren, from whom he will be sure to learn something useful." And that he cannot do better than be present at the sheep shearings of his grace the Duke of Bedford, or of Mr. Coke; "as he will there meet with able cultivators from every part of the kingdom, and may learn where best to direct his steps whatever may be his object: and this, let me remark, says he, is no inconsiderable proof of the great national utility of those meetings. He has met farmers both at Woburn and at Holkham, who were in the progress of such journies, were properly and usefully inquisitive, and without doubt received no slight advantage from the knowledge thus gained. This is the season in which corn of all sorts shows itself to advantage; the turnip season is in full operation; lucerne is mowing for soiling; the marl carts are at work; the lime-kilns active, and most of the works of a farm either in operation or effect."

TREAD *of a Horse*, in *Horsemanship*, the manner in which a horse sets down his feet when in motion. It is reckoned good, if firm, and without his resting upon one side of the foot more than upon the other, or setting down the toe or heel one before the other. If he sets his heels first to the ground, then it is a sign that he is unsound in his feet. If he sets his toes first to the ground, it shews that he has been a draught-horse. Therefore in a good saddle-horse the whole foot should be set down equally, at the same instant of time, and turned neither out nor in.

TREAD *upon the Coronet*, in *Farriery*, an injury done to it by a tread. See *Coronet*.

TREADING *of Wheat*. See *Wheat*.

TREE, the first and largest plant of the vegetable kind, consisting of a single trunk, out of which spring branches and leaves.

It is evident that plantations of useful trees might be made to very great advantage in many places in almost every county, and the country be greatly benefited by them, in the raising a continual supply of timber for ship-building, and other useful purposes.

There are in many places, heaths and other barren and uncultivated lands of very great extent, which would be found on trial capable of producing trees.

The most useful trees for the purposes of the planter in point of timber are those of the oak, ash, elm, and fir, or pine, but for the sake of ornament and other purposes of the farm, a variety of other kinds may be had recourse to by the planter See *Plantation* and *Planting of Trees*.

TREE *Transplanter*, a machine contrived for the purpose of assisting in removing and transplanting trees of a large size.

It is composed of the two hind wheels and the two fore wheels and carriage of a waggon with a platform, and diagonal frame erected upon them so as to receive the tree, and retain it in a firm, steady, position, until it is conveyed to the place where it is wanted to be replanted. A very correct representation and description of this useful contrivance or machine is given in Mr. Amos's practical work on Agriculture and Planting.

TREFALLOW, a term signifying to plough land the third time before sowing.

TREFOIL, a plant of the clover kind frequently met with in grass lands. It is a valuable plant in such lands as are kept under the state of grass. And it succeeds well on soils of different kinds. It was found to succeed perfectly by Mr. Davis on the stone brash soils; and it has been greatly advised for the chalky and other dry kinds by Mr. Boys. It has however been objected to, as being only a biennial plant, but as it sheds its seeds annually in large abundance, this is probably of little consequence, and it is known to seldom wear out of lands in which it is once established. The seed is readily procured and with little expense.

It is of much less growth than that of the common clover, much slenderer in the stem or stalk, but notwithstanding this, it is sometimes sown with crops of the grain kind in the manner of that crop; the proportion of seed made use of is about three pottles when cleaned from the husks, but in the contrary state two bushels is mostly sufficient. These quantities should however be varied according to the circumstances and conditions of the lands.

It has been supposed by some to be an useful practice, especially where large stocks are kept, to sow it with oats or among the wheats in the spring, when they are to be succeeded by grain in the following season, as by this method of proceeding good seed is provided in the stubbles for stock in the latter part of the summer and in the autumnal months, and at the same time they are left free for tillage in the spring. This the author of the Synopsis of Husbandry thinks a good method.

When employed in laying land to grass, as it is always of much importance to have the land laid for pasture to produce a full crop the first year; "and as there are some grasses or plants which require two or three years to establish themselves, and acquire their perfect growth, while others arrive at their extreme growth and expansion the first year after they are sown; some of the latter sort should be chosen, among which trefoil will be found highly valuable." And this shews the advantage of mixing it with other sown grasses. Some consider the quantity of four pounds of trefoil seed to the acre as too small a proportion; and intend in future either to double the quantity or add as much red clover seed, which may be perhaps the better method. In this quantity, it is supposed, they will not injure the other grass seeds sown at the same time, but furnish a copious vegetation until the others come to perfection, at which period both the trefoil and red clover have a natural tendency to disappear or wear out of the ground.

It is said to produce excellent pasturage for cattle stock, but to be more particularly calculated for sheep either in mixture with clover or alone, as it is not so liable to hurt them by swelling or hoving as that sort of grass. In the latter case it is of much importance in the support of sheep from its being more early than clover, and coming well in after the consumption of the turnip and rye crops before the clovers are ready in the spring season.

The author of the Experienced Farmer says, that it is supposed a bitter plant, and that sheep are not fond of it, but he must own that nothing within the compass of his experience has led him to this opinion. It vegetates about a month earlier than white clover, and long before the rye-grass is exhausted. It is improper to be sown alone, except for the express purpose of raising seed. There are no soils proper for trefoil, but what will produce rye-grass and white clover. Hay made from trefoil only is a pretty hay, but seldom abundant in the produce. He is of opinion, that he could raise more trefoil on any quantity of land, by sowing rye-grass among it, than without; as he has observed, that trefoil like the vine and the pea wants support from some stronger substance that it may cling to. For this reason, it will also prosper well with red clover, round which its tendrils will twine like woodbines in a thorn hedge. He believes also that the crop of clover will be very little less in quantity or weight from the trefoil growing in a state of mixture with it.

He considers the after-grass of trefoil as worth very little, for which reason, some recommend it to be followed by wheat; but, he can declare from continued experience, that land intended for wheat, cannot possibly be too much smothered with crops of every sort of the close growing shady kinds.

It is remarked by Mr. Young, in his Calendar of Husbandry, that upon light and poor sandy lands,

on which clover does not succeed well, it is common husbandry to sow trefoil, with a portion of white clover and ray-grass, with the intention of leaving it two years. 6lb. of trefoil, 4lb. of white clover, and half a bushel of ray are common quantities. These are for sheep-feed.

Where it is left for hay, it does not afford a large produce, but a sort which is highly useful as a sheep-fodder in the winter season, and less wasteful than most other kinds, and which at the same time is supposed less troublesome in the process of hay-making. But Mr. Kent asserts, that it readily runs together and becomes mouldy by wet. The seed is collected from the second shoot in the same manner as in the common clover, and the produce is in general considerable, often affording from six to eight bushels of clear seed from the acre. But, it is a plant on the whole less beneficial than that of red clover.

TRENCH, a furrow cut in the earth for draining land, &c. See *Bog*, and *Draining of Land*.

Trench, a term signifying a sort of small opening made by the spade or plough in the ground in digging or ploughing it up; or in laying it up in the winter season.

Trench-*Plough*, a tool of the plough kind contrived for the purpose of opening the land to a considerable depth so as to cover in the surface material perfectly. See *Plough*.

Trench-*Ploughing*, the operation of ploughing in the above manner.

TRENCHING, the practice of opening the land in trenches by the spade or plough to a full depth.

TRENDLE, the wheel of a barrow; any thing that turns round.

TRINE, a term applied to a quantity of some sorts of things, which of *fellies* is thirteen, and of *spokes* twenty-five.

TRIP, in *Horsemanship*, the act of stumbling in the horse. A horse is said to trip when he makes a false step. Horses that trip are very dangerous.

Trip, a word when applied to sheep signifying a small flock.

TRITICUM, wheat grass, the name of a genus of grasses, none of which are beneficial to the farmer, but most of them injurious as weeds in arable land.

Triticum *ripens*, the creeping couch or couch grass, which is a difficult plant to exterminate. See *Couch*.

TRONE, a term provincially applied to a drain or trench.

Trone-*Weight*, a term signifying Dutch weight, and which is much used in the northern parts of the kingdom. See *Weights* and *Measures*.

TROT, in *Horsemanship*, a well known pace which, according to Mr. John Lawrence, "is performed with a quick and straight-forward motion, and a bended knee. The horse which points out his forelegs, and goes with his knee straight, is no trotter, whatever the old jockeys may have said of their pointing trotters; for these lose time by overstriding, nor are such usually good hacks. But it matters not how far a trotter steps forward, provided his knee be sufficiently bent. Some horses trot too short, and taking up their feet rapidly, appear to set them down almost in the same place."

The trot is an highly useful pace for the road horse. See *Horse*.

TROUGH, the name of a long vessel for holding food, water, &c. for cattle to eat from or drink at.

TROUT-COLOURED, in *Horsemanship*, is a term applied to a horse which is white, speckled with spots of black, bay, or sorrel, particularly about the head and neck.

TRUCK, a sort of carriage with low wheels for removing heavy weights.

TRUG, a hod for mortar. It is sometimes written trugg.

TRUNDLE, a sort of carriage with low wheels, for carrying heavy and cumbersome loads.

TRUNK, a term sometimes used to signify an arched passage under a road, &c.

Trunk, the stem or body of a tree; or the part between the ground and the place where it divides into branches.

Trunk *Drain*, a large hollow or under drain.

TRUSS, a bundle of hay, straw, &c. It may be observed that a truss of hay must contain fifty-six pounds, or half a hundred weight: thirty-six trusses make a load. In June, July, and August, a truss of new hay must weigh sixty pounds.

TRUSSED, a term applied to a horse when his thighs are large and not proportioned to the roundness o the craup.

TRUSSES, a term provincially signifying bundles of hay, corn or straw, to be "led or carried on horse-back."

TUCKER, a term applied to a fuller.

TUCKIN, a word applied to a satchel used in setting beans.

TUCKING-*Mill*, a term applied to a fulling mill.

TUEL, in *Horsemanship*, a name applied to the fundament of a horse.

TUMBREL, a sort of dung-cart convenient for many purposes.

TUMBRIL, the name of a contrivance for the purpose of keeping hay in for the use of sheep.

It consists of a circular cage or crib, which may be made of osiers, willows, or other pliant brushwood of any kind. The whole is about ten feet in circumference, and closely wattled to the height of about one foot, above which it is left open for the space of eighteen inches, it is then wattled again to the height of eight or ten inches, and an opening, about 18 inches in breadth, is left at the top, for putting in the roots or other food whether green or dry. The staves which form the skeleton of it are 10 inches asunder, so that twelve sheep may feed at the same time in each tumbril. A representation of it is given at *fig.* 9, in *Plate* L.

And considerable advantage may be derived from the use of so simple a contrivance for the purpose of feeding sheep, as it not only effects a material reduction in the consumption and expense of provender, which is thus prevented from being trodden under foot, or soiled with dung; but also in the state of separation the stronger sheep cannot drive away the weaker, as each is secured by the head. And

as the construction of it is attended with no difficulty, it may be easily procured and conveyed to any part of the farm, and with due care be kept in constant use for eight or ten years, or even much longer.

TUMOUR, a preternatural swelling in any part of an animal, arising either from external injuries, or internal causes. They are of various kinds.

Swellings caused by external accidents, as blows and bruises, should at first be treated with restringents; thus let the part be bathed frequently with hot vinegar or verjuce, and, where it will admit of bandage, let a flannel wetted with the same be rolled on: if by this method the swelling does not subside, apply, especially on the legs, a poultice of red wine lees, strong beer grounds, and oatmeal, or with vinegar, oil, and oatmeal; either of these may be continued twice a day, after bathing, till the swelling abates, when, in order to disperse it entirely, the vinegar should be changed for camphorated spirits of wine, to four ounces of which may be added one of spirit of sal ammoniac; or it may be bathed with a mixture of two ounces of crude sal ammoniac boiled in a quart of chamber lie, twice a day, and rags dipped in the same may be rolled on. And fomentations made by boiling wormwood, bay-leaves, and rosemary, and adding a proper quantity of spirits, are often of great service.

But in bruises, where the extravasated blood is not by these means taken up or dispersed, the shortest way is to open the skin, and let out the grumes. See *Abscess*.

Critical tumours, or swellings which terminate fevers, should by no means be dispersed, except when they fall on the pastern or coffin joint, so as to endanger them; in this case the discutient fomentation should be applied three or four times a day, and a cloth or flannel frequently wrung out of the same should be bound on.

But where the swelling fixes under the jaws, behind the ears, on the poll, withers, or in the groin, sheath, &c. it should be encouraged and forwarded by ripening poultices, wherever they can be applied; oatmeal boiled soft in milk, to which a proper quantity of oil and lard is added, may answer this purpose; or the poultice recommended in treating of the strangles: these must be applied twice a day, till the matter is perceived to fluctuate under the fingers, when it ought to be let out; for which purpose let the tumour be opened with a knife or strong lancet, the whole length of the swelling, if it can be done safely, for nothing contributes so much to a kind healing, as the matter having a free discharge, and the opening being big enough to dress to the bottom. See *Abscess*.

Pledgets of tow spread with black or yellow basilicon (or the wound ointment) and dipped in the same melted down with a fifth part of oil of turpentine, should be applied to the bottom of the sore, and filled up lightly with the same, without cramming; it may be thus dressed once or twice a day, if the discharge is great, till a proper digestion is procured, when it should be changed for pledgets spread with the red precipitate ointment, applied in the same manner. And should the sore not digest kindly, but run a thin watery fluid and look pale, foment as often as you dress, with the above fomentation, and apply over the dressing the strong beer poultice, and continue this method till the matter grows thick, and the sore florid.

TUNNING-*Dish*, the common name of a funnel.

TUP, a name applied to a ram.

TUPMAN, a term provincially applied to a breeder and dealer in tups. See *Tup*.

TUPPING-TIME, the season when rams are put to the ewes.

TURF, a term often applied to the green surface or sward of grass lands.

In respect to the improvement of the turf of poor pasture land, it has been observed by Mr. Speechley, in Dr. Hunter's Georgical Essays, "that the turf on poor land, constantly gets worse a few years after having been laid down for pasture. The cause is obvious. There are a few spiry grasses, natural to most poor lands, and these are called natural grasses. The seeds of clover, and other kinds of grasses introduced, are generally termed artificial. The roots of these are not very durable on poor land, and as cattle are greedy of these grasses, they constantly crop them, and prevent their going into seed, whereby the land is deprived of fresh supplies of young plants; whereas the natural grasses, in general, being much inferior to the former in quality, are refused by cattle, and the land, consequently, soon becomes plentifully stocked with them."

He says, "the general mode of practice to improve land when the turf gets thin and bad, is to bring it under a course of ploughing. But when that is not convenient, or when the occupier of such lands is not inclined to introduce the plough, they may be greatly improved by having fresh seed sown upon them. The best season for doing this is in the beginning of April. Let the ground first be well worked over with a heavy bush harrow, this will brush up and raise the soil, and prepare it the better for the seed to strike. A dressing of compost earth should then be given, and the seed sown thereon: after which, let the ground be lightly brushed over, and well rolled. If the season prove moist and kind, the seed will thrive to admiration, and wonderfully improve both the turf and verdure." And where land has been greatly cut up by carriages, or much trod up by cattle, it is also capable of being thus improved, without the dressing of compost earth. Even in "paddocks where the land has been cut up to an extreme degree by rude and wanton horses, he has seen a new and verdant turf arise, even to amazement, in a few weeks after sowing the seeds. It will be necessary to observe, that cattle should be prevented from coming upon the land till the turf get well set."

TURF, a term also applied to blackish earth used in in several parts as fuel. It varies much in its nature in different places, being sometimes hard and of a dark or black colour, while in others it is soft and spongy. It

is a substance very useful in burning calcareous stones into lime. See *Moss* and *Lime*.

Where the turf is to be cut into peats for burning, the work is performed somewhat in the following manner: The ground being marked on the surface in a straight line of a length at pleasure, and between three and four feet in width; the surface is then dug level with a common spade. The peat is afterwards cut with a narrow spade, shod at the lower end: the spade is about four feet long, besides the handle, and four inches broad, and has an ear, or a sharp iron on one side of it, bent to a right angle, which serves to cut and separate one side of the peat from the pit, as the back of the spade does the other. In this manner every peat is formed into a long square, being then spread on the ground in a close manner till dry, when they are set up an end three or four together, and afterwards put up into windows and small stacks till they are led or carried home for use.

Turf-*Ashes*. See *Ashes*.

Turf-*Bogs*. See *Bog*, *Moor*, and *Moss*.

Turfing-*Spade*, an implement used to under-cut the turf, after it is marked out with the plough in the old practice of paring and burning.

Turfing-*Iron*, the name of a tool of the spade kind, used in paring off the green surface of land in order to be laid down in some other place.

TURKEY, the name of a well known fowl of the poultry kind, reared in different parts of the kingdom. See *Poultry*.

TURNIP, an useful esculent bulb-rooted plant, of which there are several varieties.

This is a root from the introduction of which into field husbandry, much advantage and improvement has been derived, not only in regard to the arable management of land, but in the general system of cattle husbandry. With respect to the former, the vast expense and loss of the naked fallow practice has been much lessened and obviated, and in the latter a greatly increased supply of cattle food produced. Considering the turnip in this double view, it may be said to constitute the foundation of most of the modern improvements in tillage cultivation, on all the more light and mellow descriptions of loamy or other soils, which are adapted to the growth of this sort of plants to any considerable extent: as from the necessary culture, and nature of the vegetable, the ground on which it is raised is left in a state of fine preparation, for many other different kinds of crops, but especially those of barley, potatoes, and most sorts of seeds.

The turnip is a species of the genus *brassica*, which is well known by its having a round, fleshy, eatable root, varying greatly in the shape size and colour in the different varieties or sorts, under the state of cultivation.

The leaves proceeding from the root are very large, of a full green colour, being ragged on the edges. The stem arises from the midst of these in the second season of the growth of the plant, to the height of four or more feet, affording a yellow flower, with cylindrical pods, full of a purple or reddish brown coloured seed.

The numerous varieties of this excellent plant are principally distinguished by the shape of the bulb or root, which seems in a great measure to depend upon the differences in soil, situation and the culture of the plant. The sorts that have been introduced into field-culture, with the greatest benefit as articles of cattle food, are chiefly of two kinds, those having round or flattish formed roots resting much on the surface of the land, and those in which the root is of the more long or tap rooted shape, penetrating more deeply into the soil with the root, but standing higher above it with the upper part of the bulb.

In the first of these sorts; there is also much variety in the form of the roots as well as the appearances of the tops, being mostly distinguished by farmers into the *red round* or *purple topped*, the *green topped*, the *white topped*, the *yellow rooted*, *red* or *black rooted*, the *stone*, and the *Dutch turnip*.

The second sorts have likewise a degree of variety in the form of their roots, being chiefly known by the agriculturist under the titles of the *tankard*, the *tap-rooted*, the *pudding*, the *oblong*, the *long round*, and the *hardy Russia* turnip.

It has been remarked that the different varieties of the first description of turnips, on account of their roots being more formed in the earth, than in those of the second kind, which often stand high and much exposed in their upper parts, are more suited to the general culture of the field, in cases where there is much risk of their being open to the effects of the frosts, during the severe winter months; but that in other cases, as where they are to afford a feed for the suckling ewes, or the fattening of forward sheep at an early period, the latter sorts may be had recourse to, as the most beneficial, which is said to be the practice with Hertfordshire farmers, who are much in the system of having forward lambs for the London markets.

It may however be noticed that in the turnip husbandry of different districts, different sorts or varieties of the turnip are employed, and it is probable that some kinds may be more proper for some sorts of land than others, though little has been yet done in order fully to ascertain this point. Nor is it improbable but that among the different varieties of this invaluable plant, besides their hardiness some may be possessed of greater proportions of the nutrient principle than others. It has indeed been stated in the valuable Report of Northumberland, that the green topped and white topped are there generally esteemed more sweet and nutritious than the red topped, which possesses a degree of bitterness and is apt to soon become stringy. That the white topped on the better kinds of soil, is perhaps the most proper and beneficial, as while it has the property of being hardy, it grows to a large size; and that this and one of the stone or small hard sort are the most commonly cultivated and held in the highest estimation in some of the best turnip districts, in the northern parts of the island. The latter kind is supposed by some Northumberland farmers, to stand the severity of the winter season much better than most of the other sorts; but the produce on the acre is considerably less. But by others it is

stated in the North Riding of Yorkshire to bulb quicker, have a greater specific gravity, a finer grain, a thinner skin, and to be smoother in the crown of the bulb; consequently less liable to injury from wetness and severe frost. And that although it may not grow so quick, or to so large a size, that defect may be obviated by leaving the plants a little thicker on the ground at the time of setting them out by the hoe." The common white turnip is, however, much cultivated in the above, as well as most of the northern districts where the turnip husbandry is prevalent. And the green topped have been much recommended by Martin, both on account of the qualities above noticed, and their being of a larger growth and continuing longer in a state fit for use. The yellow-rooted or straw coloured turnip, is likewise found to be a firm and sweet tasted sort, but has not hitherto been so much cultivated as the other kinds, so that its properties are less perfectly known. The red sort was formerly much in esteem by farmers, but has now mostly given way to the other sorts. And the black rooted is very rarely cultivated in any of the turnip districts of the kingdom.

In the excellent Survey of Gloucestershire, it is remarked that the tankard kind will not bear the frost, while the red, round, and green topped sorts stand the winter with perfect security. In Berwickshire, according to Mr. Low, the round white, the green topped, red topped, and the high round bottle topped, are all in use there, and very often mixed in the same field. That cattle and sheep where they have a choice in general prefer other sorts to those of the red, from which it is concluded that this sort does not feed so well as the others, but they stand the winter well, and are consequently much grown. In Norfolk the large globe white is stated to be the most prevalent sort. The green round sort stands the season well in that district, and they find the produce much larger, and much more certain. The author of the Experienced Farmer prefers the white top and stone turnips to all the others.

This sort of crop is grown after many different kinds, some prefer a wheat stubble, and others grow them after tares, potatoes, and other similar crops, as well as on old grass layers, after the process of paring and burning. And it is the practice of some to have two turnip crops, as a means of clearing the land, which has been found to answer greatly in the barley after them.

In regard to the soils which are most proper for the growth of this sort of crop, they are all those of the light, friable, loamy, and medium sandy kinds, which have sufficient depth; but they may often be raised with advantage on many other sorts which have the surface mould sufficiently fine without there being too much moisture, as those of the thin gravelly, chalky descriptions; and even on the loamy clays, by proper management in the culture, as to the preparation, the use of manure, and the laying up of the land.

On the tenacious stiff lands where crops of this sort are attempted, it must always be in the Northumberland raised method, as where sowed on flat lands much injury must be done to the succeeding crop. In speaking of the culture of this crop, on flat ridges, on the heavy clay lands in some parts of Norfolk, Mr. Young strongly observes, that the universal system there whatever may be the soil, of sowing turnips, and cultivating them on flat or nearly flat lands, must without hesitation be condemned: hollow draining, says he, can never be praised too much: but there are districts, the soil of which is so tenacious, that no drains can make the husbandry admissible.

It is observed in the Report of Essex, that "a considerable part of the moist sand and gravelly loams, might be cultivated with turnips to advantage, were the Scotch two furrow or ridge practice properly pursued, and the land left well water furrowed. With the means of a low carriage upon a sledge, the turnips might be got conveniently from off the land, and in this great care should always be taken to have the field cleared before Christmas, or at farthest before the spring or seed tops begin to shoot, otherwise a very material injury will accrue to the succeeding crop."

It has been well remarked by a late writer, that from the success of the culture of this useful root upon lands that differ greatly in their qualities, it is evident that it admits of more latitude in regard to soil than many other plants; though the opinion seems to have been too general among farmers, that it is only capable of being introduced with benefit on such as are of a very light and mellow texture. And it is suggested that this has probably had considerable influence in preventing the cultivation of the turnip root from becoming so general, as from its great utility and importance it ought to have now been. It is however added on the authority of Mr. Donaldson that "though the turnip may be grown to advantage on soils that vary in a considerable degree in respect to their natural friability and composition, it is constantly necessary to the healthy vegetation and success of the crop, that at least the more superficial parts of the land, or the bed in which the seed is to be deposited, be brought into as fine a state of reduction or pulverisation as possible; as more is found from experience to depend upon this being effectually performed, than even on the richness of the soil."

This pulverization is supposed to be beneficial in a variety of different modes, "as, by its promoting the growth of the small seed weeds, they are capable of being more perfectly eradicated, and the young turnip plants of course less endangered by them; while, at the same time, a more fine and mellow bed is provided for the reception of the seed, and its vegetation rendered more quick and vigorous in consequence of the more equal diffusion of moisture that must thus take place." It is found that without this state of mould being produced by tillage it is in vain to expect good crops of this sort.

With the view of bringing the land into a state of suitable preparation for this kind of crop, "it is the practice in those districts where the turnip husbandry is carried on in the most complete and successful manner, when the seed is put in on "fallow, to have recourse to four, and frequently five, ploughings,

having the cloddy parts of the land well broken down in the intervals by harrowing in different directions, and the occasional use of the roller, as by these means almost every particle of the soil becomes exposed to the influence of the atmosphere, and is perfectly aerated and saturated with moisture." Mr. Kent advises, that "the first earth be given towards the close of the year in a shallow manner, so as merely to skim off the rough surface, it may then remain in this situation till about March, when it should be well reduced by harrowing, and cross-ploughed to the full depth. If weedy, it is to be again broken down by the harrow in the course of about a fortnight: but, when clean, it is better to remain in its rough state. It may then be left in this condition till about the middle of May, when it should have another ploughing to the full depth, and when the season is dry, and the soil of the more stiff kind, immediately harrowed, but where it is light this may be deferred for a week or more. These repeated operations, when well performed, generally bring the land into a perfectly fine and clean condition; but if that be not the case, more must be had recourse to."

With other agriculturists it is recommended to have the "first ploughing to the full depth, and that the after-ploughings and harrowings be continued to the middle of June. It is, however, suggested that these must, in general, be regulated by the nature of the soil, the circumstance of the season, and the convenience of the cultivator. In Hertfordshire, the practice is to plough three or four times as a preparation for this crop. And in some cases five earths are given. And in the county of Norfolk seldom less than four earths are given for this crop, and in addition much use is made of the scarifier and scuffler. With Mr. M. Hill, according to the Corrected Report of Norfolk, it is the practice to scarify his turnip fallows in March, April, or May, as it may happen; the scarifier attached to a frame on two wheels, made for that purpose to save the carriage of the drill machine; but the second time of going over the land, he fixes it to the frame of a roller to which are added irons pierced for that purpose, the roller breaking any clods that contain the roots of the twitch grass, and freeing it to be taken up by the shares, or afterwards by the teeth of the horse rake, the teeth of which are freed by working in the common manner of other couch rakes through a frame of wood. And a practice of Mr. Thurtell's on a pea stubble which he has followed many times, is to scarify the land directly after harvest, and then throw it into two furrow work for winter; in the spring to take off one bout from the ridge, then harrows well across, and leaves it for weeds to vegetate.—And Mr. Parmenter finds scuffling a practice of great utility on a foul turnip fallow.—Mr. Bircham also scuffles his fallows much to his satisfaction, not to save ploughing, but additionally.—But Mr. Brown ploughs five inches deep for turnips; his first earth taking up the stubbles deep, and the first stirring *scrapes the bottom*."

However, where the seed is to be put in after grain, early peas, tare, or other similar crops, the preparation is seldom extended to so many ploughings. In some districts two ploughings and harrowings, the stubble and weeds being at each operation brought together and consumed on the land, are found sufficient with the seed earth for the purpose: while, in others, where turnip crops are made to succeed clover or grass seeds, it is the custom to pasture the land in the spring with sheep to so late a period as only to admit of ploughing two or three times. And the sowing of this sort of crop on old pasture land upon one earth, is likewise stated in the Report of the North Riding of Yorkshire, as a successful practice on the experience of several years; the method of management in which, is to plough the land pretty deep in winter, eating any grass that may arise from the edges of the flags close by sheep, and afterwards before the seed is put in, reducing it well by harrowing. It may, however, be noticed that these are not modes of practice that are in general to be attempted, though they may succeed in particular instances.

In Gloucestershire, when this sort of crop is sown on oat stubble, the land is ploughed as soon as the crop is cleared off, which is best in a cross direction, and a second time in the spring. On sandy soils the same method is pursued.

There is another method of preparation which may answer well in many cases, which is, after the surface of coarse pasture and other old grass lands have been reduced by means of paring and burning, to give one earth, or to have recourse to once ploughing over the land, the ashes being previously spread on the surface in as equal a manner as possible; the ploughing in such cases being performed to only a slight depth, in order that the crop may derive the fullest advantage from the action of the fire, and the manure thereby afforded on the soil. In this way good crops have been produced.

In sowing this kind of crop on old saintfoin lays or old down lands, it is the practice in the county of Gloucester to breastplough shallow, and burn the ashes, being found by experience to be the best of manures; after these are spread the land is ploughed, the seed sown and lightly harrowed in.

In the county of Essex it is not an unusual mode of preparing the heavier sorts of soil for this crop, to first plough the land into four furrowed-ridges; then it is ploughed athwart, and afterwards ploughed into stitches in the direction of the first ridges, after which it is well harrowed and ready for the reception of the crop.

In other cases it "is to fallow, dung and prepare for sowing for turnips about Midsummer. After a crop of hotspur peas sold in the field for the London market, the land is well cleared with the horse-hoe, and upon once ploughing, turnips are sown; and just before the young plants are observed to be cutting the ground, the field receives a light top dressing of soot-ashes, or the most portable manure that can be conveniently procured. This dressing, upon frequent trial, has been found to have a very good effect in preserving the infant turnip plant from the depredations of the fly."

In respect to the use of manure in raising crops

of this nature, where it is of the calcareous kind, as lime, marl, or other similar matters, it may be the best method to apply it after the second or third ploughings, in the first kind in the proportion of from one and a half to three chaldrons, or thirty-two bushels, and in that of the latter, from eight to ten or fifteen ordinary cart loads, according to the circumstances and nature of the land; as in this way such matters may become the most perfectly blended and incorporated with the mould of the soil. Lime is successfully made use of for this crop, in Yorkshire, and most other districts where it can be procured, as stated in the Report of that district. And the use of marl has been attended with equal benefit, Mr. Donaldson says, in the county of Norfolk, and Angus in Scotland, the calcareous manures being the most proper on such sorts of land as are inclined to be in some measure stiff and adhesive in their qualities.

It is however sufficiently evident, that where a full supply of dung can be procured, it is the most suited to the growth of the root, as the experience of farmers has fully demonstrated. And it has been suggested that for such soils as possess a sufficient degree of lightness, and are in a fine mellow condition, that which is become considerably reduced by fermentation, or in a more rotten and short state, may be the most proper, as it can be the most intimately incorporated with them; but where they have greater stiffness and cohesion, the longer kinds may be more beneficial, as they will not only tend to preserve such lands in a more open and porous situation, but, by their gradual decay in the earth, render them more mellow. Some, however, think it the most proper when it is neither in a very short or very long state, but in a medium condition between such extremes," as is seen in the Suffolk Report. "Composts consisting of dung and different sorts of materials, as maiden earth, marl, and the mortary rubbish from old walls, in the proportion of one-fifth, well mixed, by having the dung laid over them in the winter, and afterwards blended together more intimately by turning before they are made use of, have also been employed with success" according to Mr. Kent. "The dust of malt, or what is frequently termed combs, is likewise another substance, that the same writer has recommended as an useful application in the way of manure in the culture of turnip crops. And the dung of rabbits, pigeons, and poultry, chopped rags, rape cake, river weeds, and other similar matters, may frequently be employed" with advantage in the growth of crops of this nature.

And it has been suggested in a late practical work, that "dung, when employed as manure for this sort of crop, should vary in some measure in the manner of its application, according to the nature of the land and the mode in which the root is cultivated:" and that "in general, it ought to be deposited in the soil as nearly as possible to the period at which the seed is sown; as in this method, in consequence of the new fermentation that must take place in the soil, the crop may receive the greatest benefit from it. It is therefore conceived that where the seed is to be sown in the broadcast method, it may be spread equally over the land, and turned in with the seed furrow; though Mr. Kent advises it to be lightly turned in by the ploughing that precedes the seed-earth, and to be well incorporated with the soil by harrowing just before that earth is given." The former is supposed "to be the better practice, when the dung is in a sufficiently reduced state, as the plants will have the more full advantage of it." In respect to the quantity necessary, it must depend upon the different circumstances of the soil and the richness of the dung; but less than ten or twelve good three-horse-cart loads can seldom be employed with advantage. If a compost manure be made use of, the proportion should probably be much larger."

It is stated by Mr. Young, that "the practice of manuring for the turnip crop is universal in Norfolk. Before the culture had been for a long period general, good crops were sometimes gained without, but for many years past none are to be procured except on new land, without much attention to this necessary branch of the management. The more common method is, to cast the yard dung of the preceding winter into heaps, which are turned over and carted on to the turnip land before the last earth is given; but that there are variations in every step of the business." "Mr. Thurtell is of opinion, he says, that on heavy land, autumn may be a very good time for carrying on muck for turnips, but on his light land he always scales it in before the seed earth, which is given deep enough to bury it properly. All his turnips are manured from Yarmouth." And Mr. "Syble informed him that the farmers in that vicinity were, not many years ago, in the practice of carrying out dung for turnips at Michaelmas, but they have left it off, as neither the turnips nor the barley proved such good crops as with other management." He adds that "Mr. Layton, and his neighbours were in the practice of ploughing in the dung very shallow by the last earth but one, to harrow well for mixing with the soil, and then to plough and sow." And that "Mr. M. Hill applies twelve loads per acre of yard-dung or compost; sometimes turns it in by the seed earth. But when work is forward, scales it in, and leaves the land ready for the seed earth. He prefers, when it can be done, to lay the dung on in November, on the wheat stubble, and plough it in; this keeps stiff land open, and he thinks undoubtedly the best practice: the pulverization is such that an earth may be saved by it, and it ensures a greater certainty on cold wet land. This can only be done to the extent of what is made by six weeks feeding in October and November, after the horses are taken in; and this long dung is undoubtedly best for wet land, and as good as any other on all soils at that season. The turnips also come sooner to the hoe, and are less eaten by the fly. But if long muck be spread just before sowing turnips, the fly is increased, owing to the dung being not well buried."

In Mr. Coke's practice of putting in turnips, the writer "found the business perfectly arranged for an equal and steady employment of all the teams and hands: three men filled the dung-carts, of which there were four; three drivers; ten horses in the carts;

three men spread the dung, one throwing out roughly, and two with forks breaking the pieces and distributing equally. Five ploughs were at work; these followed by a light roller; then the drill plough: and after all, a pair of light harrows; thus 18 men and boys were employed, and 24 horses and mules. Six acres a day finished, upon which 60 loads of dung spread; the drive not a short one. The men out at four in the morning from their own houses, to the field at five, and finish at two; breakfast in the field: in the afternoon the ploughmen take care of the horses, and the carters in the day. The ploughs work the same hours, but out an hour later, and home an hour later, as they turn in all the dung carried out: ten loads an acre."

In Hertford, Mr. Young manures well for this crop. He first prefers yard dung from beasts fed on oil-cake, then hog dung, and after that the sheep fold. And it is common to prefer manuring for the turnip crops instead of the wheat.

It is suggested, that "where the crop is sown in the drill manner, as it is confined to the middle of the ridges, and does not occupy the whole surface of the land, a somewhat less quantity may be sufficient." But that a "liberal allowance should always be made, as the safety and advantage of the crop depends much upon the rapidity and vigour with which the young plants are pushed forward by such means." But, where the lands have been well manured for the preceding crop, this may sometimes be put in without the use of any additional quantity.

It is obviously necessary, in whatever way dung is made use of, that it should be spread out evenly, and turned into the soil as quickly as possible; as where this is not the case, much loss must be sustained by the dissipation of the more liquid parts.

In the use of malt-dust or combs, the quantity is commonly about twenty sacks, of three heaped bushels each, to the acre, according to Mr. Kent.

And such manures as the dung of birds in its dry and reduced state, and other substances that have a powdery form, when used for this sort of crop, are mostly laid on in the proportion of from about twenty to thirty bushels to the acre, in the statements of Mr. Bannister. In Norfolk, Mr. Kerrick manures for turnips with fifty sacks of malt-dust per acre, at 1*s.* 6*d.* and gets finer crops than with yard-dung; and he uses it at the rate of ten sacks per acre, at 3*s.* 6*d.* per sack.

As this sort of manures only requires to be put into the soil to a slight depth, harrowing may be sufficient in many cases, for the purpose; which should be done just before the seed is sown, care being taken to have them first dispersed in an equal manner over the surface of the ground.

And rape or "oil-cake, when brought into a fine pulverized state by mills constructed for the purpose, with two cylinders revolving towards each other; the first breaking the cake into pieces of the size of a walnut by means of cogged cylinders; while the other reduces it into powder by plain cylinders similar to those employed in reducing clay for the formig of bricks; is said to have been used in Norfolk by Mr. Styleman, with much success, in the quantity of a quarter of a ton to the acre, at the expense in 1796 of 1*l.* 5*s.*, the powder being placed over the seed in the drills by means of Mr. Cook's drill machine, merely by substituting proper cups and funnels for the business.

It is observed by Mr. Young, in the Norfolk Survey, that Mr. Coke uses this manure, which now is 8*l.* 10*s.* per ton: he drills in with the turnip-seed a ton to six acres; and though when used in lumps, it may be better to sow it six weeks before the seed, yet, in his estimation, this is not the case when reduced thus to a powder. In the district of Holkham rape-cake is very generally, perhaps the writer might say universally, used. They now spread a ton on three or four acres, usually sowing it (about eleven or twelve bushels to the acre) for turnips. Mr. Overman has compared English, Dutch, and Irish cake; the latter he thinks the worst, and suspects from its breaking of a black grain, as well as from its want of that agreeable scent yielded by other cakes, that it has undergone in the manufacture some operation by fire. This manure is very effective. Mr. Coke has procured a machine for sowing the cake from Mr. Burrel, of Thetford, which works to great satisfaction, delivering a constant stream of powder so regularly, that no doubts are entertained of the great success of the invention. It contains alternate divisions, with large and small cups for the delivery of both cake and seed into the same drills. In this way a ton does six acres, instead of three or four in the common method. This has been found to answer perfectly.

It is however stated that "Mr. Johnson, of Thurning, finds that from one-third to half a ton per acre for turnips, will, in a wet season, beat every thing. It ought, he thinks, to be sown the first week in May, if possible; all ideas of putting it in at the same time with the seed, he thinks erroneous; he has seen it quite lost thus: in dry seasons it has no effect." In a letter to the writer he observes that "rape-cake is an excellent manure for turnips, and does not subject them to mildew; they will grow longer than from any other manure; the turnip that grows most after Michaelmas is always of the best quality. Malt combs quick to bring the turnip to the hoe; rape-cake slow; where both are used they should be sown together, but not at the same time; the rape-cake should be broken to the size of walnuts, the less dust the better, and should be sown in April or May, as near the second ploughing as conveniently can be done, to have a shower on it; the malt combs should be sowed on the last earth, and harrowed in with the seed."

Others find this manure useful for turnips. And "Mr. Reeve uses large quantities of rape-cake for his turnips, which in a wet season is an excellent manure. Mucked turnips come quicker at first than caked ones, but the latter exceed them afterwards: it is best applied three weeks or a month before sowing the seed, scaled in by the last earth but one: the deeper seed-earth then deposits the manure in the centre of the furrow."

River weeds have been tried with success in the same county, being laid on the ground in their wet state immediately after being removed from the water,

and as soon as possible turned in by a light furrow of the plough.

In Norfolk and Hertfordshire there is also another method practised, which is that of folding sheep on the land after the first ploughing of it up, until the seed earth is given.

In regard to the necessary proportion of seed in different cases, it depends much on the nature of the soil, the period of sowing, and the manner and circumstances under which it is put into the soil. It is stated that in Norfolk, where this culture is carried to a considerable extent in the broadcast plan, it is generally from about one pound to a pound and a half; but on the sandy lands in Suffolk, and those of the lighter kind in Yorkshire, a pound or pint is found to be sufficient; while on the turnip soils in the county of Middlesex nearly two pounds are made use of. It is a good practice in common in sowing turnips not to be too sparing of seed, as the unnecessary plants may be easily removed in the first hoeings of the crop. On the calcareous or chalky soils, a somewhat increased quantity of seed will also be necessary.

In the culture of the root in the drill method, from the seed being delivered with more exactness, and the whole of the ground not being occupied with plants, some reduction in the quantity of seed may be made.

As a great deal in the success of turnip crops has been found from experience to depend on the quick growth or vegetation of the seed, and the plants pushing expeditiously into *broad* leaf, it may be beneficial in these intentions to have the seed steeped a few hours in water or some other liquid before it is sown. When the season is dry, this will be more particularly necessary. The steeping has been performed in linseed oil and drying with brimstone, but without effect. It was the practice of the Earl of Oxford to use for several years Mr. Winter's "process for steeping turnip seed in train oil 12 hours, and was of opinion that it was beneficial against the fly; but if heavy rains fall after sowing, the effect lessens. And Mr. Shepherd dresses all his turnip seed with train oil and sulphur, steeping it 12 hours before sowing; he has tried it repeatedly and in comparisons, and is firmly persuaded of the benefit from the superiority of the dressed seed in crops attacked by the fly, not only in experiments side by side, but also in saving crops where turnips have in general been destroyed."

"It has been found that steeping old seed in water and then drying in the sun, has brought it up sooner than sowing dry."

In respect to the time most proper for sowing crops of this nature, it must be regulated much by the intentions of the cultivator in regard to the disposal of them, but for the general more early consumption of the root, the most proper season for performing the business may be about the beginning of the month of June; but where it is intended that the crop should serve as food for animals in the early spring months, it is better to delay the sowing till towards the beginning or middle of the following month. Where the root is cultivated on an extensive scale, it may be useful to vary the times of sowing more considerably; as by such means the plants not only come more in succession to the hoe, but likewise for the purposes of consumption by different sorts of live stock.

Where the system of lamb-suckling is practised, it is essential to have crops of this sort as early as possible; of course the seed in such cases should mostly be put into the ground as early as possible in May, such land as is in a fine state of pulverization, tilth, and perfectly clean from weeds, and well manured, being chosen for the purpose of raising the crops. But in common the early sown crops are not only less sweet and nutritious, but more exposed to injury from mildew and other causes, than those that are sown later: however, the sowings should not be in any case deferred so long as that the plants cannot have time to cover and fix themselves fully on the soil before their growth is restrained by the coldness of the autumn and winter seasons, as in such cases they never answer well.

In what respects the method of sowing this kind of crop, it varies in different districts; but in most of the southern parts of the island, it is the practice to sow turnips in the broadcast manner on the level surface; while in the more northern counties, where this husbandry has received considerable improvement, it is the more common to employ the drill method, depositing the seed in rows, either on ridges raised by one bout of the plough, or on the level surface; at the distances of from twenty-four to thirty inches in the former mode, according to the circumstances of the soil and the intentions of the farmer, and from ten to twelve or thirteen in the latter case.

These two different general methods may be both had recourse to with propriety and benefit under different circumstances of the soil. As on the light, deep, sandy, or gravelly sorts of land which are apt to part with their moisture too quickly, and consequently apt to become too dry and parched for the perfect growth of the turnip, it may be the most successful plan to sow in the broadcast method on the level or even surface, as by such means the moisture may be more effectually preserved in the soil, and the plants more fully supported.

And on the contrary, where the land is of a more heavy quality, and not so apt to part with its moisture, the ridged drill method, by the mellowness which it affords, and its tendency to preserve the plants from being hurt by the retention of too much moisture about their roots, may be the most proper and beneficial. And in addition it possesses a superiority in other respects; as on the thinner stapled soils this root, on account of its long tap-root requiring a good depth of mould, can seldom be grown in a perfect manner, it is obvious the ridging up of the land may be of benefit in providing a more suitable depth of cultivated soil, and better bed for the reception of the seed, the operation having been found to more than double the common depth of mould of such soils. On this account the plants grow more strongly, and besides the manure, from its being more particularly confined to the ridges on which they grow is

less exposed to the weather, and not required in so large a quantity, consequently more land may be employed in the production of this sort of crop; while, by its concentration, and the seed being placed more immediately upon it, the nourishment of the crop may be more effectually applied, and a larger produce of course afforded. It has also been supposed an advantage for the purpose of early sowing, and being eaten off in the winter months, so late as January, as the turnips can be more readily obtained and raised from the ground for the cattle when there is a depth of snow upon the land. This has been fully shown by Mr. Jobson in the second volume of Communications to the Board. There are also various other circumstances in this method of cultivating turnip crops, that seem of importance.

It has been suggested by Mr. Low in his account of the turnip husbandry of Berwickshire, in the Farmer's Magazine, where it has been employed for more than forty years, that "wherever it has been practised and well understood, it has got a decided preference to the broad-cast husbandry, for the following among many other obvious reasons.

"1. The land under a drilled crop, which admits the plough between the drills, is better cleaned, and cultivated more like land under fallow than under crop.

"2. The hand-hoeing of the drill crop is much easier performed than that of the broad-cast crop, the former being done by women and children, who can learn their work in a day, whereas the latter requires gardeners, or expert and long experienced hand-hoers.

"3. The earth is generally laid up to the drill turnips by the plough, and on this account they are better covered, and consequently better preserved in case of severe frosts, which often spoil the crop, especially in high situations. Besides this, the drilled turnips are very easily got at in time of deep snow, and are in that situation taken up with less loss than the broad-cast crop.

"4. The drilled crop is generally better than the broad-cast crop, and will weigh more per acre, seldom less, except where the land is very fine, in good heart, clean and dry. Such only is in preparation for a broad-cast crop; whereas a drilled crop is often raised on land very coarse and foul.

"5. By drilling wet land, the tops of the drills or small ridges are in some degree laid dry, and a good crop is often raised on land so wet that the broadcast crop would have no chance to be worth working."

Many objections have however been made by different cultivators to the raised drill method; but those which seem to have the most importance are, that from the root being more raised and exposed, it is not so capable to stand the severity of the winter season; and that larger spaces are allowed than are necessary for the roots to attain a sufficient size; consequently that the quantity of produce will not be so great on the acre. It is probable, however, that from the nourishment of the plants being greatly increased, and the crops thereby rendered of a more healthy and vigorous growth, the amount of produce must be rather increased than diminished.

It has been remarked by a writer in the third volume of the Farmer's Magazine, who has for many years attentively observed the difference between turnips raised in drills with broad intervals and those raised in other modes, that they grow to a much greater size in the former, than in any other method he has seen practised: and in judging of the weight per acre, it is the opinion of the advocates of the Yorkshire method, that "the largeness of the turnip should not be so much attended to as the greatness of their number. On this point he apprehends that some erroneous ideas are entertained. The intervals in the Yorkshire husbandry are stated at about twelve inches, but he understands that it is generally 13 inches, and that the distance between the plants in the rows is twelve inches. An acre will therefore contain about 40,200 turnips. The same quantity of land in the other method will contain (taking the interval at 27, and the distance in the rows at 11 inches) about 21,100. With regard to the real size of the turnips, in the different modes of raising them, he has no doubt of meeting the support of almost every man of experience, in maintaining, when all circumstances respecting soil, ploughing, manuring, seed, time of sowing, &c. are equal, that, when those in the drills with small intervals, grow to six inches diameter, those in the drills with broad intervals will grow to $8\frac{1}{2}$ inches, upon an average. Now, as similar solids are in the triplicate ratio, the weights of the turnips will be as the cubes of their diameters, or as 216 is to 614; which experiments in weighing will prove: when the turnips are spherical; and the best kinds are nearly of this form. So that the weight of the 40,200, will be to that of the 21,100 turnips, as 86 to 129 nearly; and consequently, when the latter are worth 6*l.* the other will be worth only 4*l.* 5*d.* per acre." He adds that "it will, perhaps, be urged by some, that he has considered the turnips in the Yorkshire mode smaller, and those in the north-country mode larger, than they really are; but, even supposing the latter had been taken at considerably less than 8 inches diameter, the 21,100 would have outweighed the 40,200, by about one-eighth part, which is equal to 15*s.* an acre. He dares venture to assert, however, that the results of properly conducted experiments, will prove that he is right in taking the proportions, upon which he first calculated. The inference, then, from this investigation is, that, besides the saving of expense, and the other important advantages pointed out, the mode of cultivation, which is pursued in the counties of Northumberland, Roxburgh, Berwick, and East-Lothian, raises a weight of turnip per acre, greater by about one third, than that pursued in Yorkshire.'

Some objection has also been opposed to the raised method from the difficulty of reducing the land to a level state again; and from the ground in the intervals becoming unproductive from not having the advantage of manure: but by making the ridges in a proper manner, according to the nature of the land, these inconveniences may be wholly removed.

It has been proposed on dry level lands in this intention to have the drills formed in a diagonal direc-

tion over the field; and that where the ridges are elevated, directly across them, the plough being drawn down the furrows in order to discharge the water more fully from the ground.

And it has been stated as an additional inconvenience in the raised drill practice, that where the lands are of a wet heavy description, and have but little inequality of surface, to draw off water though larger crops of turnips may often be produced, the grounds suffer so much by being poached in conveying them off, that the grain crops which succeed them, are diminished in a larger degree than is compensated by the extra value of the crop. Under such circumstances it is recommended as more beneficial to form the land into ridges, sufficiently convex to convey the water quickly into the furrows, and of such breadths, as about fifteen feet, that a cart can be easily conducted along them without pressing the earth in and obstructing the furrows; the crop where the land is liable to throw up annual weeds, being sown in the drill method on their surfaces, as by that means the business of hoeing may be rendered more easy and convenient: however, where this is not the case, and where the seed is put in at a late period, or the land is exposed to the grub, the broadcast practice may be preferable, as being more certain, on account of the plants being left so near to each other at the first hoeings as to admit of thinning and removing the bad ones in the succeeding operations. And, they are supposed by Mr. Jobson to have the advantage of growing more strongly, from the shelter being more complete, and from the land being less stirred about them in their early growth, before the tap roots are sufficiently fixed in the soil to support them in a perfect manner.

But it seems obvious from the success that has attended raising this sort of crop in the drill mode in different places, and the greater facility and cheapness of the after-culture of the crop, that it is in general the most beneficial practice; but that the nature of the ridges and the distance of the rows must often require to be varied according to the quality of the land and many other circumstances. Mr. Jobson, in the 2d volume of Communications to the Board of Agriculture, states the "following as the results of an experiment on the weight of six different parcels of turnips taken from a field of fifteen acres, which had been sown in June, 1797, with the view of ascertaining the comparative value of the drill and broadcast methods of sowing; the whole being in a state of equal tilth, and manured in as equal a manner as possible, immediately before the seed was sown, with well-rotted fold-yard dung, in the proportion of about seventeen cart-loads to the acre, each containing twenty-eight Winchester bushels; and with the view of rendering the trial as fair and accurate as possible, different breadths of land, of twenty yards each, were sown in the drill and broadcast methods alternately throughout the whole: part of the drills being on one-bout ridges of twenty-seven inches each, and the dung deposited immediately underneath the rows of seed; and the remainder in drills on the level surfaces at twenty-one inches distance. The produce per acre was calculated on the weight of four square perches, or the fortieth part of a statute acre, of each; the tails or fibrous parts of the roots being first cut off and rejected, taking the weights of the tops and roots afterwards separately." And it is added, that "though the crop, especially on the drilled part of the field, was not a very good one, being too much thinned and otherwise injured by the grub after the plants had been finally set out, it was found that the turnips on the one-bout ridges exceeded the others in weight; the whole being taken from an inferior part of the field, in order to afford a fairer average in the trial.

Comparative Experiment between the Drill and broadcast Systems.

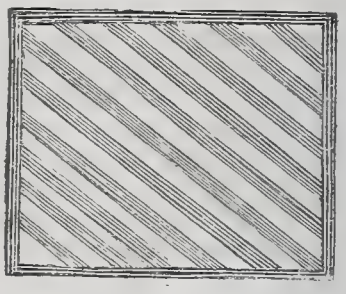
Modes of sowing.	Times of weighing.	Number upon four square perches.	Weight on four square perches, or the fortieth part of an acre.						Weight per statute acre.				Average weight of each turnip.		Average distance of each turnip.
No.			*Roots.*			*Tops.*									
			cwt.	*qr.*	*lb.*	*cwt.*	*qr.*	*lb.*	*tons.*	*cwt.*	*qr.*	*lb.*	*lb.*	*oz.*	
1. Drilled on one-bout ridges, at 27 inches distance	January	354	8	1	1	1	1	3	19	1	0	20	3	0¼	16½ in. by 27
2. Drilled with Mr. Bailey's machine on a level surface, at 21 inches distance	Ditto	428	7	1	15¼	1	1	5¼	17	7	1	8	2	4¼	17 in. by 21
3. Broadcast - -	Ditto	568	7	2	12½	1	0	11¼	17	8	1	26	1	11½	16¾ each way.
4. Drilled on one-bout ridges, at 27 inches distance - -	March 2	334	8	3	0	1	1	22	20	7	3	12	3	6½	17 by 27
5. Broadcast (these and the preceding were round white turnips) - -	Ditto	628	8	2	22	1	1	8	20	0	2	24	1	12½	16 each way
6. Broadcast (red)	Ditto	561	6	3	26½	2	3	5	19	11	1	0	1	15¼	16½ ditto

The writer here remarks that "by noting the average distance of each turnip in the last column, it is intended to shew at one view how many plants there were wanting in the drills to have made them a full crop; for if 550 be stated as a medium number in a full crop upon the fortieth part of an acre, they will be found to occupy a space of 17 inches each way in broadcast, $10\frac{1}{2}$ by 27 inches on the one-bout ridges, and of $13\frac{1}{2}$ by 21 inches in those drilled on the level surface; whence it may be easily seen how much those were wider in the rows than they ought to have been."

Where the broadcast method of sowing is practised, which may be done with advantage in some cases, as shewn above, it is of much consequence to the crop that the surface of the land be brought into as fine and even a state as possible before the seed is put in, and that it be dispersed over it in a perfectly even and exact manner, soon after the land has been ploughed up; as upon these points being attended to the success of the crop depends in a great degree. The sowing can seldom be performed by the hand in a suitable manner by persons who have not been in the habit of putting in the smaller kinds of seeds in that way, but to obviate this inconvenience a sort of box, or machine constructed for the purpose, is frequently made use of; and where proper care is taken that the perforations do not become obstructed by the seeds being fastened in them, may be advantageous in dispersing the seed in an uniform and regular manner over the land.

The seed is afterwards mostly covered by means of harrowing; a light short-tined harrow being advised as the most adapted to the purpose, as from the turnip plant forming its bulb in some measure above the ground, it should not perhaps be put in to too great a depth. And Mr. Kent in his Hints has advised in this operation to pass the harrows over the land only twice in the same direction, walking the horses in the first, and trotting them gently in the last, in order to give a neater finish and finer surface; the ridges having been laid out to the breadths of from four to ten yards, according as the soil may incline to moisture or dryness. This is the Norfolk practice in some degree, and found to be highly beneficial.

But in the drill method of sowing turnips, the land, after being prepared as above, is either formed into ridges by the plough, or the drills are stuck in the level surface, as already noticed; but the first method is the most usual. In Berwickshire, according to Mr. Low, the drills or ridges, "where the ground is not well pulverized, but remains rough and cloddy, are formed with the common swing plough, drawn by two horses, which lays together three or four rinds or furrows for one drill. But the most common and expeditious method of forming these drills is by a double mould boarded plough, which has the board hung on the sheath with hinges, and can be set wider and narrower at pleasure. It is also drawn by two horses yoked abreast, and forms both sides of the drill at once. The width of the drill is generally from 27 to 36 inches. And when the ridges are not much rounded, the drills are not laid in the course of them, which is generally parallel to one or other of the sides of the field, but are angled a little, as shown on the margin, for the purpose of having the dung better mixed with the soil, when it comes to be ploughed up into the ordinary sized ridges for grain after the turnips are ate off."

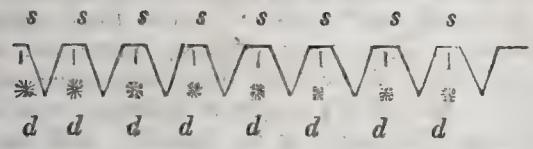


But in the extensive practice of Mr. Culley the manner of performing the business is this; "the land being made very fine, prepared, &c. as in the broadcast method, the ploughman (where it is thought most proper to begin) sets up three sticks or poles in a right line, by having his horses yoked double, and driven by himself with cords, he sees these poles between the horses, and by keeping his plough to bear always upon the poles, he draws his first furrow as straight as possible: the Suffolk ploughmen are very expert in this business according to Mr. Young. In returning, he keeps his far-side horse in the new-made furrow, and his plough at such a distance as to form a one-bout ridge, like an A; by proceeding in this manner, the land, when finished, will appear thus;

the distance of these little ridges is generally from 27 to 30 inches: a less distance does not admit ploughing between the drills." But in the Berkshire practice, "when the field is drilled up or formed into narrow ridges or grooves, a section of them appears thus:

In the Northumberland mode as executed by Mr. Culley, "the next operation is spreading the dung, which is performed as follows: a cart goes down every third drill, and lays the dung in small heaps; women and children follow, and with small three-pronged forks spread the dung evenly in the bottom of three drills, that is, in the one where the dung is dropped from the cart, and those on each side of it: when this is done, the ploughman splits the one-bout ridges, and covers up the dung exactly in the middle of a one-bout ridge; but before the seed can be sown, they require to be flattened at the top by a small roller, four feet eight inches long, and 9 inches diameter, which flattens two ridges at once: on the top, and exactly in the middle of these flattened ridges,

the seed is deposited by one or two drill-machines tied to the roller by a rope six or seven feet long, at which distance they follow the roller, and each machine is guided by a man; when finished, the work appears in this form:



where *s* represents the seed, and *d* the dung directly under it; the roller is drawn by one horse, driven by a boy. Setting up the one-bout ridges, and covering in the dung, are performed by a common swing-plough, as in the Berwickshire mode.

But in the method of this last district the operations of dunging and covering it, "go hand in hand, and follow one another as fast as can be done, always taking care to be busy in dry weather. The dung, at the rate of from ten to twenty double horse carts to the acre, is carted to the drills, and laid in small heaps in every 3d, 4th, 5th, or 6th one, at the distance of from eight to ten feet. It is immediately spread by careful hands into the furrows; and when a few of the drills or furrows are dunged from end to end, the double boarded plough is again used to split the drills and cover the dung, which it does at once going about, leaving the top of the drills or ridges immediately above the dung thus:"

And "as it is of consequence to cover the dung quickly, in order to preserve the sap in it, so is it to sow the seed immediately, while there is moisture in the ground from its being newly turned up. And as the ridging plough generally leaves the tops of the drills too high and narrow for the reception of the seed; where the dung is well rotted, and the soil a little stiff, the drills are then somewhat levelled before sowing, by a light harrow passing once or twice over them, leaving them thus:"

But the most common way of flattening them is to use a light wooden roller of about four and a half feet long, drawn by one horse as above. He walks in the furrow, and the roller presses down and spreads or flattens the tops of two of the ridges or drills at once, as in the Northumberland method; and to the frame of this roller is tied by a rope or light chain, as above, the drill or sowing plough, of which there are various kinds. But the simplest is generally the best.

In the putting in of the seed of turnip crops, drill machines of the harrow and other kinds are made use of; but those that are attached to the plough or roller, and consequently perform the different operations of ploughing and sowing at the same time, are, perhaps, in general to be had recourse to. It is advised by a late writer that "great attention is constantly necessary, to see that the seed be regularly dispersed and deposited in the soil; as from the smallness of the perforations in the revolving cylinders of most of such machines, the seeds are liable to be obstructed, and the regularity of the sowing thereby prevented." Various machines of these sorts are described under the head Drill as suited to different cases of sowing. See *Drill*.

But in Berwickshire "they make use of a drill for turnip sowing which has a cylinder or small barrel of white iron or copper, mounted on an axle with one or two wheels, oftener upon two than one. It is perforated with holes at equal distances, and as it turns round with the wheels, the seed falls equally out, and exactly in a straight line. This cylinder and wheels are fixed to a light frame-work, which has two stilts, and is kept on the top of the drill or ridge by a man or a boy, who walks behind as if managing a plough.

"Before the cylinder there is fixed to the frame work a kind of coulter which makes a small rut for the seed, and behind is fixed a rake with two or three teeth which mixes the seed dropped with the soil; and as the horse returns by the next furrow, to right or left, the opposite end of the roller rolls the ridge sown and compresses the top of the ridge on which the sowing machine follows. When it is necessary to do much work at a time, there are two sowing machines which follow the same roller, and sow two ridges at once, and a second roller follows to roll in the seed. Sometimes the roller used for the seed is a kind of broad low wheel, attached to the machine, and rolls only on the track or rut where the seed is sown. On fine land, well prepared with rotten dung, and when it is considered as unnecessary to horse hoe, there is a drill used which is attached to the common swing plough, and one plough following another the turnip seed is sown in rows at a regulated distance and depth. This drill machine is made by the patentee in Yorkshire."

Since this an improved drill of this sort has been introduced, which sows the seeds in regular lines on two of the ridges at once, the horse passing in the furrow between them. This is a very complete implement for the purpose, especially since it has had the addition of the apparatus for depositing the manure when of the rape cake kind in the drill at the same time with the seed.

It is however stated that in cases "where the drills are formed upon the level surface without being raised, which is the practice in some districts, and especially when made at narrow distances, as twelve or thir-

teen inches, the larger sort of drill machines, which sow a number of rows at a time, may be had recourse to with advantage, as being more expeditious," in the execution of the work. And that in whatever mode the turnip seed is put into the ground, experience has shewn it to be of much importance to have it deposited in the ground in such a manner and in such circumstances, as that its quick germination and growth may be certain, as upon this the success of the crop depends in a very material degree. It is supposed by some, that the seed, in order to secure these effects in the most certain manner, ought to be placed in the ground to the depth of three or more inches, and that the superiority of the drill method of culture, partly arises from the seed being deposited to a greater depth, and growing more rapidly in consequence of having more moisture, so as to become sooner out of danger from the attacks of the fly or other insects, while others think that it should be covered only in a slight manner.

The author of Practical Agriculture, however, remarks that as "air is necessary as well as moisture to the vegetation of seeds when placed in the ground, it would seem probable that the quick vegetation of such crops may be the most effectually secured by only putting them in to a middling depth, and according to the particular nature of the land and state of the season, as from an inch and a half to two or more inches, as the soil or season may be inclined to be dry or the contrary. In this way, he supposes, the inconveniences arising from the seed being too much exsiccated by its exposure near the surface, and from the want of the action of the air on account of its too great depth, may be equally obviated. But that as crops of this sort are mostly put into the earth during the hotter months, there is another circumstance that may, he conceives, be of equal consequence in promoting the quick growth of the young plants; which is, that the seed, especially in dry hot seasons, be in a great measure saturated with moisture, and of course with the oxygenous principle of the air, before it is committed to the ground; as by such means these will not require to be drawn from the surrounding mold, but the process of vegetation almost immediately commence."

This is further supported by the observations of "the Rev. H. B. Stacey, in his pamphlet on the failure of turnip crops, that the first process towards vegetation in this seed is its swelling, by having imbibed a certain quantity of moisture; it is then able to exert its vital powers; and, in order to secure its future increase, when the demand for nourishment is in proportion to its growth, it sends forth its radicle or little root, which as it lengthens begins to branch out, being covered with very fine hairs resembling down; which, by sowing a single seed close to the inside of a glass vessel filled with moist earth, may be easily observed. And that when the radicle has proceeded about half an inch, it sends forth its germ, consisting of the stem and seed-leaves, with the bud of the future plant in embryo. These seed leaves are believed to contain proper nourishment for the plant during the first stage of its growth, the radicle being then too small and weak to furnish food sufficiently delicate. That every injury, therefore, done to these leaves, either from being punctured by insects or deprived of a supply of moisture, must assist in checking the growth of the plant." And he further adds, "after suspecting heat and dryness to be the principal causes, that where the seed is sown in such seasons there is scarcely sufficient moisture to cause it to sprout; and that unless it be deposited to such a depth as that it may be screened from the action of the sun, its vegetative powers may be destroyed. But though a great part of it may imbibe sufficient moisture from the dews and dampness of the surrounding earth during the night season to render it capable of vegetating, its progress must be retarded by the heat of the succeeding days; and by being thus alternately moistened and dried, its vital principle be much impaired, if not entirely destroyed. And even if, as is sometimes the case, the seed finds moisture sufficient to enable it to produce both its radicle and germ, and even to raise its seed-leaves above the surface of the ground, still the same destructive effects may be ultimately produced; the heat then exerting its influence on the external parts of the plant, by evaporating its moisture faster than it is supplied by the radicle, by which it either withers away, or is so much injured that it never completely recovers itself; and that there is no doubt but that many acres of turnips are annually spoiled in this way." And in proof of this opinion, "though it is admitted that turnip crops may be materially injured by the ravages of insects, the following experiments were made:

"In hot dry weather, in the year 1793, some turnip seed was sown in shallow drills, drawn by a hoe, on a light poor soil; and notwithstanding the fly was accused of having destroyed many crops in the adjoining grounds, the seed came up and produced a good crop. And in 1794 the same experiment was repeated with similar success, although the fly was more general than in the former year." But with the further view of ascertaining "whether any advantage would be derived by sowing the seed deeper, under an idea that the germ would require more time to force its way to the surface, and the radicle at the same time be increasing its power downwards, and consequently be more capable of withstanding the sun's heat, thirty-two turnip seeds were sown by the same experimenter at different depths, in glass vessels filled with common garden mould, and plunged into the earth; on the fourth day after sowing they were examined, and the results were as below:

"The seed sown at 4 in. depth,	had shot forth a radicle,	3 in. long,	a germ 1 in.	}
3 ditto	ditto	2½ ditto	ditto ⅞	
2 ditto	ditto	2 ditto	ditto ¾	} on an average."
1 ditto	ditto	1½ ditto	ditto ½	

And it is supposed by the writer of a late practical work that "the general success of agricultors in raising these crops, by putting the seed in immediately after the plough, while the soil is in a moist condition, not only proves the correctness of these principles, but shews that great utility may be derived from steeping the seed in some watery liquid before it is committed to the ground, whenever the season is hot, and the surface of the land in a very dry and parched state; as by such a practice good crops of turnips may frequently be produced, where they would otherwise almost wholly fail." Sir George Staunton in his Embassy to China, as well as Mr. Gellet in the Bath Papers have ascribed the preservation of the turnip crops in that country, as well as here chiefly to this practice.

It is a matter of the utmost consequence to have the culture of these crops well executed, and at such times as are the most suited for promoting the growth of the young turnip plants, and preventing those of the weed kind from injuring them by the obstruction and shade which they produce, as much of the success of such crops must in general depend upon it; and "without considerable attention in this respect it is supposed the labour and expense that have been employed in preparing the soil and putting in the crops, must in a great measure be thrown away, the produce being seldom sufficient to repay the cultivator in an adequate manner. This culture is to be accomplished by means of the hoe. Where the crop has been put into the ground in the broadcast method, the hand-hoe only can be employed; but where the seed is sown in rows by the drill, and a sufficient space of interval allowed, those of the horse kind may be made use of, either alone, or in addition after the plants have been properly thinned out in the hand method to suitable distances."

It is stated as the usual practice, "when the plants have produced four or five leaves, or when they cover a circle of from three to four inches in diameter, which, in kindly seasons, will mostly happen in about a month or six weeks from the time of sowing, to begin these operations. In the first of which such plants as stand too close must be thinned out to a suitable distance, according to the circumstances of the season, the nature of the soil, the period of sowing, and the use to which the crop is to be applied." But, that "when the season is hot and dry, the thinnings in the first hoeings should not be to too great a distance; as by keeping the plants pretty close together the moisture of the land may be better preserved, and the crop rendered more secure: but in rich soils, when early sown, and when intended to be consumed by cattle at an early period, more thinning may at first be advantageous." Mr. Kent says, that "the most usual custom, is to leave the plants at the first hoeings at the distance of from six to eight inches from each other; but some cultivators prefer a still greater distance. In the second hoeing, which should be performed in the course of about a fortnight or three weeks from the first, according as there may be necessity, the plants that are to remain for a crop, may be left at the distance of from ten to twelve or fourteen inches in the broadcast practice; and at those of from nine to fifteen, or sometimes more, in the rows where the drill system is employed. But in these "the mould between the plants should always be well stirred, in order that it may be perfectly aerated, and any weeds that may have risen be effectually destroyed." But the future hoeings of crops of this kind must be regulated by the particular circumstances of them; the mould never being allowed to become too compact about the roots of the plants, or weeds to interfere with them.

In the Northumberland practice, "when the plants have got four leaves, they begin to hoe, and leave the plants at only eight or nine inches distance in the rows; as they have so much room sideways, or from row to row, the hoers go sideways and pull the surplus plants, weeds, &c. into the hollow or space between drill and drill, and the turnip plants are left as regularly as if they had been planted with the greatest care and exactness: the hoeing is performed by women and children, and costs about 4s. per acre for two hoeings." And that after this, "when the turnip plants become perfectly established again in the soil, which is mostly the case in about eight or ten days, the earth is taken from the rows where the turnip plants stand, by a light plough contrived for the purpose, and turned upon the plants and weeds left by the hand-hoes, in the intervals of the ridges. And when they have recovered themselves from this operation, and are become again in a vigorous condition, or when other circumstances render it necessary, the mould, which was in the former process turned from the turnip rows, is now divided and laid up equally to the different rows by the same implement, or a similar one with a double mould-board. In this way, where the land is clean and free from weeds, the business is completed; but when the contrary is the case, additional hoeings and ploughings must be given, according to the state of the land" and other circumstances.

It is a practice with some farmers to pass a light harrow over the land once in a place, as soon as the plants are sufficiently strong, in order to render the first hoeing more effectual; and even in particular cases, where they push forward rapidly, it is made use of a second time in the contrary direction, as stated in the Suffolk Report. But in the execution of this work great care is necessary, particularly when the plants are thin upon the land, as otherwise too many of them may be dragged up and the crop much injured from the want of a sufficient plant. And sometimes much advantage may be derived in the hoeing of the turnips, as by having recourse to such a practice, six labourers have been found capable of performing the work twice over more than one hundred acres, while in the contrary circumstance a much larger number will be required in doing much less labour.

The hand-method of hoeing is the only method that can be had recourse to, where broadcast sowing is pursued, but which is not only much more troublesome and expensive, but more confined and less beneficial than that of the horse method. The expense of the two hand-hoeings being generally from six to eight or nine shillings the acre;

while by the horse-hoe it is rarely more than four or five, besides the work being done in a much superior and more effectual manner.

In the horse mode of culture many different implements have been recommended, but the operation may be performed with sufficient regularity and exactness by any light plough which is not too large. In many districts, the hoe-plough is employed in this business with success. But the Northumberland farmers chiefly make use of a small light plough, about five inches in width at the bottom behind and eleven at the top, which is drawn by a single horse, for the purpose of ploughing the intervals between the rows, which is found to answer extremely well; but doctor Anderson supposes the work may be executed in the most effectual and perfect manner by the common light swing-plough. It has been suggested that, "in earthing up the rows, the double-mould boarded plough may, however, be probably more expeditious and convenient." And that "improved double ploughs of this sort have been contrived for the purpose of cleaning turnip crops, and are said to be employed with considerable success and advantage; as by their capability of being readily set to different distances, so as to suit the different widths of the rows, they not only perform the business of removing or paring off the earth from both sides of the rows at the same time, but by being brought close together effect the operation of earthing up the plants. In conducting the process with this implement, there is obviously not only an advantage in double the quantity of work being performed, but the operations are accomplished with more correctness, both in respect to the stirring of the earth in the intervals of the drills, and the application of the mould to the stems of the young plants" on the ridges.

In the Berwickshire practice, where both the horse and hand methods are had recourse to, they pursue the following mode, according to Mr. Low: In the horse-hoing, "when the turnip plants are from one to three or four inches high, or when the weeds begin to appear, a small light swing-plough of the common form, known in Scotland by the name of Small's plough, drawn by one horse, goes along one side of the ridge or drill, and turns off the earth from the young plants, and returns by the other side for the same purpose, leaving the field in appearance thus:"

Or "in place of the light common plough, sometimes the earth is turned off from each side of the young plants by a machine, mounted with two coulters, which cut from both sides at once, and on smooth land does the work equally well with the plough, and more expeditiously." This is an excellent tool when properly formed and made use of in this work.

In the hand-hoeing, which is "done two or three days after the earth is turned off from the plants, the hoers go to work, using a hoe from five to eight inches broad, and at one stroke across the ridge, cut the weeds, and leave the turnips sufficiently thinned. This work costs about 2s. per acre."

And when the crops have been "thus horse and hand-hoed, the field remains in the same state ten or fifteen days, and if the weeds grow fast, the same operation is repeated. The whole operation, both of horse and hand-hoeing, under ordinary circumstances, does not amount to above 7s. per acre."

The turnips are now to be furrowed up. After they have been "clean hoed, and are beginning to bottle, the earth lying between the rows, which has been turned off, as above mentioned, from both sides of the plants, is again laid up to them by a light double boarded plough, drawn by one horse. The operation is then finished, and the field or drills left in appearance thus:"

But "sometimes it happens that weeds, such as wild mustard, &c. grow up, and appear among the turnips after this last operation; in which case they are pulled up by the hands of women or children, so that by August nothing is seen but the tops or shaws of the turnips, covering the field thus:"

It is supposed, however, by others engaged in this culture, that the above "advantages may be equally attained by performing the business in a particular method, by means of a single-mould-boarded paring-plough, drawn by one horse, while the danger and inconvenience of being obstructed by stones or other matters is lessened or wholly removed; which is that of paring only one side of the ridge at a time, leaving the other to be performed some days afterwards. After the turnip plants have been properly set out, the work is stated to be begun and conducted in the following way.

"We shall suppose, says the writer, the turnip ridges to lie in the direction of east to west, and that the operation is begun from the east end of the ridges, and north side of the field. The ploughman counts off to his right hand, on the north, a certain number of ridges, suppose six: he enters upon the seventh ridge, and, going west, pares a furrow-slice from the north side of said ridge: turning left about, in

returning east he pares a furrow-slice from the south side of the same ridge; which ridge we shall therefore denominate *the feiring ridge*. In continuation, in going west he takes a single furrow-slice from the north side of each of the six ridges lying to the north of the feiring ridge; and, in returning east, he takes a furrow-slice from the south side of other six ridges lying to the south of the feiring ridge. Having thus completed one pitch of work, (if it will be allowed to borrow a phrase from the water flooders), consisting of the feiring ridge, and six on either side of it, in all thirteen ridges, he *feirs* anew for a similar pitch, till he has gone over the whole field.

"So soon as the weeds buried by this first ploughing may be supposed rotted, the operation is repeated, in a reversed manner, upon each pitch of work; that is, (in beginning, as before, at the east end of the ridges), a furrow-slice is taken, in going west, from the north side of the ridge lying south of the feiring ridge, and applied to the south side of the feiring ridge; and, turning right about, in turning east a furrow-slice is taken from the south side of the one next the feiring ridge on the north, and applied to its north side; and, in this manner, a furrow is pared from those sides of all the ridges in the pitch which were left untouched at the first operation.

"This mode of ploughing is continued so long as the stems of the turnips will allow of the passage of the plough: and they are never *set up* at all."

"Care is taken, at each paring, to keep the plough as near as possible to the turnips growing upon the pared ridge. And, by this, two purposes are gained: *first*, the greatest possible quantity of weeds is taken from the plants standing upon the pared ridge: *secondly*, a size of furrow-slice is raised sufficient to overlap or whelm up all the weeds growing in the interval betwixt the drill of turnip on the pared ridge, and the drill on the ridge, upon whose firm and untouched side the furrow-slice is turned over. It may here be observed, that, as only one side of the ridge is pared, and the other left firm, you can consequently bring the plough nearer to the turnip, than if both sides were pared at one operation, without risk of oversetting the earth on which the turnips stand.

"If the whole weeds are equally well buried at each operation, (as by paring, at each operation both sides of the ridge,) so as to raise the new ridges, which M'Dougal the inventor asserts to be a fact consistent with his experience; it is evident that each operation as above, performed by a single horse, is equal, both in point of effect and expedition, to one operation of dressing, performed by two horses, with the double-paring plough; besides the advantage just mentioned of M'Dougal's method, of your having it in your power to carry the plough always much nearer to your plants.

"In M'Dougal's opinion, the turnips thrive better when not set up. The sheep also (to the feeding of which, inclosed by nets on the field, he applies his turnip) get better at them: moreover, the sheep have easier footing, and more comfortable lying, when the ground is thus left more flat.

"The soil of M'Dougal's farm is light sand, free of stones: the intervals betwixt his turnip drills he keeps at about thirty inches at most."

It is observed that the "method, of paring only one side of the drill at a time, with a single plough, and leaving the other untouched for several days, is attended with many important advantages. The plough, in this way, may go much nearer to the plants; the drought has not so much impression on their growth; and the land enjoys greater benefit from the sun and wind, by being stirred different times, than when the earth is immediately thrown back into its first bed, according to the common custom. The first and last of these advantages may be procured by the double plough; though, as every second drill would in consequence be pared on both sides, it would be impossible to gain the second."

The horse-hoe offered to the public by Mr. Waistall, may be highly beneficial in clearing the intervals between the rows of turnips and in earthing up the plants. See *Hoeing*.

But whatever the method may be in which it is performed, or whatever tool may be employed, it must be of great benefit to have the mould loosened well near to the plants, particularly on the more heavy sorts of soils; and in all kinds, the turnip plants should never be suffered to have any sort of weeds growing near them, so as to injure them by their shade or choaking.

The plants in these crops are much exposed to the attacks of the *fly*, the *slug*, and the *black caterpillar*, in the early states of their growth. The first, which is said by Linnæus to belong to the *genus Coleoptera*, and described under the titles of *Crysomela oleracea* and *Crysomela nemorum*; the former being of a dark blue colour tinged with green, and the latter black striped with yellow on the different shells, and something larger than the other." These insects have been very minutely described by Mr. Marshall, in the second volume of the Rural Economy of the Midland Counties, who, after remarking that the insect is not a *fly*, but a *beetle* of the latter of the kinds described above, gives the following very accurate account of it: "The whole length of the body and head is, he says, from one-twelfth to one-tenth of an inch, and its width or breadth about half its length. The *antennæ* consist of two points, and are about two-thirds of the length of the body. The wing-cases are concave, and join by two straight edges, having the colour of dark chocolate, with a stripe of yellow white along the middle; occupying about one-third of the surface, which is dimpled, polished, and shell like, both sides the same, the texture being brittle as egg-shell. The wings are folded back under the cases, being membranous and nearly twice their length, having two or three strong nerves running about half their length. Their colour a light brown or that of stone, but that of the nerves a dark brown. The legs six, and black; the two hind ones clubbed upwards. The head and breast

black and polished. The abdomen the same, having four articulations."

And he further states, that in providing the "insect for the purpose of examination, he discovered that he had bruised a number of soft insects on the undersides of the seedling leaves, which led him to examine them more carefully, and to find that they were *paved* over with minute animals of the *aphis* kind, having different colours, as yellow, green, black, and two or three long-winged flies. On still more minutely examining them, he found that both the animalcules and the flies were individuals of the same insect in different states."

Of the flies he gives the subsequent description:— "The body and head are black, short, nearly egg-shaped, and about one-twentieth of an inch long, being somewhat larger than a grain of mustard-seed. The wings four: two very long, standing high above the tail, more than twice the length of the body; two very short, not so long as the body; but both pairs transparent, and strengthened by a few opake straight nerves. The *shade* coppery and elegant. The *antennæ* long, slender, and tapering, but the joints indistinct; the former about three-fourths of that of the body. The colour black. The legs six, but of a lighter colour than the body. The proboscis large, long, cylindric, and jointed, ending in a *point*, which the insect in either state inserts into the leaf. When the animal couches at feed, this appears to issue from the abdomen; but on being raised upon the legs, it evidently passes to the snout. In walking it is carried under the belly, lying close to the thorax, and reaching about half the length of the body. The abdomen nearly globular; flatted at the apex; with a minute black club standing out on either side, as in the fly and louse."

It is suggested, that "from these insects having been observed to be extremely numerous on the seedling leaves of turnip plants, not *eating*, but, as it were, *sucking* their juice or sap through long probosces, that serve to attach them to the leaves in the manner of leeches, that they may be the cause of the very slow progress that is sometimes made by the young turnip plants to push into *rough leaf*."

They chiefly prey upon the sweet tender seed leaves of the young plants, and their presence is rendered sufficiently evident by their leaving many little brown spots on them, and by eating away their fleshy green parts down to the fibres of the leaves. They are said to increase both in number and size until the plants are wholly consumed. See *Fly*.

In respect to the *slug*, its ravages, it is remarked, "may be easily traced, by observing the edges of the leaves; as it is upon them it first begins to feed, gradually proceeding from one part to another till each of them is more or less consumed, and the whole of the plants in many cases destroyed." It has been stated in the Middlesex Survey, that a "field of young turnips, when attacked in this way, exhibits some of them leaves as having lost a quarter, others one half, some three-fourths, and others the whole, the stems only remaining, and in some instances these are also attacked" and partially consumed.

In regard to "the depredations of the *black caterpillar*, they principally take place after the crops are in a more advanced state of growth, and the plants have formed considerable tops, and are in what is usually termed rough leaf; the green parts of the leaves being eaten through and destroyed, and of course the growth of the plants greatly retarded."

A great many different means of preventing the young turnip plants from being destroyed by these kinds of insects have been suggested at different periods; but hitherto probably without any one of them being found fully effectual in the business. It would seem, however, from a variety of circumstances that the safety and preservation of the turnip should depend much on the land being so enriched by the use of manure, and in such a state of moisture, as that the germination and growth of the seed, and the growth of the plants afterwards may be such as to bring them quickly into rough leaf. This may likewise be further promoted, as has been suggested above, particularly in hot dry seasons, by steeping the seed in some watery or other liquid before it is sown. It has been advised by the author of Modern Agriculture, in these "views to make use of new seed and such as is one year old together, as in this manner the crops, by coming up at different times, may be less in danger of being wholly destroyed; or, what is probably a better practice, to steep one-half the seed, after being thus mixed, in water for twenty-four hours, and then blend the other half with it, sowing the whole in the usual manner. In this management the plants, by rising at many different periods, may have a greater chance of escaping in sufficient quantity for the purpose of a crop." The advantages of this plan are rendered still more probable from the circumstance of the insects frequently making their attacks suddenly in large numbers, destroying the plants as fast as they rise, and as suddenly disappearing, leaving such as come up a few days afterwards untouched.

Where oily substances, such as have been noticed above, are employed as steeps, it is usual to let the turnip seed remain in them twenty-four hours or more; and, after it has been taken out, to drain them well from it by means of a fine sieve, linen bag, or other contrivance; then to mix with it finely-sifted earth or sand, putting it in the soil as quickly afterwards as possible: in which method the same oil may be repeatedly made use of in this way.

It has been suggested also on the idea that other sorts of plants are more liable to be fed upon by this devouring insect than the turnip, that the practice of sowing other sorts of seed with that of the turnip has been of late revived and strongly advised in different publications; in which intention radish seed has been sown with that of the turnip, in the quantity of two pounds or thereabouts to the acre. The author of Practical Agriculture, however, thinks, "that this plan must be extremely uncertain, as it cannot be successful except where the two kinds of plants rise exactly at the same time, which, from the great difference in the vegetative powers of the two seeds,

will probably seldom be the case. If any advantage is to be gained in this way, it must, he thinks, be by employing a plant which is preferred to that of the turnip, and the seed of which is somewhat quicker in its germination and growth; as, where this is not the case, the turnips may frequently be destroyed before the other plants be in a state to be fed upon." And that "it has been suggested that the ruta baga, or Swedish turnip, may be a more useful substitute in this view than the radish; as, by its being steeped and the turnip seed sown dry, the plants would rise well together; and the fly is well known to be so eager in feeding upon it, that it is with difficulty the cultivator can preserve a sufficient plant. In this case it is hinted, he says, as a further advantage, that when both sorts of plants remain without sustaining any material injury, the farmer may have the option of cutting out either of them, as he may find the most convenient and beneficial." But, he appears to think it doubtful, "whether the radish plants are always preferred by this insect or not; as he has often remarked in the garden, that where turnip and radish crops were cultivated adjoining each other, the leaves of the former were equally devoured with those of the latter."

On the whole, this plan of preventing the attacks of these mischievous insects is seldom to be fully depended upon for this purpose.

In regard to the depredations of the slug, which is a sort of white snail, its attacks on turnip crops are often equally, if not more highly destructive than those of the fly, from its eating them at a more advanced stage of their growth, and consuming not only the leaves, but the more solid parts of the plants, as the stems,&c. It is of course necessary for the cultivator to guard against them also as much as that of the above insect. In this view various means have been suggested, but perhaps with but little success.

On the supposition that slugs chiefly quit their terrestrial habitations during the night-time, or early in the morning before the sun rises, when the surface of the soil is moist from the dews, it has been proposed, by writers at different periods, to roll the land in the night with a weighty roller, in order to crush and destroy them before the light or heat of the day causes them to retire into the hollows and crevices of the earth. Mr. Reynolds, in the Transactions of the Society of Arts, &c. also thinks that the practice may be beneficial against the fly, where they exist in great abundance, and the work is performed while the surface is moist, by licking them up with the clammy earth, and in that manner completely removing them from the land. It has likewise been supposed useful against such insects, by confining the moisture more effectually in the soil, and by preventing the germs of the young turnip plants from appearing before their roots are fully established in the soil. The sowing of different saline substances, such as vegetable ashes, lime, and soot, in a fine powdery state, over the turnip crops by the hand, has likewise been occasionally employed with success against the fly and the slug, in the quantity of from ten or fifteen bushels of the lime and ashes, and twenty of the soot.

It is supposed that "the former, by the powers which they possess of destroying such animals, their attracting humidity from the atmosphere, and their furnishing more abundant supplies of nourishment to the young plants, and the last by its rendering the young plants nauseous and unfit to be fed upon, as well as the promoting of the more rapid growth of them," may be found beneficial. And "the sprinkling of water in which tobacco-leaves have been infused over the plants from the tail of a cart, has also been proposed as advantageous on the same principle as soot, against the slug; or what is probably better, especially where the crop is not extensive, as being found highly successful in garden practice, the mixing of the tobacco-water with soap-suds and urine. The use of this composition is said not only to bring them up from their holes and habitations, by which they quickly die, but destroy the ova deposited in the soil, as may be more fully seen in Forsyth's Treatise on Fruit Trees, &c."

Of the many other modes of preventing the mischief of the slug on turnip crops, that of sowing barley chaff over them immediately on their first appearance, as by this means they become directly entangled and destroyed; and the practice of turning a flock of sheep upon the turnip lands, keeping them constantly in motion by the means of a dog and person to attend them, seem the most beneficial. In the latter mode the slugs are shaken from the young plants, and destroyed by being forced into the ground by the treading of the sheep. See *Slug*.

The black caterpillar, which proves destructive in the more advanced growth of the turnip plant, has been supposed to be removed by the use of the tobacco infusion or mixture noticed above, as well as by the application of the barley chaff over the crop on their first appearing, taking care at the same time to pass a light bush-harrow over the land in order to dislodge the animals from the plants to the ground. And it has also been supposed, that the fly, from which this sort of caterpillar is produced, might be prevented from fixing upon the plants, by causing any thick offensive smoke to pass over the ground, provided the period of its coming could be exactly ascertained, and the state of the wind be at the same time favourable for the purpose.

Many other remedies have been proposed in these cases, but perhaps with little success. See *Black Canker*.

There is another sort of disease in turnip crops which affects the roots of the plants. It is a sort of large excrescence forming itself below the apple or bulb, which, after becoming in a state of maturity, takes on the putrid fermentation, and sends forth a most offensive smell, and to which the title of anbury has been given. See *Anbury*.

It is stated by Mr. Young in the Survey of Norfolk, that "the anbury, or external knots, each containing a small worm in the centre, depends on soil, and most of the soils in Norfolk are subject to it till

they have been marled or clayed, which is an almost sure preventive."

It is remarked, that on some "light thin soils, especially in dry seasons, the mildew is another disease which is sometimes apt to attack turnip crops, and produce great injury to the young plants by checking their growth; the chief remedy of which is, that of properly thinning out the plants, and occasionally stirring the earth perfectly about their roots by the hoe.

And that where it occurs in lands of a more retentive quality, advantage may be obtained by rendering them drier, by deepening the ridge-furrows, and other methods of the same nature. See *Mildew*.

There is also another sort of disease or accident which affects the turnip crops, which is that of sending off numerous stringy roots with lumps or knots at the ends containing white worms which soon decay and come to no account, or what are provincially termed *fingers* and *toes*, instead of swelling and forming bulbs. It occurs generally where the crop is sown on fresh land, and no method of removing it is said to have been yet discovered. More perfect tillage and the use of such manures as have a tendency to render such lands more mellow and friable, may perhaps be beneficial in preventing such effects. Mr. Parkinson however, thinks, that in these cases, the land, wants to be made "more coherent."

Where turnip crops have been eaten off by the fly, or destroyed by other means, it is advised by some, "to sow the same land over again, and harrow the seed in, without having recourse to the plough:" this however, the author of Practical Agriculture says, "is a method that should seldom or ever be adopted, as in such a mode of proceeding there must constantly be greater danger of the plants of the second sowing being destroyed in a similar manner. It is perhaps always, he thinks, a better practice either to give the land a shallow ploughing, by means of a light plough, before such second sowing is performed, or to leave it entirely for a crop of wheat." The latter, Mr. Bannister considers the better method.

It may be remarked, that the seasons most favourable for these sorts of crops, are those in which the weather is warm, with frequent showers, but not much continued rain. It is found that in the autumn and winter periods, when frequent changes from frosts to thaws and rain take place, turnips mostly experience great injury, by being rendered extremely subject to decay, and become rotten; and even such as are capable of withstanding such seasons, seldom afford that due proportion of nourishment to the stock that may be fed upon them, that is usual under other circumstances.

Turnip crops are very often liable to be much hurt in the winter season also by the wounds produced in the turnips by different sorts of birds, such as the wood-pigeon, rook, and some others; they should therefore be guarded against as much as possible in situations exposed to them.

It is evident that the expenses of raising crops of this sort must vary much according to the nature of the soil, the crops which they succeed, the methods of putting them into the soil, the situations and other circumstances of different kinds; but in the drill practice in many cases it may be stated in the following way:

Expense per acre.

	L.	*s.*	*d.*
3 Ploughings at 8*s.*	1	4	0
3 Harrowings at 4*s.* 6*d.*	0	13	6
Cleaning by hand-picking	0	7	6
Making up drills	0	4	6
Manure and labour, half allowed	2	5	0
Covering up drills	0	4	6
Seed	0	1	8
Drilling in	0	1	0
Horse-hoeing twice	0	1	8
Hand-hoeing once	0	6	0
Earthing up rows	0	1	0
	5	10	4

It is mostly the practice in the southern districts of the kingdom to sow barley after the turnip crops. But in Berwickshire, "on most of the dry lands along the Tweed and sea-coast where turnips are raised and ate off by sheep, it is common, Mr. Low says, to sow wheat upon such fields as are cleared by the 1st or middle of March. Those cleared from the middle of March to the middle of April, are sown with early or Dutch oats. After that, where turnips remain, the land is sown with barley. All these crops generally get only one ploughing, and are sown with clover seeds 12lb. to the acre half red, half white, with a bushel of rye grass, if the field is to remain in grass longer than one year, but if intended to remain only one year in grass the whole seed is broad or red clover."

From the differences of season, the nature of the land, and the method of culture that is practised, it is obvious that these crops must vary greatly in the quantity of produce or animal food, in different cases: but a middling crop, where the ground is good and well adapted to the purpose, may afford about fifteen tons, the acre; in many instances it must however, be much less. And the value of such crops must depend upon various circumstances, as their quality and abundance; the manner in which they are capable of being consumed, as on the land or in cribs or stalls; in fattening or rearing different sorts of live stock; and the state of the markets in regard to the sale of the stock, thus fed. In general it may be from about three to six or seven pounds the acre, and in some cases so much as ten. It is found by experience, according to Mr. Donaldson, that "an acre of good turnips will be sufficient to fatten a beast of about forty stone, or eight sheep. And in the feeding off in the open field, they are stated in the Survey of Middlesex to pay from two shillings and sixpence to four shillings and sixpence the ton, a crop of twenty tons producing in beef or mutton from fifty shillings to four pounds ten shillings, besides the dung and urine, which may be equal to fifty shillings more." But when

consumed by cattle in stalls, they are said to afford one shilling a ton more than when eaten by them in the field." The advantages of consuming these roots are however shown more fully in speaking of stall-feeding. See *Stall-feeding*.

It is stated by Mr. Low in the paper mentioned above, that in Berwickshire, "by the end of October, or 1st of November, the turnips are drawn for feeding black cattle, tied up in the sheds or stables, or going at large in straw yards, or laid out to them in dry grass fields; or they are ate on the field by sheep, kept together on the same spot by stakes or hurdles, which are shifted once a week. More generally now, the one half, that is, about five or six rows, is drawn for black cattle, and the other half remains to be ate on the ground by sheep, either ewes or wedders, which go to market from 1st March to the 1st May, and sell for from 45s. to 70s. each. A great proportion of the crop, raised by breeders, is consumed by young stock (sheep), which feed on them from 1st November to the 1st May, and are thereby raised to a great size, and kept in good order. They go off then, in the middle of May or 1st of June, to the Yorkshire dealers, at from 30s. to 40s. a head."

And that "many farmers, who are neither breeders nor feeders of stock, cultivate and raise fields of turnips. These they lett to feeders or breeders of stock, to be ate off, as may be stipulated, in a given time, either with black cattle or sheep. Formerly (about ten years ago) the price ran from 2l. to 3l. per acre. Of late years, owing to the increasing value of stock, the price has run from 4l. to 7l. per acre. An acre of good turnips will maintain and feed an ox of 60 or 70 stone for five months, or ten sheep for the same period. The ox's price in ordinary years will advance by this feeding 5l. and the sheep's 10s. There is more trouble in feeding with black cattle than sheep, but the additional quantity of dung made compensates this trouble. It is not uncommon to find turnips, in drills, on fresh new land, that will weigh from 20 to 32 lb. English; but a size under 10lb. is the most common crop."

It is added, that "the rage for raising turnips there is so great as to induce the farmers to sow them sometimes on land so wet and spongy as not to bear the sheep's feet to eat, far less the cart wheels to carry them off. In this case, it is considered to be the best way to carry them off in creels (or large baskets fastened to a saddle) on horseback. The horse walks in the furrow between the rows of turnips without poaching the land. These creels or baskets open at bottom to let out the turnips when carried to the place where they are wanted. A horse will carry at a time from three to four hundred weight with ease."

In the raising of turnip crops for seed, great attention is requisite in order to produce good seed, as where it is collected from such turnips as have been sown three or four years in succession, the roots are liable to be numerous and long, and the necks or parts between the bulbs and leaves coarse and thick: and when taken from such as have been transplanted every year, these parts are liable, Mr. Kent says, to become too fine, and the tap-roots to be diminished in too great a proportion. Of course the most certain plan is to procure seed from turnips that are transplanted one year and sown the next; or, if they be transplanted once in three years, it is supposed, by the writer of the Experienced Farmer, that the stock may be preserved in a proper state of perfection. It is stated, that the method of performing this business in the best way, is to select such turnips as are of the best kinds and of the most perfect forms, from the field crops, and, after cutting their tops off, to transplant them, about the month of November, or following month, into a piece of ground that has been put into a fine state of tillage by repeated ploughing or digging over, and which should be situated as near the house as it can be, in order that the birds may be better kept from it. The seed will mostly be ready for gathering in the end of July, or in the following month. Other cultivators, however, advise "that the seed collected from a few turnips thus transplanted, should be preserved and sown in drills, in order to raise plants for seed for the general crop, drawing out all such as are weak and improper, leaving only those that are strong and which take the lead; and that when these have appled or formed bulbs, to again take out such as do not appear good and perfect, as by this means turnip seed may be procured, not only of a more vigorous nature, but which is capable of vegetating with less moisture, and which produces stronger and more hardy plants. The practice of transplanting the whole of the turnips for seed for the main crops being contended to be not only highly expensive, but injurious, by diminishing the strength of the plants from the destruction of their tap-roots." Very good seed may, however, be raised in either of the methods that have been here described.

After the seed has become fully ripened, it is mostly reaped by cutting off part of the stems, and afterwards tying them up into sheaves, which, when sufficiently dry, are put into long stacks, and kept through the winter, in order to be threshed out about the time when it is wanted. But as in this way much seed is liable to be lost, by its readiness to escape from the pods in which it is contained, it is advised as a much better practice to have it immediately thrashed out, either upon a cloth in the field where it grew, or in some other convenient place, being then put into bags proper for the purpose and placed in a situation which is perfectly dry.

From seed crops of this sort being subject to much injury and loss in different ways, the quantity of produce must be very different under different circumstances; but it may in general be stated at not less than from twenty to twenty-four bushels the statute acre. And the price of turnip seed being seldom less than seven or eight shillings the bushel, on account of the great demand for it, it may at first appear to be a very advantageous sort of culture; but from the exhausting nature of the crop, the loss

sustained in grain, and the quantity of manure afterwards necessary, it is probable that turnip seed can only be grown to advantage in particular circumstances of soil and situation. In most cases it is, however, well for the farmer to raise his own seed, as that of the shops is seldom to be fully depended upon.

This is a sort of root which is capable of being made use of in different intentions, but the principal one is, that of the feeding and fattening different sorts of live stock, in which there is much difference in the practices of different districts of the island. It has been observed by the author of Practical Agriculture, that, "though few experiments appear to have been instituted with a view of determining the particular state in which those roots afford the greatest proportion of nourishment to the animals that feed upon them; it would seem, from their containing a much larger proportion of nutritious saccharine juicy matter while in their fresh or green state before being taken from the ground, than when taken from the land and preserved by being packed up in sheds or other places," as is evident from their losing their firmness, and becoming soft, wrinkled, and flabby, and diminishing considerably in weight, to be a more economical and beneficial practice, especially where the nature and situation of the ground, and the state of the season will admit of it, as on the dry soils in most of the southern districts, to consume them under the former than the latter circumstances; but in the more cold exposed situations, as in many districts in the northern parts of the kingdom, and wherever the lands are much inclined to moisture, as the roots may be greatly injured by the frosts, and the animals receive much injury from the coldness of such places, while feeding on them, as well as the lands be much damaged by their treading, it may be better to eat them under the latter." He adds that, "there are likewise other situations in which it may be particularly necessary, as well as advantageous, to make use of turnips after being drawn and removed from the land to places of security; as those where it is difficult or inconvenient to raise other sorts of green food for cattle for winter and spring use." And it is remarked in the Gloucestershire corrected Report, that "the Cotswold farmers are not agreed as to the quality of nourishment afforded by turnips, nor have experiments been made to ascertain it, but a score of middling-sized sheep may be kept on an acre for three months. It is the opinion of many that they have no feeding qualities in them, and that if sheep and other cattle are put upon them in low condition, they will merely not sink or lose ground. The general practice of giving hay with them in the proportion stated below, shews that they are considered either as food too watery of themselves to be safe, or not nutritious enough to fatten. A ton of hay should nearly of itself finish 6 or 8 sheep, if already forward, and this being the allowance to an acre, little dependance seems to rest on the turnips: but the great advantages which the farmer looks forward to, are the improvements of a light and poor soil, by the manure and treading of the sheep, and without these his land is of little value."—"But, a cultivator of Turkdean, who has been all his life employed on Cotswold farms, thinks that the nutritious qualities of turnips are such as to increase wool and carcase, but not to produce fat; and that while sheep are on this food they should be allowed as much hay as they can eat without wasting it."

The former of these writers also thinks, that "wherever crops of this kind are taken from the ground to be consumed by animals in other places, as from their large growth and luxuriant nature, they must tend greatly to exhaust and draw away its fertility, it will constantly be necessary to return an equivalent in manure, otherwise the injury sustained in this way may more than equal the advantages of the turnip crops." And it is further stated that the "tap-roots of the turnips should likewise be broken off and left on the land, that neither soil nor manure may be carried away by adhering to them:" but that, "where the lands are sufficiently dry, in a high state of fertility, and conducted under a judicious system of husbandry, it may often, however, be an advantageous and economical practice to have a partial recourse to both the methods; by having one part of the crop drawn and removed to be eaten in some convenient situation off the land, according to the particular circumstances of the case, and the other consumed in the field where they grow; as by such means a much larger quantity of ground may, he thinks, be benefited and improved, without injury being done to the crops that may be afterwards cultivated on the land." This has been shown above to be a very beneficial practice in Berwickshire. And Mr. Kent has remarked, in his Useful Hints, that, where such crops are good, "twenty acres will at least fatten fifteen bullocks, and support ten followers, or store cattle, for twenty-five weeks; or sheep in the proportion of eight to one bullock;" besides the benefits in preparing the land for other succeding crops, which he supposes far greater than the other "in point of real profit." For he thinks it obvious that most of the estates in Norfolk have been improved in the proportion of at least forty per cent. merely by marling and pursuing this mode of raising turnips; as many thousand acres now, he says, produce fine crops of grain and turnips, and support a prodigious number of sheep and other sorts of stock, which were formerly covered with various kinds of coarse plants, and unproductive in a great measure.

Some difference in the use of this sort of crops is also caused by the sort of stock which consume them; as when they are used in the rearing or fattening of neat cattle, they are generally pulled up and eaten either after being removed to some convenient dry piece of ground in the state of grass or stubble, or to some shed or other building near to the straw-yards or feeding-houses; in the latter modes, the turnips being given to the animals in bins or cribs, or placed before them in stalls constructed for the purpose, in which the cattle are tied up and confined. Some think the last the better practice, though it is less frequently had recourse to, as there is the least waste, while the dung and urine of the animals are supposed the most effectually preserved. Where the first method

is in use, the fat stock are first admitted, the lean following to eat up what may remain: they are, in most cases, consequently confined upon the roots, except when prevented by the severity of the season, in which case the straw-yard is commonly the place of their consumption. And in Northumberland, the ground to which the turnips are removed in this mode of feeding, is that which is intended to be ploughed up the following year for wheat or other grain crops; of course each field, in turn, has the benefit of having such crops consumed upon it, which is found more beneficial than feeding them on the land where they were raised. But the roots, in these cases, must not be scattered over the ground too thickly; as, where that is the case, much loss is sustained by their being crushed and bruised by the feet of the animals in eating them.

In some cases where milk is a principal object of the farmer, this root may also be made use of, as a rich succulent food for milch cows; but in this way of using turnips great care must be taken that all the decayed leaves or other parts of them be taken away, otherwise the milk may be liable to acquire an unpleasant flavour from them. But in the Report of Perthshire it is suggested "that where such a taste prevails, it may be completely removed by making use of a very weak solution of nitre in water." And "the offal produced by these means may be made use of for the dry stock, and of course little or no loss be sustainedin the consumption of the roots.

This sort of crop has also been applied in the feeding of labouring horses with success; as by their use the common quantity of corn may be diminished in the proportion of nearly one-half, and the animals rise in condition, as well as perform their business with more ease and be less subject to diseases of the bowels than when fed in the common method.

However, in this application they should be chopped and have dry food combined with them.

But the most extensive application of turnip crops is in their consumption by sheep, with which the most general practice, where the lands are light and sufficiently dry, is that of confining them upon a suitable proportion of the crop, by means of hurdles, and removing them to fresh portions or breaks every eight or ten days, or oftener, according to circumstances; but where the soils are of the more heavy kind and of course retentive of moisture, it is a better and more economical way to have the roots conveyed off the land to a neighbouring field, as already suggested, as by this mode there is not only less injury and waste by the treading of the turnips into the ground, but the sheep get a more regular supply of fresh food, and the shells, by being left clean, are more completely eaten up by the store cattle that are afterwards put upon them: and in the former mode it is also sometimes a practice, as stated above, as when the land is poor, to draw every other ridge of turnips, and convey them from the field to be eaten in another place, while those that are left are consumed upon the land on which they grew by the sheep. In cases of this kind the custom usually is to turn the sheep upon them as standing in the field; but, unless the bulbs be exposed much above the surface of the land, it is perhaps better to have the roots drawn up before the hurdles are fixed down or the sheep turned in, as the animals are not only less apt to break and soil the turnips, but feed much better upon them in this way, which is in use, in Norfolk and some other districts. In all cases, expence and labour should be savedas much as possible in fixing down the hurdles.

It is stated in the Gloucester Report, that "turnips on the hills are fed off with sheep folding; and one ton of hay is usually allowed to every acre, to be eaten by them. In this expenditure of turnips the beginning is made at the lowest part of the field, and a new portion, or "*hitch*," is allowed every day, still gradually rising. If intended as a preparation for barley, the crop should be cleared off by the middle of April at farthest, that there may be sufficient time for working the land."

"But in the vale, or the clay soils, the turnips are drawn and carried to the stall, and eaten with hay and other dry food."

However on the Cotswold farms where so much depends on this sort of crops, but where they are very uncertain, notwithstanding the best management, the following plan of culture and feeding of the crops have been had recourse to with advantage in preventing their failure: "Let one-third part of the land intended for turnips, be sown with peas or oats, and let the whole be eaten on the land as if it had been sown with turnips; that is, thrash out the corn, cut up the straw, and give the whole to be eaten on the land where it grew, by folded sheep, which perhaps would improve the soil more than if the whole had been in turnips." In this case the land certainly raises its own manure, and leaves a saving of that from the yard for the turnip land; these crops will also suit the stiffer soils, which are not so proper or certain for turnips.

The author of the Experienced Farmer has suggested, "that much loss is often sustained in these modes of folding sheep upon turnips, especially where they are cultivated under the broadcast system, and it is the custom to give the sheep large folds or breaks at a time, from the occurrence of frost and snow." In such cases he thinks the drill or ridge method far preferable; it being easy to have sheep-penns or turnip-trays made and fixed in such a way as to constitute a sort of moveable trough, the bars or trays being set near the side of the rows of turnips, and boards from ten to twelve inches in breadth, having stakes of suitable lengths, according to the depths of the soils, nailed to them, fastened on the sides from which the sheep feed: the narrower the spaces the turnips are included in, the better. As it may be apprehended that the animals may get in among the turnips thus fenced off, it is remarked that supposing they occupy a regular space of about twelve inches, the troughs may be made little more than a foot in width at the bottom, having a sloping direction upwards. The trays or bars may likewise have an inclination towards the sheep, and hang over the troughs or parts in which the turnips are inclosed, and thus prevent them

from getting in." And he supposes the sheep in this mode will have their food quite clean, and that by setting off at a time only the quantity necessary for a day, they may eat it with more avidity, and without the danger of spoiling so much by their excrement as is the case in the ordinary circumstances of feeding.

It is added, that if this mode should be objected to as only suited to small concerns, he contends that, on examination it will be found even on a large scale to be better in many respects, as well as considerably cheaper, as "on the lowest calculation three sheep may be kept in this way to two by the old method—perhaps even double the number, and they will fatten much sooner."—Suppose, says he, "two hundred sheep to employ one man and boy every day, and admitting the boy to be unnecessary in the common method, but allowing one shilling per day for him; and estimating the same quantity of turnips to keep three sheep that was employed for keeping only two; then three hundred sheep may be kept where only two hundred were kept: and estimating the profit on one hundred sheep at only two pence a head per week, the amount will be 16s. 8d. for that length of time; and deducting from it the extra expence of 7s. for the boy, there will remain a clear profit of 9s. and 8d. per week. But where the flock is larger, the profit will, it is observed, increase in proportion; as a man and boy are capable of managing four hundred sheep. Two hundred are, however, sufficient to be fed together; but by dividing four hundred equally, they can be managed by the above number of persons." He is, however, "clearly of opinion that two sheep may be kept in this way for one in the other. "If so, says he, the amount would be 1l. 13s. 4d. per week, which in twenty weeks would come to 33l. 6s. 8d. a sum that would more than clear the expences of the boy and the extra pen the first season."

And it is further stated, on the idea "that animals do not feed so well where a redundance of food is placed before them, that "if the sheep in such cases were driven into the straw-yards during the night, and even to eat straw in the morning, they would retain the turnips longer, and fatten quicker; and in the mean time the persons employed in looking after them might move the hurdles a row further, and thus little time would be lost. If both feeding and store sheep should be kept in this way, it would be adviseable, he thinks, to give the feeding stock rather more than are sufficient for the day, and to turn in the store sheep the succeeding day to consume what may be left. In this method the length of turnips that is necessary without much waste being committed may soon be discovered." It may, however, be remarked, that the constant trouble, difficulty and expence of this system in procuring the hurdles and in fixing the folds, must render it incapable of being put in execution, except in cases of a small number of sheep, where it may be an improvement in the feeding off turnip crops. In this practice great care is necessary that the hurdles be at first well set into the ground, and secured by stakes of sufficient length, with proper withs for tying them together, as after frosts and snows they are apt to be thrown down by the rain or the wind. The hurdles employed are mostly of two kinds, or what are termed, flatted, or rodded, the former being formed of a sort of split wood, while the latter is made by wattling rods of hazel, or other suitable woods, together; the former sort is the most lasting, but more expensive at first; and there is another sort of material used in this way, which is a sort of small corded net-work, termed toiling, which is, however, more expensive, though less heavy in the carriage. See *Hurdle*.

Expense of Hurdles.

	s.	d.		l.	s.	
Flake or flatted hurdles, from	16	0	to	1	1	per doz.
Rodded or wattled hurdles,	12	0	to	0	16	
Toiling, from - - -	2	10	to	0	4	per rod.

Mr. Bannister states it as having been found in the fattening of sheep with the turnip, that they make the greatest progress immediately before the turnips begin to run or form their seed stems; a circumstance which is supposed by some to depend partly upon the turnips containing, at such periods, the largest proportion of saccharine nutritious matter, and partly on the weather becoming more dry and warm. Hence it is, he says, a practice in some districts, toward the latter end of March or beginning of April, according to the season, to mow off the shoots or stems that are advanced, with a scythe; as by this practice, from the numerous lateral shoots that are sent forth, a more copious supply of green food is not only afforded, but the roots or bulbs of the turnips are preserved longer in a condition fit for use in this application.

In Norfolk the method of consuming this root is stated in the report of that district by Mr. Young, to be as follows, with different cultivators: "Mr. Bevan has for some years pursued the common practice of drawing half his crop alternately by stitches, and carting them to his yard, or to layers, for cattle; and feeding the other half on the land by sheep: he has long suspected that he lost by it: this year his barley is so inferior to what it ought to be, as to afford entire conviction of it; and he is determined never more to repeat it. The sands of Riddlesworth are not rich enough to bear this treatment." And "Mr. Drake, of Billingford, carts off his turnips with quarter-carts, the horse and one wheel going in the furrow, and only one wheel on the land, and that on the crown of the ridge. The mischief thus done, he says, is less than in any other method he has seen. The soil strong and wet." Also "upon good land Mr. Coke draws half and feeds half; but on the weaker soils feeds all."

It is likewise stated as "common with many farmers in West Norfolk to draw out the largest roots for carting home to bullocks, and for feeding the smaller ones in the field by sheep. Carting damages many; but there is a great advantage in leaving the small ones, which resist the frost the best. He

has known crops carted, at a great expense, into ditches to rot.

"Thirty years ago, three roods of turnips would fatten a beast of forty-five stone, or six Norfolk wethers in East Norfolk."

The writer, "in 1770, found the general method of consuming the crop from Norwich to Yarmouth, to be drawing every other land for beasts, and eating the other half on the land by sheep. At Thelton, the soil not being generally adapted to sheep, the crop is consumed by bullocks in the farm yards or spar yards. Many drawn also at Billingford and Thorpe Abbots, as well as through all that country, sheep not being a common stock." And "Mr. Thurtell, near Yarmouth, draws about one-third of every field for bullocks, kept loose in the yard; of tying up in stalls, his expression was, it is done with: ten beasts at liberty make as much manure as thirty tied up: not that they may not fat something faster; the difference, however, is small, if there be sheds around the yard: if he fatted a beast on a bet, it should be tied up. The remaining two-thirds of the turnip crop are eaten by bullocks and fat sheep in the field; and, in this consumption, he is in the Fleg system of drawing and carting enough to spread a fair portion of the field cleared for the yard fatting; and the whole of the turnips consumed in the field, are pulled and thrown. This method is now common in Fleg, and the best farmers have an high opinion of it: the stock do better, and less offal is made, than where the roots are not drawn. Mr. Everitt, of Caistor, is in the practice, and thinks that to pull and throw, though in the same field, will make the turnips go further by one fifth, and the stock doing better at the same time. One-horse carts the best for this work."

But "Mr. Ferrier, at Hemsby, carts his whole crop to the par yard, the roots being first tailed in the field. At Hemsby, &c. in Fleg, 30 great cart-loads an acre; and single roots as much round as a middle sized man's body." And "they have been sold at Ormsby, to the Yarmouth cow-keepers, at 7l. 7s. an acre. A price fixed by appraisement, at Michaelmas, to incoming tenants, often 4l. 15s. He has known thirty-six large loads an acre; and 24lb. a turnip, and quite brittle, no flockyness." It is likewise the practice with Mr. Hornard, of Ludham, to draw "all his crop; he throws on his layers, on the wheat stubbles, and on wheat. He eats all his crop abroad, none in the yard or stalls; but the bullocks are brought home at night to hay or straw. The expense is something, but not heavy, as two horses, with one lad, will cart thirty or forty acres in a season; the fields, however, within a furlong: some farmers do the same, though they have to cart a mile and a half."

And it is added, that "at Catfield, and, in general, through all Happing, they draw all the turnips; and think that an acre thus managed, goes as far as five roods fed on the land: they are carted to bullocks in yards, or thrown on ollonds, or wheat stubbles: it is not uncommon to throw on wheat in February and March, and it is seldom hurt, if not done too late; but if in April, damage ensues; if a dry time succeeds, and the land not in good heart, it is generally injurious. In South Erpingham the same practice: at Coltishall, all drawn, and thrown on wheat stubbles or eaten in the yards." But "at Oxnead, all drawn for feeding on the ollonds, &c. till Christmas, or till too jammy, that is, too much trodden from moisture; then into the yards. But Mr. Repton steams them, mixing turnips and their liquor with chaff, cut by horse work, and giving it with much success to young cattle, &c. And Mr. Reeve, of Heveringland, draws the largest turnips, and throws them on ollonds, or wheat stubles: he has thrown sometimes on wheat, and if the land be light, it answers very well in this intention."

It is stated further, that "Mr. Bircham, of Reepham Hackford, reckons that twenty acres of turnips will muck in the consumption twenty acres of ollond, especially if thrown for sheep; and leaving enough for eating on the land; so that if more was left, the barley would not be the better, but, from its bulk, perhaps worse. In drawing the large turnips, they go only in the furrows, picking up all that are broken by horses or wheels, using small carts with two horses; often drawing in this manner, more than half the crop." And it is added that "Mr. Johnson, of Thurling, used to be very fond of par feeding bullocks, but has left it off for two or three years past, now feeding them on the land: he draws part, and feeds part, picking out the great turnips; by which means he improves forty acres of land, by growing twenty of turnips; prefers throwing on wheat stuble to jamm it in for barley, which answers better than haulming." And "in feeding turnips by sheep, he remarks, that it is right to begin at the poorest end of a field, or where the worst crop is, as the flock, by falling back, will double dress it. Hay is beneficial to give to sheep while at turnips; but they will fatten without it." And he thinks "that it is wrong to top turnips for fatting beasts; the top being beneficial, if freed from slime and rotten leaves."

But it is the practice with "Mr. Reeve, of Wighton to feed on the land by sheep: of all practices he most condemns drawing turnips; it is a heavy expence, and all to do mischief: far better to buy oil-cake." And "Mr. M. Hill wishes to feed on the land all that is possible; draws no more than for converting straw to dung. Mr. Dursgate is also such a steady friend to feeding turnips on the land by sheep, that he would not have a bullock on his farm, except for the purpose of treading his straw into muck. He would have no straw eaten. In drawing a crop for beasts, he takes all, and manures with rape-cake, to supply the loss to the barley. And "Mr. Styleman, at Snettisham, feeds all his turnips on the land with sheep; and therefore sells most of his bullocks in autumn. Much the greater part at Hillington also fed on the land by sheep."

Thus the practice of feeding this root upon the land would seem most adviseable.

But in feeding turnips off by all sorts of animals, very great attention should be paid on their being first turned upon them, that they do not remain too

long, otherwise they will be much injured by the distention which is occasioned by their eating too greedily of them, and being thereby diseased.

It is mostly necessary to preserve this root by some means or other, during the winter season, where it is to be employed for cattle or other stock, to prevent its being destroyed by the frosts and thaws. But though many different methods have been attempted, the only secure way of guarding against the effects of intense frosts in such severe seasons, is probably that of having them drawn, topped, and piled up with dry straw in houses constructed for the purpose, contiguous to the cattle-sheds, or feeding-stalls; but which are liable to objection, as being both troublesome and expensive, especially where turnips are cultivated upon an extensive scale. Another method which has been found very effectual, less expensive, and attended with but little trouble, is that of stacking them upon the field where they are raised, with layers of dry straw betwixt them. It is practised in Hertfordshire, where they use one load of straw to about thirty or forty tons of turnips. According to the Survey of Middlesex, the mode of performing the business is this: "the turnips being drawn during a dry time, and the tops and tap-roots removed, a layer of straw is spread on a dry part of the ground, and a layer of turnips placed upon it to the thickness of eighteen inches or two feet; after this another layer of straw, and then a layer of turnips, proceeding alternately in the same manner till the heap or stack is brought to a ridge or point; when the edges of the different layers of straw are turned up, which serves to prevent the turnips from falling out, and at the same time affords a sort of external covering to the heap, which is completed by being thatched well over the top with long straw.

"They have also been attempted to be preserved by being formed, without straw, after the tops have been cut off and used as a green food, into what are termed pies, in the way that potatoes are sometimes kept, being well thatched over on the outside."

It is stated in the Norfolk Report, that "the Rev. Mr. Hoste practised a method with this intention, that answered well; he took the coulters out of his ploughs, and then ploughed in the turnips; and they held good through a very bad March."

And "the Rev. Mr. Munning has published his method: it is drilling at eighteen inches and two feet, and ploughing furrows between, to bury them as well as may be effected. This method has been, it is said, practised with great success by Mr. Repton, at Oxnead; and other farmers."

And it has been supposed by some, that the difficulty of getting them up, and the dangers they are exposed to during frosty seasons, as well as the inconveniencies the cattle experience in feeding upon them from their coldness, and the danger of their injuring the land, may be prevented by piling them up in small heaps or stacks, the tops outwards, near to the places where they are intended to be consumed, with a little straw between the different layers, covering them over with wattles or hurdles lined with straw, as suggested above.

It has been observed, that "the practice of drawing the turnips, cutting off the tap-roots, and carting them to a piece of pasture-ground adjoining the farm-yard, to be set together upright upon their bottoms as close as possible, has been found successful in some districts. And Mr. Dean, in speaking of the practice of a farmer, remarks, that he got, he said, his turnip seed into the ground early in June; and in October, by which time the turnips would have grown to a large size. He had the largest of them drawn without injuring the leaves, and then placed close to each other on the grass in the orchard, in the same position in which they grew. Their leaves preserved them from external injury, and their tap roots put out in a short time other fibrous roots into the grass; which in orchards is generally long in the autumn: and that the turnips were preserved good for use."

In Essex, according to the Report of that district by Mr. Young, Mr. Parker's method of preserving turnips from the severity of the frosts is this: "lay the land upon three feet ridges, upon each ridge drill two rows in the centre, about twelve inches apart; as soon as the turnips are grown to a tolerable size (some time after hoeing) go between the ridges with a double-breasted plough having high mould-boards to throw the mould upon the bodies of the turnips. The operation may be repeated if sufficient mould be not thrown on the first time. Turnips drilled in this manner have been found to grow much larger, and to be on the whole a much better crop, than those which are sown broadcast, the double-breasted plough drawn by one horse, used on this occasion affords an excellent opportunity of clearing the furrows." It is observed in the Suffolk Report, that in the former of these practices the growth of the tops is "but little interrupted, consequently afford a full compensation for any waste of bulb that may take place. And it is believed that the quantity of nutritious food is increased. The business is best performed when the weather is dry and windy, as the tops are then less brittle, and the roots in the cleanest condition."

It has been suggested by the author of Practical Agriculture, as "not improbable but that turnips might be well preserved against severe frosts, at least on a small scale, by the application of straw, fern, or any similar light substance that has the power of resisting its operation, along the rows as they stand in the field, as is frequently practised in the garden culture of different kinds of vegetables. Such sorts of materials might be applied in a cheap, convenient, and expeditious manner, by women and children; proper means, according to circumstances, being provided for securing them upon the plants; the matters thus employed being afterwards either removed or turned into the soil, as may be found most suitable and convenient to the cultivator."

In all cases of preserving this root in heaps, care must be taken not to have them too large in size, or too closely heaped together, as the danger of their heating and being spoiled may be obviated in a great measure in this way. In this mode the turnip may be preserved as a winter and a spring food

for live stock, in situations and seasons the most exposed and severe, which under different circumstances is a matter of much consequence to the farmer.

The statements given below, show that the produce in seed as well as quantity of food in the root of the plant are very considerable, where crops of this kind are managed in a proper manner:

Produce in Seed per Acre.

	Bushels.
On fine friable loamy soils -	from 24 to 28
On inferior stiffer soils -	from 16 to 20

Produce in Root per Acre.

	ton.	cwt.	qr.	st.
Where set out so as to stand one foot square, or 26 10 turnips on the acre, at 8lb. each - - -	9	8	2	2
And at 14lbs. each they will weigh	16	10	0	0

The weight of cattle food in these crops have likewise sometimes risen much higher than even this last quantity.

Turnip-*Cabbage*, the name of a variety of the cabbage, so called from the stalk, at some distance from the ground, after rising of the usual thickness, and in the manner of those of other cabbages, enlarging suddenly to such a degree as to form a knob or bulb as large as the turnip, and of which it has likewise somewhat of the figure, though it is in general more oblong. See *Cabbage*.

Turnip-*Drill*, that sort of drill machine which is employed for the purpose of sowing turnip seed in the row method. There are a great variety of machines of this kind that are made use of in different districts of the kingdom, but those of the improved kind which are in use in Northumberland and Berwickshire, are probably the best. See *Turnip* and *Drill Plough*.

An useful instrument of this sort has been contrived by Mr. Bailey, for sowing turnips on the tops of one-bout ridges. In this implement the defects of sowing too much or too little seed are obviated. It consists of a solid cylinder, made of iron or brass, about two inches in diameter and one inch broad, on the surface of which are formed fifteen or sixteen cavities resembling the form of a semi-egg when cut longitudinally, and as deep as to hold four or five seeds each. On the back of the cylinder, a little from the top, is placed the hind part of the hopper, to which is fixed a piece of iron, or brass, one inch long and half an inch broad, hollowed on the inside into the form of a gothic arch, the sides of which meeting the sides of the cavities in an oblique angle, prevent the seeds from being bruised: at the lower end of this piece of iron, or gatherer, there is a slit three-tenths of an inch long and one-tenth wide; and at the back of it, a thin flat piece of iron moves up and down, by means of a screw at the top of the hopper, which enlarges or lessens the orifice directly above the cavities, and increases or diminishes the quantity of seed delivered, as the operator may think proper. This slip of iron, or regulator, is let into a groove made in the board which forms the back part of the hopper. The cylinder is fixed before the cavities are made, on an iron axle one inch square, turned very true, as well as those parts of the axle which turns in the collars fixed in the handles. To the ends of the axle, two wheels, twenty-six inches in diameter are fixed, which turn the axle and cylinder round, and which in passing through the hopper containing the seed, bring forward in each cavity a number of seeds and drop them into the spout, by which means they are conveyed to the coulter, which forms a channel on the top of the one-bout ridge in order to receive them. It is seen at *fig.* 7, and another at *fig.* 8, in *Plate* XXXI. in the first volume.

If the cavities in this drill be made to hold five seeds when the regulator is screwed close down and there be sixteen of them, it will deposit eighty seeds each revolution; and from the diameter of the wheel being twenty-six inches, and the circumference eighty-one inches and a half, eighty seeds will be sown in eighty-one and a half inches, or nearly twelve foot. This being the minimum quantity, by screwing up the regulator the number may be increased gradually to fifty or sixty in a foot; which is far more than is necessary, except in particularly unfavourable situations.

Turnip-*Fallow*, that sort of preparation for turnip crops which is made by repeatedly ploughing over the land. The most improved method of accomplishing this business is, according to Mr. Young, is that of not having the turnip fallows that received an autumnal ploughing ploughed again till the surface operations in March have stirred and loosened the earth, to favour the vegetation of weeds. This is best done by scarifying or scuffling. These tools will do their work if they are well constructed, to any depth the farmer may wish, and this tillage keeping the surface that has been pulverized by frosts, unburied, is much more favourable to the growth of weeds, than turning it down by ploughing. The work also is done much more rapidly, which, at so busy a season, is an object of great consequence."

But notwithstanding this excellent practice, much must constantly in such work depend on the nature and situation of the land. See *Fallowing of Land*.

Turnip-*Hoe*, that sort of hoe which is made use of in the culture of this excellent root, and is either of the hand or horse kind, but the latter is the most effectual; though both are frequently made use of in raising crops of this sort. See *Turnip-hoe*, and *Hoeing*.

A valuable *hoe*, or *turnip-chopper*, has been lately recommended by Mr. Malcolm, the use of which is at present chiefly confined to the county of Surrey, but which deserves to be adopted in other districts where cattle feeding is an object. It "is first made like the common nine-inch garden-hoe, forming an oblong square, with an eye to receive the handle: from the centre of the first hoe another hoe crosses it at right angles but this second hoe is not made solid as in the first common hoe, but is made like a Dutch hoe, the centre part of it being open the whole length of it. The turnip being pulled out of the

ground by the angles of the hoe, is immediately struck with it about the centre which divides it into four, and and if these four pieces are not small enough, the stroke is repeated upon each of the pieces until they are sufficiently so." It is supposed capable of being greatly improved "by having two stoutish prongs on the back or reverse part of the hoe, proceeding from the neck of the eye; these prongs would pull up the turnips with infinitely more expedition, and the increased weight of the hoe would rather be in its favour by lessening the force necessary to split the roots. The whole expense is so trifling, and the simplicity of it is such, as greatly to enhance its value."

By means of this tool "the shepherd may take up the turnip, and slice it by one or more strokes into as many divisions as, according to the size of the root, each piece may be sufficiently small either for lambs to take into their mouths, or (which is of more immediate consequence) to enable the *crones*, or old toothless ewes, to fatten with nearly equal facility as the young ones do; as they are capable of picking up these pieces, and by a toss of the head can throw them into the further part of the mouth to the grinders. Thus they are enabled properly to masticate the root, when they would otherwise find it very difficult to supply themselves with a sufficient quantity of food by the usual method of nibbling the turnip, either while it is in the ground, or after it is picked up without being so cut."

Turnip-*Rooted Cabbage*, the name of another plant of the cabbage kind which has been found useful as a cattle food. See *Cabbage*.

Turnip-*Slicer*, an implement of the cutting kind made use of in preparing this root for being eaten by cattle or other sorts of live stock. There are tools of this nature constructed on different principles, but those which have the greatest simplicity are constantly to be preferred.

At *fig.* 11. in *Plate* XXXV. is the representation of a simple but useful contrivance for this purpose; in which the turnips are cut by means of a knife fixed upon the fly wheel *a*, the roots being forced upon it through an inclined hopper or trough, as shown at *b*.

And in the Report of Hertfordshire, it is stated, that "Mr. Keate has a very simple and effective *turnip-slicer*, which cuts in common a bushel of Swedish turnips in a minute; three bushels in two minutes have been done. It is made by a wheelwright at Hatfield, and has much merit. It cost 2*l.* 12*s.* 6*d.*

Turnip-*Tray*, a sort of shallow moveable box or trough contrived for the purpose of sheep eating this sort of food, in order to prevent the waste which is apt to be committed where these animals are fed upon turnips. See *Turnip*.

Stubble-Turnips, such crops of this sort as are raised on stubble lands as an article of sheep-feed. And on good lands they are said to answer well and become very useful.

Swedish-Turnip. See *Ruta Baga*.

TURNIPING, the collecting of turnips for use.

TURNPIKE *Roads*, a term applied to such roads as have toll-gates established upon them. See *Road*.

TURN-SICK, in *Farriery*, a name signifying the staggers. See *Staggers*.

TWIFALLOW, a term applied to a second ploughing over, or fallowing the land.

TWIFALLOWING, the act of ploughing the ground a second time. It is generally done in June. It is sometimes written Twyfallowing.

TWILL, provincially a quill.

TWITCH, the name of a very troublesome plant of the weed kind, of which there are several kinds; as black, white, creeping, &c. See *Couch Grass*.

Twitch, in *Horsemanship*, an instrument used by farriers to keep the head of a horse in a particular position whilst he is undergoing any painful or unpleasant operation. It consists merely of a short stick, or roller, to the end of which is affixed a noose of cord, sufficiently wide to admit the animal's upper lip. The noose being twisted by a few turns of the stick in the hand of the groom, the horse is thereby secured from making any resistance.

TWITCH-*Rake*, the name of a tool of the horse-rake kind, used for dragging and collecting couch together in arable land. See *Couch-Rake*.

TYPHUS, in *Farriery*, the nervous, or low, fever.

TWO-FURROW PLOUGH, a double plough. See *Plough*.

TWO-FURROWING, a term signifying double ploughing; also trench-ploughing, and sod-burying.

TWO-MEAL *Cheese*, a term applied to the cheese made from the skimmed evening's milk added to the new milk of the morning's meal, that from the neat milk being one meal. See *Cheese*.

TYROSIS, in *Farriery*, a coagulating or curdling of milk in the stomach, after the manner of cheese.

TYTHE. See *Tithe*.

U

UDDER, the glandular organ of a cow, mare, ewe, or other animal, which is destined for the secretion of milk.

The udders of young cows that are in a high condition, are sometimes greatly swollen, and inflamed for several days before they calve, in which case it will be proper to milk them repeatedly, and alternately to anoint the distended udders with cooling ointment and brandy. Besides these swellings, the udders of the cows are liable to injuries, which are often of serious consequence, by falls, blows, wounds from sharp or pointed instruments, by the violent sucking of calves, and also from the injudicious or rough treatment of harsh or inexperienced milkers. While the inflammation remains in an indolent state, the parts affected ought to be repeatedly anointed in the course of the day with fresh butter, or with salve consisting of one ounce of Castile soap, dissolved in one pint and a half of new milk over a moderate fire, constantly stirring it till it be thoroughly incorporated. An ointment prepared from the juice of the leaves of the common thorn apple (*Datura Stramonium*) mixed with hogslard, is likewise said to be an excellent application for swollen udders; or the tumour may be anointed with a little mixture, consisting of camphor and blue ointment, about half a drachm of calomel, being given in a hornful of warm beer, three or four mornings, if the malady continue to increase: where, however, the udder and teats are considerably inflamed, internal remedies should be resorted to; for this purpose it has been recommended to mix four ounces of nitre with one pound of common salt, and to give two table spoonfuls of the powder in a gallon of thin water gruel every three hours. But in case the disorder should, from neglect, have made such progress as to exhibit hard tumours, the following fomentations may be applied. Let one handful of common hemlock (*conium maculatum*), a similar quantity of the dwarf or round-leaved mallow, (*malva rotundifolia*), and the same proportion of common melilot (*trifolium melilotus officinalis*), be boiled in a sufficient quantity of water, and diligently applied, as warm as the beast can bear it. As soon as the tumour opens, let the sore be properly cleansed, and then cover it with a plaster of Turner's cerate, or of basilicon ointment. The annexed remedy has also been successfully employed in obstinate cases of ulcerated udders:—take of gum ammoniacum and gum galbanum, Castile soap, and extract of hemlock, of each one ounce, form them into eight boluses, one of which should be given every morning and evening: and when the teats only are sore, they may be washed with clean warm soap suds, and rubbed with an ointment, consisting of pulverized cerusse, or white lead, that has previously been saturated with brandy, mixed or incorporated with a sufficient quantity of goose greese or elder ointment.

When the lambs are yeaned, the lactiferous ducts of the ewes' udders are also liable to various obstructions, in consequence of hard tumours being formed, which are accompanied with inflammation, and which, if not shortly relieved, will terminate in a mortification in 24 hours. As soon as such tumours are discovered, the wool must be shorn closely off, and the part affected be frequently rubbed with camphorated spirit of wine. Should suppuration ensue, the parts should be opened with a sharp knife or razor, and the morbid matter be discharged,

when a little fresh butter, or any common healing salve, may be applied to the wound. Ewes when thus affected ought to be kept separate from the flock, and though one teat may be lost yet they may be allowed to suckle their lambs: but when both teats are affected, there is no alternative but to fatten them off for sale, and to bring up their lambs by hand as well as possible.

ULCER, in *Farriery*, a solution of continuity in some fleshy part of the body of an animal, with loss of substance. The term ulcer is by some confined to that breach or erosion of the skin and parts immediately adjacent, which either proceeds immediately from an internal cause, or at least is closely connected with a particular state of the constitution. But others divide ulcers into two classes; the simple and the compound: the former being a mere wound which is capable of being restored by nature without the assistance of art.

But though an ulcer may be supposed to proceed from a vitiated state of the habit, all common sores may also be reckoned ulcers, when they degenerate and contract an ill disposition, whether they take their origin from an internal or an external cause. Of course they are of various kinds, according as they are owing to these different causes. Wounds, bruises, and other accidents, ill treated or neglected, occasion ulcers; as well as a depravity of the blood and juices, which in the first instance only produce tumours. Of this kind are the poll-evil, fistula, &c. Some ulcers are also internal in the lungs, liver, kidneys, or other viscera, where they produce wastes and decays, and some are among the joints and ligaments. But there are also other distinctions made use of in describing ulcers, as *sinuous*, *fistulous*, *putrid*, *scrophulous*, *cancerous*, &c.

A simple ulcer is superficial, attended only with foulness, and hard or uneven edges raised above the surface of the skin. A compound ulcer, properly, is when not only the flesh is ulcerated, but a caries exists in the bone, with other symptoms. A cavernous ulcer is that which has a small narrow entrance, with a wide spreading bottom. Those ulcers that run aslant, proceeding from abscesses between the muscles or their tendons, are called sinuous ulcers; and those that are tubular, smooth, and callous on the inside, and run in several meanders, are called fistulous. And where there is a great efflux of foetid matter, with swelling, inflammation, and inward sickness, such ulcers are called putrid. Cancerous and scrophulous ulcers are usually seated on the glands, and may be distinguished by their proper diagnostics: the scrophulous ulcer being more slow in its progress, and less offensive; whereas the cancer extends rapidly, and makes great havoc on the part, and seriously affects the whole constitution. Varicous ulcers are situated among the veins, and are always soft and distended with blood. Of this last kind are many that happen to horses in the farcy and some other complaints.

It is found from experience that simple and superficial ulcers on the skin are not, in general, difficult of cure; but sometimes their edges rise above the surface, and grow callous, in which case they require some time before these can be cicatrized. An ulcer or caries in the bone is necessarily more tedious and difficult to cure than an ulcer in the flesh, and the difficulty is more or less, in proportion to its situation, and the causes from whence it proceeds. Cavernous ulcers often become so, merely by their situation in places where bandages cannot be applied; but are not so troublesome as sinuous ulcers, especially when the sinuosities terminate near the joint, for then they are often attended with great difficulty. Fistulous ulcers are attended with all the same difficulties, or rather greater, being often situated among the joints, and other inconvenient places; a circumstance which, to horses, is of bad consequence, and, for the most part, renders them of little use, even when a cure is effected. Putrid ulcers are always dangerous, as proceeding from a bad state of the constitution; and when they discharge very great quantities of foetid matter, they are apt to end in mortification. Cancerous ulcers are of no less ill consequence, only that there is more respite given; for horses will live languishing a considerable time with cancerous and other anomalous ulcers, as in some kinds of glanders, and sometimes in the farcy, till they are quite extenuated, and the cure in such cases is for the most part impracticable. Varicous ulcers among the blood-vessels are spongy, and hard to manage, discharging, for the most part, a bloody ichor. Of this kind are also some of those ulcerations that creep along the veins in the limbs, where they are both troublesome and difficult of cure, on account of the animal's exertions; but a single varicous ulcer may be easily healed by suitable applications and the proper use of bandages.

In the cure of those sorts of ulcers that have not been already noticed under other heads, the following methods may be pursued with success.

1. The *simple ulcer*. This, according to Gibson, seldom needs any other treatment than washing with spirit of wine, and then dressing it with pledgets spread with turpentine and honey. He advises that "if there be an itching with small pimples, to mix with every four ounces of the digestive one drachm of verdigrise in very fine powder, and apply it once a-day, or once in two days, if the running be small. If little papillæ or pimples arise in the bottom of the ulcer, of a faint red colour, to let the dressing be mixed with precipitate; viz. a drachm of precipitate in fine powder to every two ounces of the digestive." Where the ulcer is deep, and does not fill up in a kind manner, as happens to some weak declining constitutions, bark and other strengthening remedies, and good keep, must be had recourse to, and the part dressed in the following manner:

Take of Common turpentine, four ounces;
The yolks of two eggs:
Incorporate these well together; then add,
Myrrh, in powder, half an ounce;
Mastic, or frankincense, in fine powder, two drachms;
Tincture of myrrh, a sufficient quantity to bring it to a due consistence.

And the ulcer may be dressed every other day with this digestive, washing it first with brandy, spirit of wine, or tincture of myrrh, or any similar application.

It is found that the common black basilicon, made of pitch, rosin, and bees-wax, with oil instead of hog's lard, will greatly promote the cure of these ulcers where there is a poor weak blood. The common yellow basilicon will do the same. The latter is advised to be compounded, by Gibson, in the following manner; and, he says, it not only makes a proper dressing for such ulcers, but is useful in many other cases:

Take of Yellow wax,
Yellow rosin,
Burgundy pitch, of each three pounds;
Common turpentine, twelve ounces;
Linseed oil, three pounds six ounces;
Melt them over a slow fire into an ointment.

And the black basilicon is directed to be thus prepared.

Take of Yellow wax,
Rosin,
Pitch, of each half a pound;
Olive oil, nine ounces;
Melt them together, and strain through a piece of canvas.

It is supposed that either of these will tend to fill up those ulcers that need it with good granulations of flesh; especially if proper remedies be at the same time administered inwardly. It is also advised that equal parts of antimony and gum guiaicum, be divided into ounce doses; one to be given every day, with good and nourishing diet, consisting of the best hay and oats, and water-gruel to drink.

But when an ulcer fills up too fast, and produces a quantity of fungous flesh, it may be repressed principally by dressing with dry powders, such as myrrh and calaminaris, or occasionally with red precipitate and burnt alum in fine powder, of each equal quantities, mixed; carefully avoiding all greasy applications. If the fungus be still troublesome, the ulcer may be dressed with lint or tow, first dipped in blue vitriol water, and then wrung out dry and laid to the ulcer. If the edges be callous, and make a kind of rim round the ulcer, precipitate dressings always answer best; for which purpose,

Take either of black or yellow basilicon, four ounces;
Oil of turpentine, one ounce;
Red precipitate, in fine powder, three drachms, or half an ounce. Mix.

According to some, this method has been found to succeed better with horses than either cutting the callous edges off, or eating them down with caustic, or with the actual cautery. Though somewhat slower, it is supposed more safe, not being so apt to produce inflammation, which instead of destroying the callosities, frequently renders these ulcers more obstinate than before, and more liable to fungus."

2. *Cavernous ulcer.* In this sort of ulcers, where they are deep, narrow at their entrance, and wide at their bottom, they require to be laid open, or else the orifice to be widened by a caustic; so that no matter can lie concealed. Where the ulcer is in such a situation that it can be laid open with safety, and the habit of body is good, it may be cured with the same ease as a simple flesh wound, by observing the same methods as in the former case. But when it does not fill up by the means already directed; and if it be found, on probing the part, that it has also sinuosities; it must then be treated in the manner of a sinuous ulcer.

3. *Sinuous ulcer.* This is a sort of ulcer which should be laid open, without loss of time, by incision; provided acrid injections, such as the solutions of blue vitriol, alum, or corrosive sublimate, have been previously tried, and where bandage cannot be used; for when these are suffered to continue long, they will run deeper and deeper, and often among the tendons and interstices of the muscles, so as, at last, to make their way to the bones, which become carious, and the cure then becomes both tedious and difficult.

4. *Fistulous ulcer.* This commonly takes place in this manner: First, there is inflammation and a tumour, that forms an abscess; and if this last is not cured by incision, and proper pressure applied, the discharge penetrates deeper, and forms a sinuous ulcer; and when this has existed long, or when it happens to an unhealthy animal, several sinuses form, and the matter makes its way from one to another by small tubes, or communicating passages; in which cases the inside is generally lined with a callous coat or membrane, so that no re-union can take place till these communicating passages are laid into one, and their callosities destroyed. This, by proper incisions, may be done; and the parts should then be dressed with levigated red precipitate, or with pledgets dipped in a solution of blue vitriol, or with phagedænic water, which may be made with two drachms of corrosive sublimate (known to the farriers by the name of white mercury), dissolved in a quart of lime-water: and in some obstinate cases, it may be made stronger by increasing the quantity of the sublimate.

It sometimes happens that, by injudicious treatment, common abscesses are converted into sinuous and fistulous ulcers. These of themselves would perhaps have no such tendency; but a bad practice exists amongst common farriers of introducing long hard tents, by which the muscles are separated in the same manner as a piece of timber is cleft with a wedge, and thus by tearing the membranes the abscess grows deeper, and even sometimes runs into sinuses that lie out of the reach of common applications. The same thing is often promoted by a frequent and unnecessary use of the probe. In an abscess, the weight of the matter collected in it occasions an easy separation of the contiguous cellular membrane, so as to yield easily to a slight force applied by a rude hand, and to form deep sinuosities; to prevent which, the parts ought in all such cases to be kept as firm and close, by a bandage, as they are able to bear, or a depending opening may be made for the passage of the matter in another direction, or a seton may be introduced for the purpose, so that by one or other of these methods many bad accidents may be prevented. See *Seton*.

5. *Putrid ulcer.* This, whatever is the origin, always exists under an unfavourable state of the constitution, consequently the cure of it requires internal means, such as are proper in malignant diseases. Externally, cataplasms of mithridate, and the treatment, in every other respect, that would be required in a case of apprehended mortification, is advised by Gibson.

6. *Varicous ulcer.* In the cure of this ulcer, it has been advised to bathe with restringent fomentations, made of pomegranate or oak bark, of each a handful; with alum and white vitriol boiled in vinegar. "The matter of these ulcers is generally, it is said, a thin bloody water, which will thicken or dry off by this method. If the vessels continue relaxed after the ulcer is healed up, firing will be proper to strengthen the part, by contracting the coats of the veins that feed the ulcer: and in some cases it may be made so deep as to cut off their communications." Watery ulcers, which have some affinity to the varicous, occur in horses with the farcy, and other similar diseases.

The *Cancerous ulcer.* This is a sort of ulcer which sometimes exists with the farcy and glanders; but besides these, some horses are subject to cancerous warts, which, when they are deep seated are apt to degenerate into true cancers. And Gibson asserts that he has known cancers take their rise from rowels injudiciously placed in glandular parts.

It has been found a ready mode of curing old ulcers, to draw and support their sides together by means of slips of sticking plaster, in the legs of old people, and may be equally useful in those of brute animals. It is a method introduced by Mr. Baynton, of Bristol.

ULGINOUS, an appellation sometimes given to a moist, moorish, and fenny soil.

UMBEL, the extremity of a stalk or branch of a plant, divided into several peduncles, or rays, beginning from the same point, and opening in such a manner as to form an inverted cone.

UMBELLIFEROUS *Plants*, those whose flowers are produced in an umbel, on the top of the stalks, somewhat resembling an umbrella. Of this kind are fennel, parsley, parsnip, carrot, hemlock, &c.

UMBILICAL VESSELS *of vegetables*, a name applied by Dr. Darwin to the vessels which pass from the heart of the seed into the seed lobes, and thence imbibe a solution of farinacious or oily matter, there deposited for the support of the new vegetable. They are therefore supposed to perform the office of supplying nourishment to the infant plant, and of oxygenating the vegetable juice or blood.

UNDER-*Draining*, the forming of drains under the surface of the land. See *Draining of Land.*

UNDERGROUND-*Draining*, a term signifying the same.

UNDERLETTING *of Land*, the practice of reletting lands, or the letting of them by tenants. It is a matter of much importance to the public and the advancement of husbandry, that tenants should have the power of underletting or assigning their farms.

It is remarked, in the second volume of the Farmer's Magazine, that, by the law of England, "leases are not only assignable, but the proprietor of the farm must, on an assignment of the lease, declare his election, whether he inclines to hold the original lessee bound for his rent, or trusts to the assignee, as he cannot have both; and, on the whole, a lease, whether granted for a long or short term of years, seems to be held, there, under as ample powers as the proprietor might have possessed the ground himself, for the period of the lease."

But, that in Scotland, "from the present interpretation of the laws, by the decisions of the Court of Session, a tack of lands does not imply a power either to assign or even to subset, although, in the latter case, both the principal lessee and subtenant were always understood to be bound for the rent to the landlord.

"Tacks, in general, are, by the commentaries of their lawyers, considered as unassignable, from their being supposed to imply a *dilectus personæ*, or election of the person of the tenant by the landlord: Yet it is admitted, that a life-rent tack is assignable, which surely implies more of a *dilectus personæ* than any other. All tacks, likewise, that are to subsist for a great length of time, are also assignable, as well as subsettable; but, rather unfortunately, the length of endurance necessary for conferring this privilege, hath not been fixed by law. By a late decision of the Court of Session, in the case Simson against Gray, 22d May, 1794, it was found, it is said, that a power of subsetting was implied in a lease of thirty-eight years. With submission, there seems to be no solid ground for any distinction, in judging a tack assignable or unassignable, derived from the length of its duration merely."

It is added, that, "by the feudal law, this *dilectus personæ* was carried so far, that even an heir was not permitted to enjoy the tack of his father, unless it was so expressed in the lease. What an obstacle, this, to the improvement of the soil! And does not the exclusion of assignees in tacks, remain an obstacle of the same nature? What an incentive, on the other hand, to industry, if a tenant, who had successively improved one farm, had it in his power to assign his tack, and remove to a new and wider field for exercising his talents! Nor does there seem to be any sound reason, that a tenant, who now-a-days, generally buys his tack, as the highest bidder, at a public or private sale, should not have it in his power to sell it again, to avoid loss, or obtain profit, to any person able to pay the rent, as freely as a proprietor of lands sells his property, when he finds it does not suit his views. This plan would be much more reasonable than that the law should force a tenant to remain in a farm he cannot manage, till he is utterly ruined; as is but too often the case." And that, moreover, if a tenant does become bankrupt, it is hardly to be expected, that an adjudger, who enters to his farm from necessity, and is accountable as a factor, will do any thing for the improvement of it: for it is held as law, that a tack which bears no

power to assign, may yet be adjudged by a creditor of the tenant. Expediency may, therefore, in every view, be strongly urged in favour of a more unlimited power in assigning tacks.

It is farther stated, that "the idea of a *dilectus personæ* seems to have arisen from circumstances of a temporary nature, now no longer of consequence; from the rudeness of the age, landlords then relying more on the fidelity of their tenants and retainers than on the protection of the laws, from the municipal regulations of the country, which rendered proprietors of the land responsible for the conduct of those who resided on their estates; and also, from the nature of the prestations then exigible from tenants, which, consisting almost entirely of personal services, brought them nearer the state of menial servants than that of modern farmers. Hence it was, that a lease, during these periods, was considered as a contract *stricti juris*. If given to a woman, it fell by her subsequent marriage. If to a man, it became void by his death. It was alike incapable of voluntary, as of judicial transmission. But, for more than a century past, this contract having been treated by the legislature, and wisely enforced by our judges, in conformity to the sense of the country, has regained much of its original nature. It is no longer the personal services of the tenant, or his peculiar qualifications, but the rent, in money, which he can afford to pay, which a landlord has in view. Accordingly, the Court of Session have found, that the principle of law, regarding tacks not bearing to assignees, being unassignable without the consent of the heritor, does not apply to urban tenements; and, on that principle, on a question, as to a tack for thirteen years, of a house in a burgh, it was decided, it might be assigned without the consent of the proprietor.—Kilkerran and Falconar, January 7, 1748, Aitcheson against Benny."

And that "as to subtacks, Mr. Erskine observes, there was not the same reason against sustaining them as against sustaining assignations; because, by a subset, the principal tacksman is not changed. On that principle, the power of granting them seems to have been ever, till of late, recognized as implied in a lease, by our law, as it was by the Roman law. This power, however, was questioned in the years 1686 and 1687. The first case was of a tack of nineteen years let to a person, secluding his assignees. It was contended, that the exclusion of assignees, implied the exclusion of subtenants: but the Court of Session decided, that the tack might be subset. Sir James Roughhead against Mudie.—And to the same judgment, the court adhered in a similar case decided the following year: Maddar against Lord Tarras."

It is stated, that "this implied power in tacks, of subsetting, seems to have been understood to be a settled principle of law till lately. But that material point of public policy, was not altered by any act of the legislature, but by a decision of the Court of Session. It was first considered on general grounds, in the case of the Earl of Peterborough against William Milne, decided 8th March, 1791. A missive of tack, to endure nineteen years, which made no mention of assignees or subtenants, was, by the Court, found neither capable of being assigned nor subset." And that "there have been several decisions since to the same purpose; but as none of them have hitherto been appealed, and received the judgment of the House of Peers, till then it is understood that the law is as interpreted in the case of Milne above mentioned. The writer had himself a similar question decided against him by the Court of Session; and considering the judgment to be erroneous, and such as would not be supported by the Court of Review, he appealed it; but the matter was, before a decision of the Peers, submitted to arbitration. He recommends, that the first similar case that occurs should be appealed by a subscription of farmers. And he cannot help thinking that it would be more conducive to the improvement of the country, if all restrictions against assigning and subsetting were abolished, than that the free disposal of property should receive, by implication, additional fetters."

The necessity and utility of this must be evident in many points of view. See *Farm*.

UNDERSTRATUM, a term signifying the same as subsoil.

UNDERWOOD, a term applied to coppice, or any wood not accounted timber. See *Coppice* and *Wood*.

UPLAND, such as is situated in a high elevation, or much exposed, from the height to which it is raised above the other surrounding lands.

UPLAND *Farm*, that sort of farm which has a high situation, and which from its being dry, and the grass mostly short, is in general conducted under some sort of sheep husbandry. The Downs and sheep walks in different parts of the kingdom are of this kind.

URE, a provincial term applied to the udder of a cow, sheep, &c.

URINARIUM, a sort of reservoir or place constructed for the reception of urine, and the liquid matters discharged from the stables, cattle sheds, pig sties, and other places about the farm yard.

A receptacle of this nature is essential to every well contrived farm yard, as by blending vegetable, earthy, and other materials with these liquids, a vast increase of manure may be provided. They should be formed in the most shady parts of such yards, and be well connected with the buildings destined for the cattle, horses, &c. In particular situations, they are likewise so contrived as to be capable of being discharged over the grass lands below them. An useful reservoir of this sort is described by Mr. Pew, in the seventh volume of the Bath Papers, in which cow-stalls are placed on the side of a nap, or small elevation, and by means of gutters behind, the liquor is conveyed into a sink which runs under the stable, where it meets, by the help of another drain or sink, with the stable liquor; and these, with that of the pig sties, run through an under-ground drain into the receptacle or reservoir. It is the practice of the proprietor to put all sorts of refuse vegetable and animal matters into this receptacle, where it quickly rots, and when the weather proves moist he has it stirred well with poles, when it is discharged over a meadow

below, or any particular part of it by trenches cut for the purpose, which is in this way rendered astonishingly fertile and productive, as well as much more early than even watered lands. It is suggested that this plan might be extended by having the stables placed on the centre of a knoll; in this case three or four reservois might be formed, and that by stopping some drains and opening others, the fluid contents might be directed one year to one side and another year to another side as circumstances might render necessary. See *Farm Yard.*

URINE, a saline fluid secreted from the blood of animals by the kidneys, and emitted by the canal of the urethra.

It is of much use as a manure, being an extraordinary fertilizer of most kinds of soil. Columella has asserted, that old urine is excellent for the roots of trees. And Hartlib commends the Dutch for preserving the urine of cows as carefully as they do the dung, to enrich their lands.

It is a fluid capable of being employed with great benefit both on *meadows* and on *arable* land, which renders them uncommonly fertile. In the former case, the best time for *sprinkling* the fluid is during the winter, when the rains will wash the fertilizing saline particles into the soil; or, the land may be *sprinkled* early in the spring, when it is laid up for hay: because no cattle will touch the grass so long as the salt adheres to the blade. Another circumstance necessary to be attended to, in order to make the most of this valuable manure, is, that it be carried to the meadow or pasture, intended to be watered, in dry weather, as the farm yard liquor in the reservoirs is at that time strongly impregnated with salt, which may be known by its deep brown tinge. Thus the reservoirs or ponds appropriated for its reception, may be constantly kept in a state of readiness for that purpose; while the land may be watered or sprinkled as often as occasion may render necessary.

It is remarked by a writer, in the fourth volume of Communications to the Board of Agriculture, that the powerful effects of urine in promoting vegetation are generally known; but he does not recollect to have met with any experiments on its salts, tending to show their distinct effects. There are two sorts of salt, he says, in urine, the *soda phosphorata*, or phosphorated mineral alkali; and the *ammonia phosphorata*, or phosphorated volatile alkali. And he states the following experiments.

"On the 11th of August, 1803, he filled three flower pots, holding about a quart each, with sifted gravel from Epping Forest. No. 1. was left unmanured; No. 2, was manured with five grains of *soda phosphorata;* and No. 3, with five grains of *ammonia phosphorata.* On the same day he sowed nine seeds of garden cress in each pot; which were equally supplied with water, by pouring it into pans in which the pots were placed.

"On the 18th of August, the plants had made their appearance in all the pots, and there was no perceptible difference. On the 26th, the plants in No. 2 and 3 were about equal, and greatly superior to those of No. 1. He finds that he that day diminished the number of plants, leaving five of the strongest in each pot. On the 3d of September, the difference was still increasing in favour of the manured pots. On the 27th of September, he put an end to the experiment, and weighed the plants, the roots being cleansed. Plants in No. 1. 40 grains; No. 2, 180 grains: No. 3, 188 grains.

"Thus it appeared, he says, that so small a weight as five grains of these salts of urine was capable of making the produce more than quadruple. The difference in their effects, weight alone considered, does not seem to have been remarkable; yet the appearance of the plants in No. 2 and 3, was very different. The weight of the plants in No. 2, lay chiefly in their stems, and two of the plants shewed blossoms. Of those in No. 3, the weights was principally in the crowns and roots, and only two of them had begun to advance their flower stems. He was afterwards sorry that he did not weigh the tops and roots separately, as the results must have been remarkable. Though the experiment lasted but forty-seven days, he is convinced that the plants in No. 2 were, on an average, ten days more forward than those in No. 3, and at least fifteen forwarder than those in No. 1. Whether the *soda phosphorata* will in general hasten the maturation of vegetables, deserves further trial. The *ammonia phosphorata*, however, not only yielded a greater weight of vegetable matter, but from the abundance of root, and the superiority of colour in the plants manured with it, evinced in this experiment, and in others which he has made, an evident superiority. He believes the *ammonia phosphorata* to be the cause of the luxuriant vegetation of corn at those places where the urine or dung of animals happens to fall. He has made an experiment with these salts on a bed of Swedish turnips in his garden. The *ammonia phosphorata*, in the quantity of sixty grains to a yard square has had an excellent effect. The *soda phosphorata* has also had a powerful effect, but of an opposite nature. For a time it seemed to be useful, but suddenly the plants manured with it were seized by a small yellow worm with many legs, which abounds in his neighbourhood. The plants have been entirely destroyed on that particular spot where the *soda phosphorata* was used. The spot manured with the *ammonia phosphorata* has apparently escaped. The other parts of the bed are injured considerably. When he states these marked effects from manures, at the rate of sixty grains to a yard, which is no more than forty-one pound and an half avoirdupois upon an acre, he is almost fearful of incurring the suspicion of exaggeration."

He adds, that he "cannot conclude these remarks without alluding to the importance which the ancient agriculturists attached to the preservation of urine. Columella, book the 4th, chapter the 8th, directs urine to be prepared and used as a manure for vineyards: he is so particular in his directions as to state that six sextarii or pints should be allowed to each vine. The practice of most modern farmers is as opposite as possible; for they not only suffer the urine of their cattle to flow away, but generally have

their dung heaps so situated that they are drenched and impoverished by rain, which conveys their most valuable ingredients into the next river. The more cumbersome materials which the water can neither dissolve nor sweep away are frequently alone reserved, to be bestowed, at a great expense, on the defrauded land."

He conceives, that "the quantity of most valuable manure which may thus be carried away is greater than is perhaps imagined. A few days ago, he obtained more than half an ounce of dry fœtid substance from one quart of human urine. Supposing the urine of cattle to be equally productive, every hogshead of it which flows out of a farm yard, without even any impregnation from the dung heap, carries away seven and an half pounds of solid matter."

It is however stated in the seventh volume of Bath Papers, that a friend of Mr. West's, a diligent and observing farmer, took the trouble one year to carry out all his stable liquor *alone*, without observing *any good effect*, and that he knew another person who had done the same thing without any better success.

These experiments, though they may serve to excite the inquirer into further researches on this interesting subject, are upon much too narrow a scale to be of any great practical utility to the farmer.

URINE, *Suppression of*, in *Farriery*, a disease arising from the want of making water. It is caused, according to Gibson, "either by an inflammation obstructing the functions of the kidneys, or when the ureters are obstructed by stones, or other foreign matter, or affected with any numbness or other defect, that may disable the kidneys in their office of separating the urine from the blood. In this case the bladder is generally empty, so that a horse will make no motions to stale, nor stand straddling as in other disorders of the urinary passages, when the bladder is full or the urethra inflamed; but if he continues a few days in this condition, without a secretion of the urine, his body will swell to a very great degree, and he will break out universally in blotches, and, without speedy relief, will die."

Where horses are subject to an obstruction in the passage of urine from calculi, which is rarely the case, "the proper method of cure is, according to Gibson, to begin with the strongest diuretics, with the use of stimulating clysters; and if there be a suspicion of inflammation in either the kidneys or ureters, it is proper to bleed plentifully, to the amount perhaps of three pints or two quarts. And he also advises the following balls to be given, and repeated two or three times the first day (for in such cases no time must be lost), and as often the next; for if a horse does not stale in thirty hours his case is desperate:"

Take of Juniper berries, in powder, one ounce;
Sucotrine aloes,
Nitre, in powder, of each six drachms;
Oil of turpentine, half an ounce;
Oil of amber,
Oil of Juniper, of each two drachms;
Liquorice powder, enough to make a mass of a suitable consistence.

This being two large for one ball, may be divided into two for one dose.

For a clyster, the following is advised:

Take of Barbadoes aloes, two ounces;
Turpentine, beaten up with the yolks of two eggs, two ounces;
Jalap, in powder, half an ounce;
Nitre, powdered, four ounces;
Juniper berries;
Bay berries, bruised, of each about a handful;

Let these be infused in two quarts of a decoction of mallows and marshmallows; then add,

Linseed oil, one pint. Mix.

Where these do not remove the complaint, he advises "to rub the horse's loins with a mixture of oil of turpentine and oil of amber, and to lay a cataplasm over the small of his back and kidneys, made of pounded garlick, mustard-seed, camphor, and soap. This, it is said, will prove beneficial as a stimulant to the kidneys, in case they happen to be deficient in nervous influence; and, in case of inflammation, the same remedy will act as a blister, without the danger of a strangury, and in that respect also do service.

"It should, he says, be spread, on a coarse flannel cloth doubled, bound on with a woollen cloth, and renewed once in two days till the horse comes to stale freely: calomel may also be of use in case the kidneys are not inflamed, viz. two drachms, made up in a ball, and repeated in two days; and after these the horse may be purged when necessary."

URITH, a term signifying etherings or bindings of hedges.

URIVES, a term applied to nets to catch hawks with.

URRY, a term applied to a sort of blue or black clay, lying near a vein of coal.

USTILAGO, a term signifying the same with burnt grain. See *Smut*.

UTENSIL, a domestic tool, implement, convenience, or moveable of any kind.

It is a point of great importance to have proper and convenient utensils in performing a great variety of processes in farm business, as without this be the case, great loss both in labour and the value of the products are frequently sustained.

In considering the nature and modes of conducting different sorts of operations in the management of particular departments of rural practice, the most suitable and best adapted utensils for the execution of the work, have in general been described. It may however be useful in this place to give a list of the prices at which they may be procured.

Cyder Utensils.

	L.	*s.*	*d.*
Horse mill and press	35	0	0
Hand mill	5	0	0
Hair cloths per dozen	3	12	0
Hogshead of 105 gallons, from 2 2 0 to	2	12	6

In the management of the dairy, the number of the utensils must be adapted to its extent. For about twenty cows, two whey-skeels, three milk-skeels,

six cheese vats, and two butter skeels, will be required. And the other utensils as below.

Dairy Utensils.

	L.	s.	d.
Cheese tub or cowl	1	10	0
Sieve and milk bowl	0	3	0
Barrel churn, iron work and stand	2	12	0
Common barrel churn	3	10	0
Harland's improved ditto	5	5	0
Set of vats lined with lead	3	3	0
Whey-skeel	1	1	0
Milk-skeel	0	8	4
Milk-pail	0	6	8
Cheese vat	0	3	0
Butter-skeel	0	5	0
Lade, or gallon bucket	0	1	6

UTE

	L.	s.	d.
Skimming-dish	0	0	10
Pair of butter scales	0	3	0
A brass pot for warming the milk	2	0	0
Cheese-press and cloths	10	10	0

Hop Apparatus and Utensils.

	L.	s.	d.
Hop oast, sixteen feet square, with proper stowage room from 150*l.* to 200	0	0	0
Picking basket	0	5	6
Scale beam, with weights and scales	5	0	0
Hop-shim	2	2	0
Hop-harrow	1	15	0
Iron peeler from 0 6 0 to	0	7	0
Hop-dog	0	5	0

V

VAGS, a term provincially applied to turfs for fuel.

VALE, any low grounds; a sort of valley.

VALLEY, a small hollow or depression between two hills: also a gutter or channel in a road.

VALUATION *of Land*, the business of ascertaining its real worth. It requires considerable knowledge of the nature of landed property, and the improvements of which it is capable by cultivation and other means.

Before entering upon it, the nature of the tenure, title, &c. should be understood. But Mr. Marshall supposes that the value of the *feesimple*, or pure freehold tenure, being ascertained, that of any inferior holding may, from this, be found by the general rules of calculation.

It is remarked, that "the feesimple value of lands is liable to fluctuation, by general causes; and is likewise actuated, and in a much higher degree, by local circumstances. Lands of the selfsame quality are, he says, of fivefold value in one situation, comparatively with what they are worth in another: not merely, though principally, on account of the rental value, or the current price they will let for, to tenants, in different situations; but through other less permanent causes:—as the quantity of land at market, and the number and value of purchasers, in a given district; as well as the temporary spirit which prevails in it, with respect to the temporary possession of landed property at the period." These are circumstances that are worthy of attention, by a purchaser whose views are not confined to any particular spot or district.

It is stated that, "the usual method of coming at the feesimple value of land is, first to ascertain the fair rental value, or price by the year, and to multiply this by the number of years purchase which the existing demand for land will bear, in the given situation, at the time." But that "the number of years purchase, or the ratio between the rent and the sale value of lands, varies greatly, as from twenty to forty, twenty-five to thirty being the more ordinary numbers." Of course, "a parcel of land whose fair rental value is one hundred pounds, is, in common cases, worth from two thousand five hundred to three thousand pounds. But the real rental value, which is the only firm groundwork to proceed upon, whether in the purchase or the management of landed property, cannot easily be obtained. Speaking generally of the lands of England, it is, he thinks, what a very few men are able to set down. It is true, that, in every district, almost every township, there are men who tolerably well know the rate at which the lands of their respective neighbourhoods are usually let. But interchange them, reciprocally, into each other's districts, and their errors would be egregious. Nor can a mere provincialist, especially in a district which is unenlightened by modern improvements, be aware of the value, even of his own farm, under the best course of management of which it may be capable: nor can he see, through the double veil of ignorance and prejudice, the more permanent improvements that may be made upon it, so evidently as one who has a more general knowledge of rural subjects, and is in the habit of detecting and prosecuting such improvements." It is, of course, necessary to have different persons to fully accomplish the business.

The circumstances which require to be considered as giving value to land are, "1st. The quantity of the land, which is the ground work of the calculation; though it has little weight in the scale of valuation. The feesimple value of an acre of land may be less than twenty shillings, or it may be more than a hundred pounds. Nevertheless, it is on the quantity the rental value is calculated; and it is usual for the seller to exhibit a "particular" of the estate on sale; showing, or which ought to show, not only the aggregate quantity, but the number of acres that each piece or parcel contains; and ought, most particularly, to specify the distinct quantities of the lands of different qualities; in order that their

several rental values may be ascertained with greater accuracy and ease."

"2dly. The intrinsic quality of the land, which is essential in forming the estimate. But even this, Mr. Marshall says, in a general view of the value of lands throughout the kingdom, is often of secondary consideration: for, in many cases, their values are given by situation, rather than by soil and substrata. In some cases, as has been already noticed, the value of the situation may be fivefold that of the intrinsic value of land."

But "this excessive influence of situation is, however, limited in its effects,—and is chiefly confined to the environs of towns, and other extraordinary markets for produce: a great majority of the lands of England owe their values less to situation than to intrinsic quality; and to come at this, with sufficient accuracy, is the most requiste, and, at the same time, the most difficult part of valuation; as it depends almost wholly on extemporary judgment, exercised on the frequently few data which rise to the eye, in passing over the field of estimation. It is almost needless, therefore, to observe, that, to acquire the degree of judgement necessary to this critical task, it is requisite to know the productiveness of lands of different appearances:—a species of knowledge which scarcely any thing but mature practice, in the cultivation of lands of different qualities, can sufficiently teach; though long habit may do much, in ordinary cases, towards hitting off the value of lands, without an extensive knowledge of the practice of agriculture. There are, however, cases in which both of these qualifications are found insufficient to give any accuracy of judgment; even among provincial valuers. And a man who ventures to step forward as a universal valuist, should either have an extraordinary talent for his line of profession, or should, after a suitable initiation, have had great experience in rural concerns, in various parts of the kingdom."

"3dly. Situation. But although is has been stated above, that the value of the lands aggregately considered, depends less on situation, than on intrinsic quality; yet, in every part, situation has great influence. Thus, an acre of land, whose intrinsic quality renders it, in an ordinary situation (with respect to locality merely) worth twenty shillings an acre, would, he observes, not in some districts, be worth more than fifteen shillings; while in others it would bear to be estimated at twenty-five shillings, or a higher rent,—to a farmer on a large scale, and away from the immediate environs of a town, or any populous district of manufacture;—for reasons that will appear in examining the different particulars of situation." And "in the temperature of situation, whether it is given by elevation, aspect, or exposure, a powerful influence is found, which is capable of altering, exceedingly, the value of lands. The same soil and sub-soil, which, he says, we not unfrequently see on exposed mountains, and hanging to the north, and which in that situation are not worth more than five shillings an acre, would, if situated in a sheltered vale district, and "lying well to the sun," be worth twenty shillings, or a greater rent. Even on climature something considerable depends. In the south of England, harvest is generally a month earlier than in the northern provinces; though it is not regulated exactly by the climate, or latitude of the places: a circumstance that requires to be attended to by those who estimate the values of estates. For an early harvest is not only advantageous in itself, but it gives time to till the ground, or to take an autumnal crop; which are advantages that a late harvest will not so well admit of. And another kind of temperature of situation has still more influence on the value of lands; namely, the moistness of the atmosphere. A moist situation not only gives an uncertain, and often a late harvest, but renders it difficult and hazardous; as is too frequently experienced on the western coasts of this island."

It is added that, "even in the turn of surface, exercise is found for the judgment. Lands lying with too steep or too flat surfaces (especially retentive arable lands) are of less value than those which are gently shelving, so as to give a sufficient current to surface water, without their being difficult to cultivate. Steep-lying lands are not only troublesome and expensive, under the operations of tillage, but in carrying on manures, and getting off the produce. Lands lying with an easy descent, or on a gently billowy surface, may be worth more by many pounds an acre, purchase money, than others of the same intrinsic quality, hanging on a steep." And, "another consideration of the same weight in valuing an estate, is a supply of water,—for domestic purposes,—for the uses of live stock,—and for the purpose of irrigation. There are situations in which a copious stream of calcareous water would enhance the feesimple value of a large estate some thousand pounds." Likewise a sufficient supply of manure, whether dung, lime, marle, or other melioration, at a moderate price, and within a moderate distance of land carriage, materially adds to the intrinsic value of lands."

And, "the established practice of the county in which an estate lies is capable of enhancing or depressing the value of it exceedingly. Even the single point of practice of ploughing light and loamy lands with two oxen or two active horses, instead of four heavy ones, is capable of making a difference, on good land which is kept alternately in herbage and corn crops, of five to ten shillings an acre, a year; or ten pounds an acre, purchase money."

It is also stated that, "the price of labour is another regulator of the marketable price of land, in a given district. It is always right, however, to compare this with the habits of exertion and industry which prevail among farm workmen, before the neat amount of labour can be safely set down." And "the price of living, or expence of housekeeping, prevalent among farmers, has its share of influence on the value of lands. In the more recluse parts of the north of England, farmers, (he speaks of the lower and middle classes) and their servants, are fed, cloathed and accommodated, at nearly half the expence of those of a similar degree in many parts of the more central and southern provinces." And, "in a county

where frugality prevails, lands of a given quality will ever bear a higher rent than they will where a more profuse style of living has gained a footing." Hence "the spirit of improvement, or the prejudice against it, which prevails in a district, is a circumstance of some value. For if the former is in a progressive state, especially if it is still in the earlier stages of its progress, a rapid increase of rent may, with a degree of certainty, be expected: whereas, under the leaden influence of the latter, half a century may pass away, before the golden chariot of improvement can be profitably put in motion."

And, "lastly, may be noticed the attractive centre to which the labours of the husbandman will ever tend, markets, in which more than in any other circumstance, we are to look for the existing value of lands. Their influence is not confined to towns and populous places of manufacture; for in ports, and on quays, whether of inlets, estuaries, rivers, or canals, markets are met half way: even by good roads their distance from the farm yard may be said to be shortened."

It is observed that, "in this detail of the particulars of situation with respect to the value of landed property, the attention requisite to be employed, by a valuer who is called upon to act in a county that is new to him is perceived. A provincialist, or even a professional valuer, who acts in a district, the existing value of the lands of which he is sufficiently acquainted with, determines at sight, and according to the best of his judgement, on their respective values: for he knows, or ought to know, their current prices,—what such and such lands let for in that neighbourhood, what he and his neighbours give, or would give, for lands of the same quality and state, without adverting to the particular circumstances of situation (they being given, in the established current prices, which have arisen out of these circumstances); resting his judgment solely on the intrinsic quality and existing state of each field or parcel, as it passes under his eye. But let his skill be what it may, in a county in which he has acquired a habit of valuing lands, he will, in a distant district, the current market prices of the lands of which may be ten, twenty, or fifty, per cent. above or below those which he has been accustomed to put upon lands of the same intrinsic qualities and existing states, find himself at a loss; until he has learnt the current prices of the country, or has well weighed the circumstances of situation: to which, in every case, he must necessarily attend, before he can determine their value under an improved practice, or venture to lay down general rules for their improvement."

"4thly. Another class of circumstances which influence the marketable value of lands, remains to be enumerated. These relate to their existing state, or the manner in which they lie at the time. Their state, with respect to enclosure, is a matter of great consideration. Open lands, though wholly appropriated and lying well together, are of much less value, except for a sheep walk or a rabbit warren, than the same land would be in a state of suitable inclosure If they are disjointed and intermixed in a state of common field, or common meadow, their value may be reduced one third. If the common fields or meadows are what is termed Lammas land, and become common as soon as the crops are off, the depression of value may be set down at one half of what they would be worth in well fenced inclosures, and unencumbered with that ancient custom."

Further,—"the difference in value between lands which lie in a detached state (though within well fenced inclosures) and those of the same quality that lie in a compact form, or (in the familiar phrase) within a ring fence, is considerable. The disadvantages of a scattered estate are similar to those of a scattered farm. Even the single point of a want of convenient access to detached fields and parcels is, on a farm, a serious evil. And it is on the value of farms that the value of an estate is to be calculated. And in addition "the state of the roads, whether public or private, within an estate, and from it to the neighbouring markets, or places of delivery of produce, is an object of consideration." In this business likewise "the state of the watercourses, or shores and ditches, within and below an estate, requires to be examined into; as the expense of improvement or reparation will be more or less, according to their existing state, at the time; or, perhaps, by reason of natural causes, or through the obstinacy of a neighbour, and the defectiveness of the present laws of the country in this respect the requisite improvement cannot be effected at any expense."

Also "the state of drainage of lands that lie out of the way of floods or collected water, requires to be taken into consideration. For although the art of draining is now pretty well understood, it cannot be practised, on a large scale, without much cost."

And "the state of the lands, as to tillage and manure, is entitled to more regard than is generally paid to it, in valuing them. But even to a purchaser, and still more to a tenant for a term, their state in these respects demands a share of attention. Lands that are in a high state of tillage and condition, so as to be able to throw out a succession of full crops, may be worth five pounds of purchase money, an acre, more than those of the same properties, which are exhausted by repeated crops, and lie in a useless state of foulness; from which they cannot be raised, but at a great expense of maaure and tillage.

"Their state, as to grass or arable is, it is observed, better understood, and generally more attended to. Lands in a state of profitable herbage, and which have lain long in that state, are not only valuable as bearing a high rent while they remain in that state, but after the herbage has begun to decline, will seldom fail to throw out a valuable succession of corn crops. Hence the length of time which lands, under valuation, have lain in a state of herbage, especially if it has been kept in a state of pasturage, is a matter of enquiry and estimation" in the execution of this business.

And "lastly, the state of farm buildings and fences is, the writer says, a thing of serious consideration. Buildings, yards, and inclosures that are

much let down, and gone to decay for want of timely reparation, incur a very great expense, to raise them again to their proper state. And, when great accuracy of valuation is called for, as where the purchase value of an estate is left to reference, and when the tenants are not bound, or if bound are not able, to put them in the required state, it becomes requisite to estimate the expense which each farm, in that predicament, will require to put it in sufficient repair, so as to bring the whole into a suitable state of occupation." And the same principle of valuation holds goods in ordinary cases.

But "this comes more properly under the head of deductions, encumbrances and outgoings, which now require to be enumerated. In respect to leases, it appears that, by a long lease, the feesimple value of an estate may be, in effect, annihilated. Even a lease for lives, with a mere conventional rent, may reduce it to nearly one third of its feesimple value. And every other kind of lease, if the rent payable be not equal to the fair rental value at the time of sale, is an encumbrance;—even to a purchaser who has no other object in view than that of securing his property on land, and receiving interest, in rent, for the money laid out. If personal convenience be immediately wanted, or improvements required to be done, a lease, though the tenant pay a full rent, becomes an obstacle to the purchase," and of course must be considered in fixing the value.

It is suggested that "an error which is not unfrequently committed in estimating the encumbrance of a lease for a term of years, is here to be noticed. The difference between the lease rent and the full rental value (encumbered with the same outgoings and repairs as the lease rent) being ascertained, it is multiplied by the number of years unexpired, and the product, in full, deducted from the value of the land, free from such encumberance. But, from the product, thus found, ought to be deducted half the interest thereof, during the said number of years,—together with that of one half year over, if the rent be payable half yearly, or of one year, if payable annually. For all that a purchaser has a right to expect is to receive the full rent for his land, during the continuance of the lease. The tenant pays him what the lease stipulates; and if the seller were to make up the remainder, at the end of every six or twelve months, whenever the tenant is to pay his part, the purchaser would receive the full rent, the same as if no encumbrance had existed. But if the seller pay down the whole sum, in ready money, at the time of sale (which in effect he does), he is certainly entitled to some discount for prompt payment. Thus, supposing the difference of rent, occasioned by the lease, to be ten pounds a year, and the length of term to run to be ten years, the product would be one hundred pounds; and supposing, for the ease of calculation, the stipulated payments to be annual: the interest to be deducted would be the half of fifty pounds (the interest of 100*l.* for ten years, at 5 per cent.) with the half of five pounds (one year's interest) together amounting to twenty-seven pounds ten shillings; which being deducted from one hundred pounds, the gross product, leaves seventy-two pounds ten shillings,—the clear sum to be deducted." And "the truth of this rule of calculation may, he thinks, be familiarly proved. For if the seller were only to pay the deficiency of rent, as it should become due, he would, during the first year, hold the whole hundred pounds in his hands; the interest of which, at 5 per cent. is - - *L.* 5 0 0

"The second year he would hold	-	90*l.*		4	10 0
The third year	-	80*l.*	-	4	0 0
The fourth year	-	70*l.*	-	3	10 0
The fifth year	-	60*l.*	-	3	0 0
The sixth year	-	50*l.*	-	2	10 0
The seventh year	-	40*l.*	-	2	0 0
The eighth year	-	30*l.*	-	1	10 0
The ninth year	-	20*l.*	-	1	0 0
The tenth year	-	10*l.*	-	0	10 0
				L. 27	10 0

In regard to tithes, where "in valuing lands they are considered as tithe free, the tithe or modus, if any, requires to be deducted, as an encumbrance, and from the great variation in the values of tithes and moduses, according to custom, and plans of occupation, it is the plainest way of proceeding to value all lands as free of tithe, and afterwards to make an allowance for whatever they may be estimated to be worth."

In respect to taxes, "although it may be called the custom of the country for proprietors to pay the land tax, and the occupier all other taxes; yet this is not the universal practice. Nor is it, in valuing an estate, on sale, and to be let at will, a matter to be enquired into. The annual amount of the payable taxes, and other outgoings, is the fact to be ascertained. For whosoever discharges them, they come as a burden upon the gross value of the lands, out of which they are payable. For if a tenant pay them, his rent is, or ought to be, estimated and fixed accordingly. But if an estate, on sale, is already let under lease, for a term to come, it is highly requisite to ascertain what parts of the annual outgoings and repairs are discharged by the tenants, and what the proprietor will be liable to, during the term to run. "The land tax, where it still exists, is extremely uncertain as to its value. And the poor tax is equally varying, in different situations. The church, highways, and county rates are, taking them on a par of years, less liable to local uncertainty, and are consequently less entitled to enquiry, by a valuer of lands."

And the "fixed payments, or rent charges,—such as chief rents, quit rents, annuities, endowments, schoolmaster's salaries, charitable donations, &c. &c. to which an estate is liable; also repairs of public works, buildings, roads, &c. incumbent on the estate, are subjects of enquiry and estimation: as well as the ordinary repairs." And further "the hazard or risque

under valuation; as that of their being liable to be inundated in summer, or to be torn away by floods at any season;—is entitled to mature consideration. For although these evils may generally be remedied, by river breaks and embankments, the erecting of these is mostly attended with great expense; and the estimated value of this becomes, in course, a fair deduction" to be considered.

It is stated that "there are two practical methods of valuation, with respect to taxes and other outgoings (as in regard to tithes); namely, either to set down the gross value of the lands, and then to deduct the outgoings; or to view them under their encumbrances, and to estimate in a summary way, their neat rental value." The latter is the more general, but the less accurate method of performing the business.

This is what relates to the purchase value of the lands. But it is added, that "appurtenant to an extensive estate, there are generally other valuable considerations;—as, *Minerals* and *fossils*,—whether metals, fuels, calcareosities, or grosser earths. *Waters*,—whether they are valuable for fisheries, decoys, mills, domestic purposes, or the irrigation of lands. And *Timber*,—as of woods and hedgerows."

And "buildings that are not let with the farms; but which bear rent, independent of the lands; which, when scattered over an estate may well be considered as belonging to landed property. Add to these the estimated value of evident improvements."

"And, lastly, the abstract rights which arise out of appropriated lands, or their appurtenances; as the *right of commonage*, which is generally of some value, even when commons lie open, and may be of more, when they shall be inclosed;—provided the cost of inclosure do not turn out to be more than the extra value of the appropriated lands, above that which naturally, or fortuitously, attends the lands of the common right in their open state. The *right of seigniority*,—to feefarm rents, or other chief rents, payable to the possessor of lands on sale, out of the lands of other proprietors. These rents though small, are of certain value in themselves; and the idea of superiority which they convey to some men's minds, may be worth more than the pecuniary value; which indeed, where the sums are very small, (as is often the case) is much lowered by the expense of collecting them:—The *rights of feudality*, or manorial rights, are, at present, if not in their origin, very different from those last mentioned; and the value of which is to be estimated by the quit rents, fines, heriots, escheats, and amerciaments, which long custom and a train of circumstances have attached to the given court. And beside what relates to the appropriated lands of the manor, the lord has a profit arising from the commonable lands (if any lie within it) as lord of the soil; which cannot be broken without his permission. Hence the fossils and menerals, which it covers, belong to him; as well as the timber which grows upon the waste, ad the waters that are annexed to it. He is moreover, in ordinary cases, lord of the game which inhabits or strays upon his manor. This, however, being a right of pleasure rather than of profit, has no fixed standard of estimation. The *right of tithe*, when attached to an estate, is the most desireable of abstract rights arising out of landed property. For, as far as the right extends, (whether to a lay rectory, or a vicarial impropriatorship), the lands which it covers become, in effect, tithe-free; as every judicious proprietor incorporates the rents of the tithe with those of the lands out of which it is payable: thus (if the right, as it generally is, be rectorial) freeing them wholly from the encumbrance of tithes, as a tax on improvements, and as an obstacle to the growth of grain. The *right of advowson*, or the privilege of appointing a pastor to propagate religion and morality upon an estate, properly enough belongs to its possessor; as no other individual is so intimately concerned in the moral conduct of its inhabitants. The *right of representation or election*, or the appointment, in whole or in part, of a legislator to assist in promoting good order in the nation at large. And what class of the community can produce a fairer claim to this right, than the proprietors of the county? The values of these rights are left for others to estimate.

It may be observed in concluding this subject, that the difference between the particulars that give value to a landed estate, and the encumbrances to which it is liable, is the net value of the property under valuation. See *Purchasing of Lands*.

VALUER *of Land*, a person employed in the business of forming estimates or ascertaining the value of estates.

VAN, the name of an instrument to winnow corn. See *Threshing Machine*.

VARDLE, a term applied to the common eye or thimble of a gate with a spike only.

VARICOUS *Ulcer*, in *Farriery*. See *Ulcer*.

VARIX, in *Farriery*, a sort of dilatation in a vein, forming a kind of knot. See *Spavin*.

VASCULIFEROUS *Plants*, such plants the seeds of which are contained in vessels divided in the cells.

VAT, the name of a vessel used in cheese making. It also signifies the bed of the cyder-press, and likewise a vessel for holding wine, ale, beer, cyder, &c. in the time of their preparation. It is sometimes called *Fat*.

The cyder vat is a wide plank in the press with a groove running round it, near the edge, or what is better, a raised bevelled border, coinciding with the edge, about an inch thick, to prevent the liquor running off the sides, and to conduct it to the sluice or spout, from which it passes into the receiver. See *Cyder*, and *Cheese*.

VAULT, in *Farriery*, is to forge a horse-shoe hollow, as in the case of Mr. St. Bel's shoe. See *Shoeing*.

This sort of shoe, however, spoils the feet; for the sole gradually assumes the form of the shoe, and the frog becomes every day more and more raised from the ground.

VEGETABLE, a term applied to all plants, considered as capable of growth.

Vegetables are simple organized bodies, constituted of solids, fluids, and a vital principle. The solid parts, as in animals, being formed of simple fibres, arranged in such a manner as to afford proper firmness and support, to their different parts, and which by being intermixed in various ways, constitute the membranes, cellular substance, receptacles, and vessels; and from the simple solid parts, proceed those which are usually considered in some degree distinct in their nature and functions, as the root, stem or trunk, leaves, flowers, fruit, seed, &c.

In regard to the root, which connects the plant with the earth or soil, and which is the chief source of its nourishment, it differs greatly in different sorts of vegetables. But all kinds of roots agree in the circumstance of being fibrous at their extremities, and it is principally by their fibres that they are capable of drawing nourishment from the ground. It is well known that the root terminates upwards in the stem or trunk, which supports and sustains the other parts of the vegetable. The internal structure of the root, or rather of its fibres, differs not very materially in general from that of the stem, consisting of a cuticle, bark, wood, and in most cases of a small portion of pithy matter, though there are some roots which have little or none at the extremities, but a considerable quantity near the top. The cuticle, in all roots at a certain age, is double, the cutical substance or bark differing very greatly in its quantity and disposition in different sorts of plants, being thin in trees; while in some esculent roots, as in the carrot, it is on the contrary one half of the semi-diameter of the root; and in dandelion it is nearly twice as thick as the woody part. The roots as well as the trunk of vegetables are furnished with a great variety of vessels for the purpose of conducting, conveying, and circulating air, and the juices necessary to their nourishment and support.

It is stated by Dr. Hooper, in his "Observations on the Structure and Economy of Plants," that "the root of a vegetable is only a continuation of the trunk descending into the earth, appearing to consist of the same parts, although less conspicuous; thus says he, if the trunk of the *salix*, or willow, or any other similar tree, be torn up, and inverted, so that the trunk and branches be put into the ground, then the part which was originally trunk and branches, becomes roots, and the root is converted into trunk and branches."

The fixing of the root in the earth by its ramifications, prevents the vegetables from being torn up by winds.

The fibrous radicles and the leaves constitute of course the media through which the growth and increase of vegetables are effected.

The form or shape of the roots of vegetables differs very materially in different kinds, being in some branching and fibrous in a lateral direction, while in others they are tap-rooted, pushing directly downward into the soil: and in some few they are clubbed or of a knobby form. See *Root*.

The part of a vegetable which stands next in importance, when considered merely as a plant, is the stem or trunk, also including the branches as well as all the more solid parts, and which principally consist of the bark, the wood, and the pith, and are organic.

The first, or bark, is protected on the outside by a cuticle, epimerdis, or scarfskin, which is sometimes constructed of numerous layers, differing in thickness in different plants, but mostly, according to Dr. Hooper, formed of fibres which cross each other in every direction. Its texture is sometimes so thin that the direction of the fibres becomes visible even by holding it against the light. Some have supposed it an organized substance composed of extremely minute bladders, interspersed with woody fibres in a longitudinal manner, as is very evident in the nettle, thistle, and various other vegetables; and likewise to contain longitudinal vessels, and be evidently porous in some plants, as that of the cane.

Its use, Dr. Hooper says, is to defend the cortex or bark which lies next to it, from the injuries of the air; to keep open, by its callous nature, the pores of the exhaling and inhaling vessels; to modify the impressions of external objects upon the vegetable; to protect the extreme ramifications of the aerial or aqueous vessels; and to cover the cellular substance, in which the several fluids are elaborated.

It is added, that when this covering is destroyed in the living plant, it is regenerated, adheres more firmly to the cortex or bark, and forms a sort of cicatrix or scar, so as to protect the true bark.

When the cuticle or thin external covering has been removed, the true bark becomes evident; and which, Dr. Hooper observes adheres in trees to the next covering or liber; but in tender plants it is soft, and called the *cutis* or *skin*. Others however consider it as a congeries of pulp or cellular substance, in which are placed a number of vessels as well as longitudinal fibres. These vessels of the bark being differently situated are destined for various uses in different vegetables. In the bark of the pine then, for instance, the innermost are supposed lymph-ducts exceedingly minute; those nearest the surface, gum or resiniferous vessels destined for the secretion of the turpentine, and of so large a size as to be visible to the naked eye.

The next covering or coat is what is termed the *liber* or *inner bark*, which is, Dr. Hooper says, "the third integument of the trunk of trees or other vegetables. It is membraneous, flexible, and sometimes wholly separable from the cortex and *alburnum* described below. These two coats of a tree are, he says, formed of *laminæ*, as will appear by mascerating them in water, by which the cellular substance is destroyed, and the laminated appearance becomes conspicuous. They appear to be parts very essential to the life of the vegetable, for in them the principal functions of life, as nutrition, digestion, secretion, &c. are performed; as is evinced in those trees which are hollow within, and plants which are kept in vigour by the good state of their barks, although rotten internally."

The next integument to the liber is the *alburnum*, or woody coat, which is, he says, "situated between it and the wood, composed of a soft white substance, not easily discernible in some trees, but in the *oak* and *elm* it is harder and more apparent. It is as it were an imperfect wood, not having acquired the degree of consistence proper to perfect wood, on which account it may be compared to the cartilages of animals, which at length become bone. It is that state between bark and wood, that the former must necessarily arrive it, before at can become the latter. The hardness of the alburnum is in proportion to the vigour of the plant."

And the *wood* is the compact fibrous substance, disposed into concentric layers, surrounding the *medulla* or pith. It appears, Dr. Hooper says, to be composed of a congeries of dried vessels, and in annual and biennial plants is called the *flesh*.

It has been by some supposed to consist of two substances, the *parenchymatous*, or cellular, and the *ligneous* or woody. The ligneous parts are no more than a congeries of old dried lymph ducts. Between the bark and the wood, a new ring of these ducts is formed every year, which gradually loses its softness as the cold season approaches, and towards the middle of winter is condensed into a solid ring of wood. These annual rings, which are visible in most trees when cut transversely, serve as marks to determine their age in some cases. They seem to decrease in breadth, as the tree advances in age, and as they are found to be very unequal in size throughout, their breadth, probably, varies accordingly as the season is favourable or otherwise.

But the wood does not only differ from the bark in the degree of hardness; but also in its structure, which is essentially different, and the apparent conversion of bark into wood, is imagined by some, to be entirely a deception. The most striking difference between the wood and the bark, is, that in the former there are spiral vessels, which run from one end of the tree to the other: and from the great resemblance of these vessels to those of insects, they are supposed to be subservient to the same functions. The stems of some vegetables are quite hollow; partly, it is supposed, from these plants, which are gerally of a quick growth, requiring a more than ordinary supply of air in their support.

In respect to the *medulla* or *pith*, it is the innermost substance of trees, being situated in the centre of the stem. It is soft and vessicular, differing from cellular texture by its snow-white colour. According to Dr. Hooper, "in young trees it is most copious or abundant; but as the plant grows, it diminishes, and at length disappears. Thus it is evident, he thinks, that the medulla is necessary in the beginning of the life of plants, but not for its continuation. Perhaps nature reserves a superfluous nutritious humour in the medulla, if, from any cause, the young plant should become dry, that it then may be absorbed, and converted into aliment."

It is supposed by some authors, to consist of exactly the same substance as the *parenchyma*, or cellular substance of the bark, and to be composed of small cells, or bladders, generally of a circular figure; though, in some vegetables, as borage and the thistle, they are angular.

In respect to the leaves, they are organs essential to the existence of vegetables; as plants and trees, when totally divested of them, or, in general, when stript of any considerable proportion of them, do not shoot vigorously.

It is found that "the leaves are produced from the barks of the trunk of the plants, and consist of an *epidermis*, a vascular network, and a parenchyma, full of a greenish juice. They are every where supplied with fibres, which are commonly termed the *nerves* of the leaf, but which are merely its vessels, running in every direction, and branching out into innumerable small threads, interwoven with the parenchyma, like fine gauze or lace. And both surfaces of the leaf are covered with a membrane, which is a thin bark, continued from the scarf-skin of the stalk."

Further, "the *surface*, or outer covering of a leaf, like that of an animal, is full of pores, which serve both for respiration and the absorption of dew, air, &c. These pores, or orifices differ both in shape and magnitude in different plants, which appear to be the cause of the variety of texture, peculiar to every plant."

And "the *parenchymatous* substance consists of very minute fibres, diposed in extremely small cells, which are of various sizes in the same leaf: and all leaves, of whatever figure, have a marginal fibre, by which the rest are bounded; the particular shape of this fibre determining the figure of the leaf.

With respect to the *vessels* of the leaf, they have, at the first, the appearance of inosculating; but when examined by a microscope, they are found only to be interwoven, or laid along each other in the substance of the leaf.

In regard to the use of the leaves, it is to nourish the plant with the nutritious juice which they reserve in the parenchymatous substance, and to expire and inspire air and water.

It is observed by the writer noticed above, that all the parts of a vegetable "appear to contribute to the fructification, by which is understood the flower and fruit of plants; for although the fruit does not swell and ripen until after the flower has fallen, its rudiment, or first beginning, is in the flower, of which it properly makes a part." This last is therefore "a temporary part of vegetables allotted to generation, terminating the old vegetable and beginning the new."

It is observed to consist of seven principal parts, viz. the *Calyx*, *Corolla*, *Stamina*, *Pistillum*, *Pericurpium*, *Semina*, *and Receptacle*; the four first belong properly to the flower, and the three last to the fruit.

The 1st, which is also sometimes termed the impalement, or flower-cup, is the termination of the cortex, or outer-bark of the plant, which, after accompanying the trunk through all its branches, breaks out in the flower, and is present in the fructi-

fication in this new form. Its chief use is to enclose and protect the other parts of the flower, having different appellations, according to the circumstances with which it is attended.

The 2d, the foliation, or leaves of the flower, is the termination of the fibre, or inner bark, continued to, and accompanying the fructification in this new form of painted or coloured leaves. Its use is the same as that of the calyx, serving as an inner work of defence for the part it encloses: as the calyx, which is usually of a stronger texture, does for an outer one. The leaves of which the corolla consists, are called *petals*, and the corolla has different names, according to the number, form, &c. of the petals.

The 3d, which are sometimes termed threads or chives, are supposed to be the male part of the flower, designed for the preparation of the pollen, or fecundating dust. Each individual stamen consists of three parts: the *filament*, or thread, which serves to elevate the anthera or summit, and at the same time connect it with the flower; the *anthera*, or summit, situated on the top of the filament, which contains within it the pollen, and when come to maturity, discharges the same; and the *pollen* or meal, contained within the anthera, which is a fine dust secreted therein, and destined for the impregnation of the germen, described below. Each portion of this meal is, by a microscope, seen to be concealed in a very fine pellicle (which at the time of impregnation bursts) containing the prolific liquor or principle.

From the supposed function of the stamina, they afford the chief foundation for the distribution of the vegetable system into classes. Those flowers which want this part, being denominated female; such as have it, but which want the pistillum, male: those having them both, hermaphrodite; and such as have neither, neuter, or of neither sex.

The 4th, the pistil, or pointal, is the female part of the flower, designed for the reception of the pollen, and which consists of three parts: the *germen*, which is the rudiment of the fruit accompanying the flower, but not yet arrived at maturity, which is situated at the bottom of the stile, and is generally called germen, until the anthers have discharged their pollen, after which period it becomes the pericarpium; the *stile*, which is the part that serves to elevate the stigma from the germen; and the *stigma*, or summit of the pistillum, which is mostly covered with a moisture for the purpose of retaining and dissolving the pollen.

The 5th, or seed vessel, which is the germen grown to maturity, and which, when ripe, discharges the seeds it contained.

It is observed that the pericarpium of several vegetables has a considerable quantity of a proper juice, contained in a parenchymatous substance, or in vesicles, every where supplied with very minute air and sap vessels, which are termed *fruits*: and these consist of nearly the same parts as the stem, as a skin or cuticle, which is a production or continuation of the skin of the bark of an outer parenchyma, which is the same substance continued from the bark, only that its vesicles are larger and more succulent or juicy. Next the core there is commonly an inner pulp or parenchyma; and the core is no more than a hard woody membrane; which incloses the seed. It is to be observed, however, that the organization of the fruit is very various; in some, the seeds are dispersed through the parenchymatous or pulpy substance; in some, instead of a core, a strong woody substance is met with, inclosing the seed or kernel, which, from its great hardness, is termed the *stone*; in some there are a number of seeds; and in others, only a single seed, inclosed in a large mass of parenchymatous or pulpy material.

The 6th, or seeds, are a deciduous part of the vegetable, each seed including the rudiment of a new one, endowed with a vital principle by the sprinkling of the pollen, which they are capable of retaining for an immense length of time.

A seed consists of the following parts: the *corcule*, or embryo of the new plant within the seed, which is divided into the *plumule* and *rostel*. The *plumule* is a scaly ascending part, conspicuous when a seed begins to vegetate. The *rostel*, the plain part of the corcule, and aways descends into the earth. The *cotyledon*, or side of the seed, which is of a porous and perishable substance. The *aryllus*, or exterior covering of the seed which comes off spontaneously. The *hilum*, or external mark or scar on the seed, where it was fastened to the pericarpium. And the *receptacle*, or base, which connects the other parts of the flower together.

It has been generally supposed, and with some degree of probability, that the perfect plant, or the organization necessary to it, exists in the seed surrounded by a quantity of farinaceous matter, which serves to absorb moisture and to furnish nourishment to the corculum, till its parts are sufficiently unfolded to draw support from the soil. This is exemplified in the kidney bean, which when it has been soaked for some time in water and begins to swell, is easily separated into its two lobes, between which is seen the nascent plant. The stem and its connection with the lobes is evidently seen; and innumerable vessels ramify through the lobes, immediately communicating with the embryo plant. And on the external surface of the seed, are absorbent vessels, which attract moisture, by which a degree of fermentation is produced, and a juice elaborated and prepared by a process proper for the nourishment and support of the plant in its first tender growth. The plant at first is a pulpy substance, increasing and indurating by degrees; the hardness of the wood bearing a pretty near proportion to the slowness with which a plant increases, the parts of the stem next the root first assuming the woody texture.

In order to ascertain how far the lobes of the seed were essential to the growth and health of the corculum, M. Bonnet detached them in a dexterous manner, without injuring the vital principle of the young plant, and found with some French beans treated in this way, and sown in a light soil, that they grew; but that the first leaves were not only much smaller, but the plants uniformly weaker in every part of their growth than others, which, for the sake of compa-

rison, were sown at the same time in the usual way. They put forth fewer blossoms and produced less seed. The seeds of mosses are naturally devoid of lobes. The first leaves which make their appearance, and which are called seminal, appear not less necessary to the perfection of the plant than the farinaceous lobes. If they happen to be broken off, the plant experiences a proportional loss of vigour in its growth.

In respect to the circumstance of the seed always coming up in the proper direction in whatever way it may be put into the ground, M. Dodart has offered an ingenious conjecture, which is that the rostellum contracts by humidity, and the plumula, on the contrary by dryness; consequently, when a seed is deposited in the ground in a wrong position, the rostellum, which in that case points upwards, contracts itself towards the part where there is most humidity, and of course turns downwards, while the plumula, on the contrary, pointing downwards, turns itself towards the part of the soil which is dryest, and necessarily rises towards the surface.

"1st. It is evident from the above, therefore, that every vegetable is furnished with flower and with fruit, there being no species where they are wanting.

"2nd. That there is *no fructification* without antheræ, stigma, and seed.

"3rd. That the antheræ and stigma constitute a flower, whether the coverings (calyx and corolla) be present or wanting. And

"4th, That the seed constitutes a *fruit*, whether there be a pericarpium or not.

It is added, that every part of the flower is perfectly formed before it appears outwardly; and the flowers which appear this year, are, properly speaking, those of the last, as is exemplified in many instances.

In regard to the vessels of vegetables, it is remarked that, like animals, they have their fluids contained in certain appropriated vessels, strengthened by a thin fibrous texture. By these vessels which are disposed in a regular order, the different functions necessary to the growth of the vegetable and its various secretions and excretions are performed.

According to Dr. Hooper, the vessels of vegetables are divided into,

"1st. The *succous*, which ascend perpendicularly, and carry the nourishment or *chyme* of the plant from the root to every part. At their extremeties they are generally called *absorbents*.

"2d. The *utriculous*, which run horizontally in the cellular texture, and are evident upon cutting the trunk in a straight manner.

"3d. The *medullary*, which belong to the *medulla*; they are few in number, and never fasciculated, and run very irregularly in an horizontal direction.

"4th. The *proper*. These are very thin, and found lying close to the larger vessels. May not these, it is asked, be vessels of nutrition?

"5th. The *spiral*. These are contorted in a spiral form, and are larger than the *succous* vessels, by which they are surrounded in clusters. They are situated under the external skin, and carry air and their proper juice at the same time. They are also called spiral *tubes*, or *trancheæ;* but may with greater propriety be termed *pneumato-chymiferous vessels*. When a leaf is slowly broken, they appear like small woolly fibres, connected at both ends of the broken leaf."

It is added, that "the internal surface of the succous vessels is *villous;* as the plant increases, they gradually thicken, and in the stems of annual and biennial plants, they at length form a ligneous *ring*. In the trunk of trees, two of these *annuli* are found every year, which are separated from the preceding by a dense cellular texture.

And, in respect to the fluids contained in the vessels and receptacles of plants, they are of two kinds, *common* and *proper*.

The first is inodorous and aqueous, and is, as it were, the very *blood* of the plant. It is found in all the vessels of the plant, and is that from which nutrition is performed and the other fluids separated.

It is evident from wounding their trunks in the beginning of spring, that plants contain water.

And from different experiments, it seems clear, that the aqueous vessels are principally situated in the wood of trees: that the water of a tree furnished with leaves is carried through the vessels to support those leaves; and that the fluid is conveyed upwards and downwards.

The second or *proper juice* is secreted from the common juice, and occupies peculiar vessels and receptacles, and differs in its nature, smell, taste, colour, &c. in different sorts of plants and trees.

But, although this juice may appear to reside in every part of the plant, its proper place seems to be between the *cortex* and *alburnum;* for, if an incision be made in that part, it drops in greater abundance; hence it follows, that the vessels destined to convey the juice are principally situated between those barks.

These two different sorts of fluids or juices are never blended with each other in the tree, the latter only existing in its proper vessels.

In regard to the circulation and nutrition of vegetables, Dr. Hooper states, that "the oscula of the absorbent vessels on the surface of the plant, take up a nutritious juice and convey it to the different parts."

And that "the surface of a plant has two sets of absorbents, which constitute the absorbent organ of vegetables; the oscula of the radicles of the roots, and those on the surface of the leaves.

"The *root* imbibes the nutritious juices from the earth, by means of its absorbent oscula as long as it remains tender; but as soon as it becomes ligneous, it emits radicles on every side, which continue the absorption and convey it first to the root, and then to the whole plant. Thus, if a plant, or tree, be transplanted, it succeeds with greater certainty, the more absorbent radicles are preserved with the root."

"The *leaves* absorb humours from the air in the

same manner as the radicles do from the earth, and convey them to the other parts of the plant."

This he considers as fully shewn by the following circumstances; "plants which grow tabid by the heat of the day, revive in the night time by the dew, which cannot be attracted by any other organ than the leaves."

"Leaves lying in the water, or on its surface, preserve their greenness; but immediately become yellow, if spread over with oil or varnish by which the absorbent vessels on the leaf are obstructed."

"The whole plant is enervated, if deprived of its leaves."

And "lastly, the *cacti* and *sedæ*, although they have very small roots in proportion to their size, and grow on the driest hills, are very succulent."

"The leaves of plants, especially their inferior surfaces are, furnished with innumerable *villi*; these *villi* are their absorbing vessels."

He supposes that by "means of the absorbent system, the water is distributed to every part of the plant, and constitutes its principal aliment; deprived of this universal fluid, the plant droops and dies, but by its influence is not only nourished, and the vessels of the whole fabric dilated, but it contributes greatly to irritate the languishing fibres, and thus, to augment the vital power of the vessels. By means of this system of vessels, the atmospherical air, which is essential to vegetation, is also absorbed, for plants *in vacuo* cannot be evolved from the seed; nor can they afterwards vegetate. This, most probably, is the reason why seeds buried very deep in the earth, do not vegetate, but die. See *Vegetation*.

It has been suggested by Mr. Bonnet, that nutrimental juices pass during the day time from the roots to the trunk by the ligneous fibres, assisted by the air vessels, and are principally carried to the surface of the leaves, where a copious perspiration takes place. And that, at the approach of night, the heat no longer acting on the leaves, and the air contained in the air vessels, the sap returns towards the roots at the same time that the humidity condensed on the inferior surfaces of the leaves, which, by their inequalities are best fitted to retain it, is absorbed and conveyed through the branches to the trunk. In this manner, he is of opinion, that vegetables are nourished in the day time by their roots, and in the night, by their leaves.

It is further stated by the first of these writers, that "the nourishment of animals is found to be composed of principles analogous to those which enter into the nourishment of vegetables." But, that "the alimentary matter is less attenuated, and less divided, when it enters into the interior of the former, than when into that of the latter. The animal by peculiar powers decomposes all the nutritive substances in the *primiæ viæ*, or stomach and intestines, into their elementary parts, which chemically unite and form proper alible substances to be absorbed by the patulent oscula. Nature performs the same openings in the earth to supply vegetables; for, by the putrefaction of the various organic substances, their elementary principles are disengaged and attracted by the mouths of the absorbent radicles. Thus, vegetables, like animals, are nourished by a similar set of vessels, which, in the former, are situated externally; but in the latter, are placed internally in the intestines."

And that "the organs of nutrition of vegetables, (like those of the circulation in animals) are the most active powers that nature has bestowed upon them; for by their actions the aliment is converted into a peculiar fluid (totally different in its nature from what it was before its absorption) called the sap; which in consequence of this action, becomes endowed with the vital principle. This animated alimentary matter universally distributed, serves for the nutrition, developement, and reproduction of vegetable substances; in which respect it is perfectly similar to the blood in animals. It serves for nutrition, by its intimate penetration into every part of the plant, and for its developement by its softening the parts and rendering them ductile enough to admit of extension and increase."

With regard to the difficult point, as to the manner in which the different parts of plants receive the nutritious juice; it is supposed from different experiments made on the growth of vegetables of the succulent and other kinds, that "the chyme is carried through the absorbent oscula into the succous vessels, of which they are a continuation; and by the *pneumate chymiferous* vessels into the parenchyma of the leaves, there to be changed into a nutritious juice by the vital principle, and thus prepared to be carried to all the other parts of the fructification, through their proper vessels, and inserted by the same power into all the fibres, or to serve for the various secretions." And that in this mode all the parts of plants are nourished, the vessels elongated and the whole plant increased."

The simple constituent elementary principles of vegetables, so far as they are yet known, are *heat*, *light*, *electric matter*, *carbon*, *hydrogen* or *inflammable air*, *oxygen* or *vital air*, *azot* or *mephitic air*, *phosphorus*, *sulphur*, *metals*, and an *earthy* material.

And the nature, form, arrangement, and union of these elements and principles determine the species of vegetable. "The cause of this union appears to depend upon the *vital principle*, which exists in every part of the plant, and which constitutes its life; for by its means, a mode of union is induced widely different from that which arises from the common laws of chemical affinity, in consequence of which, nature produces the sap and proper juices, as the resins, gums, sugar, &c. &c."

But the solid parts of vegetables are composed of vegetable gluten and a small portion of calcareous earth.

The *gluten* is found to be composed of carbon or charcoal, and azot or mephitic air.

But *calcareous earth* does not appear, according to chemical experiments, to constitute the essential part of this gluten.

The fluid parts of vegetables are constituted of a great variety of principles, as the *aqueous*, the *oila-*

ginous, the *farinaceous*, the *gummous*, the *ceraceous*, the *melleous*, the *resinous*, the *balsamic*, the *camphorated*, the *saccharine*, the *bitter*, the *saponaceous*, the *narcotic*, the *acrid*, the *astringent*, the *colouring*, the *acid*, the *alkaline*, the *neutral saline*, the *mediate saline*, and the *extractive principle*.

It is found, that when in the spring season an incision is made in the birch tree, it will often yield, in one day, eight or ten pounds of sweet *water*. And by drying, some vegetables may be reduced from a pound, to two or one ounce, or even half an ounce in weight.

The emulsive seeds and kernels of different vegetables are found to afford a fat oil by means of pressure. "The way in which the oil is generally obtained, is, by first crushing the seeds between large stones into a kind of paste, which is put into bags and squeezed in a press: the oil is thus forced out of the seed and received in a proper vessel." These oils are different in their form and appearance, when taken from different seeds. See *Oil*.

Many fragrant aromatic vegetables also afford an essential oil, by distillation, coming over with the water and floating on the top in small globules. It is collected by pouring a quantity of the distilled water with the oil as it comes over into a vessel, so constructed as to suffer the watery part to escape from a stop-cock near the bottom; the vessel is again filled, and when settled, the water is again let out; in this manner the oil is collected in great quantities, floating upon the surface of the water. This essential or ethereal oil resides in a particular appropriated part of the plant; but which is different in different sorts of vegetables. And they vary in their nature or properties from different plants. See *Oil*.

The pulverized material, flour or *farinaceous principle* of vegetables, is obtained by grinding or bruising the seed of corn and separating the fine parts from the husk. It may also be procured from the root of the potatoe plant, from yams, &c. from the fruit of chesnut trees; and by a particular process, from the roots of acrid plants; as bryony, cuckow pint, and pæony. It is a principle which consists of vegetable gluten, starch and sweet mucilage. The amylaceous or starchy matter in wheat flour is to the glutinous in the proportion of about three to two; the muco-saccharine matter consisting only in a very small quantity. See *Farina*, and *Vegeto-animal Matter*.

The *gummy principle* exudes spontaneously in the form of tears from the bark of trees in warm climates, and from some trees, even in this. It is also abundant in the leaves and in the seeds of some vegetables.

It is very abundant in vegetables, and is found in a great number of roots; the young shoots and young leaves contain it in large quantities, and its presence may be known by its viscous and adhesive quality when these parts are crushed between the fingers. Gum is usually obtained by wounding the bark of particular trees. It is observable, that "saccharine fruits, when sour and unripe, are found to contain gum and an acid; whence, it seems not unfair to conclude that saccharine matter is formed of these materials, operated on by the process of vegetation."

The *resinous principle* is produced from the root, leaves, bark, &c. of several plants by being put into spirit of wine, and suffered to stand a few days, and the spirit then evaporated. It also exudes spontaneously in the form of drops from the bark of trees.

Where the resinous principle is mixed with the gummous, it has the denomination of the *gummi-resinous principle*, and which is afforded by many vegetables.

The *waxy principle* is found to abound in the antheæ of almost every plant, and a great quantity is obtained from the fruit of different plants.

The *melleous principle* is secreted by the surfaces of the stigma of most flowers, and in some plants, it even collects in drops. It is found to consist of sugar dissolved in mucilage.

The imperfectly fluid oily aromatic substances, termed *balsams*, are produced from incisions made in the trunk of balsamiferous vegetables, their juices flowing out often spontaneously. They are found to consist of a peculiar resi , dissolved in ethereal oil.

The *camphorated principle*, is procured by spliting the trunk of the camphor trees, which grow in China, Japan, &c. &c. in which large and pure tears of *camphor* are found between the barks; but that in the shops is obtained from every part of the tree, by distillation with water in a proper apparatus. It is likewise obtained from the roots, leaves, and fruit of some other vegetables.

The *saccharine principle* or matter is met with in a great number of vegetables, being readily detected by the taste, especially in dates, figs, raisins, apples, quinces, plumbs, cherries, mulberries, currants, &c. &c.; but the plant in which it exists in the greatest quantity, is the *(arunda saccharifera,)* or sugar cane. The trunks of the sugar maple *(acer saccharifera)*, and manna ash *(froxinus ornus)* also afford this principle very largely, as is evident from the quantity of manna which spontaneously flows every season from their barks. It may likewise be obtained from carrots, parsnips, red beet, the roots of dandelion, ferns, liquorice, farinacisus grain, potatoes, &c. See *Saccharine Matter*.

The *bitter principle*, is found to be afforded profusely from the incisions of the leaves of some plants, and it predominates in many, as wormwood, gentian, &c.

The *saponaceous principle* is also found in the leaves of *soap-wort* and in the *nuclei* and the roots of various othe vegetables.

The *narcotic principle*, called opium, prevails in the poppy, but only resides in the seed vessel, which flows out by puncture or incision. That obtained in this country would appear to be as powerful as the opium imported from abroad, and by cultivation might be collected in quantities.

Other vegetables also contain this principle, but in an inferior degree.

The *acrid principle* is found to exist in a great number of vegetables, but in different parts, in different plants, as in the substance, root, seeds, fruit, &c. being very acrid in some, as the dumb cane *(arum seguinum)*; but more mild in others, as the horse radish *(cochlearia armoracia)*.

The *astringent principle*, which consists of the gallic acid, and the gummous principle, is found in a vast variety of vegetables, particularly in the *galls* of the oak, &c.

It resides in different parts, as the wood, root, bark, leaves, and flowers.

The *colouring principle* exists in most vegetables, and is of course extremely various. The art of dying depends upon the knowledge of this principle.

The *acid principle* of vegetables is found to be equally various: They are the *citric*, *malic*, *oxalic*, *tartaric*, *gallic*, and *benzoic acids*.

The citric acid is obtained from the fruit of the citron, orange, lemon, &c. The malic acid resides in the fruit of the apple, &c.

The oxalic acid is found in the leaves of sorrel, &c. The tartaric acid is found in the fruit of the *tamarindus gallica*, &c. and in some roots. The gallic acid is detected in all astringent plants, combined with the gummous principle. And the benzoic acid is obtained from gum benzoe, and balsam of Peru, &c.

The *alkaline principle* of vegetables is of three kinds, as ammoniac, soda, and potash. The first resides in ethereal oils, &c. and is obtained during distillation by the addition of the carbonate of potash or fixed alkali. Soda is presented in the ashes of all maritime plants, and potash is obtained from the ashes of plants not maritime.

Neutral salts of different sorts are also contained in many vegetables of different kinds, as tobacco, millefoil, &c. &c.

The *mediate saline principle* likewise exists in different plants, as the sulphat and oxylat of lime, in rhubarb and Indian corn.

And the *extractive principle* is given out by all plants.

VEGETABLE *Earth*, that sort of fine earthy material, which is formed by the destruction and decay of different vegetable productions, either on the surface or within the soil. But the term is more generally applied to the peculiar earthy material, which constitutes the superficial layer of fine dark coloured mould, in which plants, for the most part, strike root and grow in every sort of land, and it varies greatly in different situations, from the variations that happen in respect to its depth, and the progress it has made towards the state of perfect decomposition, as well as from the nature of the vegetables of which it is constituted. And it has been suggested as acquiring some diversity from "its being more intimately or more loosely mixed and blended with the other bodies that are found in soils;" and also "that the earthy matter which is formed from the destruction of some sorts of vegetable substances may be better suited for the purposes of vegetation than that which proceeds from others. It is a material that is produced both by the destruction and decay of vegetable substances, being probably acquired partly from the air, water, light, by the process of vegetation, and partly from the properties of the soils. In some cases it is of very considerable depth, while in others it forms merely a thin superficial stratum; and there are still other soils, in which it is scarcely met with at all.

And it may be observed still farther, that "vegetables, from their having in their composition a large portion of mucilaginous matter in a state of mixture with their other substances, are in some degree capable of being dissolved in water, though the external coverings of living plants, principally on account of the resinous material that enter into their composition, are preserved from its action" and effects.

It is obvious from the first of these circumstances, and that of earthy matters being contained in them, which had been taken up in the state of solution or diffusion with their fresh juices while growing, that considerable quantities of vegetable earth must be continually formed and deposited on lands by the natural dissolution and decay of such bodies. But its formation is much more abundantly effected by means of the putrefaction or dissolution of such vegetable productions as are cut down, or otherwise destroyed, on the surface of the land, and the laying of different kinds of dung and compost materials upon it. It has been remarked that "where these have been in great abundance for a long time, there is mostly a deep rich surface soil of this earth; but that where few vegetable productions, and those of the less luxuriant kind, have been left to undergo the above process, or little assistance given by means of manures, the crust of surface mould is generally thin and poor." It is plain that "the dissolution and decay of vegetable materials must be greatly promoted by a proper degree of moisture and heat, and a suitable state of the atmosphere."

The close and stagnated state of different sorts of luxuriant tall growing crops of the grass or other kinds, have likewise much effect in the forming of this material, by the decayed foliage falling down and being deposited on the land.

These materials, during the state of decay, undergo different changes in their constituent parts; the water which they contain being decompounded, pure air or oxygen absorbed, heat disengaged, and new compositions of the saline and ærial kinds formed; by which means a number of matters are prepared and fitted for the use and support of vegetable life, which could not have been supplied in any other way, as well as rendered much more extensively applicable in this intention than they could otherwise have possibly been.

It has been conceived by the Earl of Dundonald, that the absorption of oxygen from the surrounding atmosphere, or what he terms the process of oxygenation, is the principal cause of the retention of vegetable matter on the surface of the earth, in deep peaty soils, as well as others, but especially such as have been long in a state of tillage, or under the

plough. This process having the power of rendering the vegetable matter less destructible, scarcely any of it being carried away in a state of dissolution by rains, or water in other ways, an accumulation takes place, which, under other circumstances, could not have happened. "The indestructible state of vegetable matters, under these circumstances, and their constant accretion, may, says he, be referred to the insoluble compounds produced by the action of pure air on these inflammable substances.

"The insolubility, to a certain degree, of this system, adopted by nature, is undoubtedly, he thinks, to be preferred to one more completely soluble; for it is evident, that if putrefaction, or oxygenation, had possessed the power of rendering all the vegetable matter, by a speedy process, soluble in water, two pernicious consequences must have followed: The rains would have washed down such extracts, and soluble matters, as fast as formed, into the rivers and springs, contaminating the waters, and rendering them unfit for the existence of fishes, or for the use of terrestrial animals. The sea, in process of time, would thereby receive all the vegetable and animal produce of the dry land, and the earth would ultimately become barren, consisting alone of the simple earths, without any admixture of vegetable matter; consequently there could be no accumulation of this substance on the surface, as is the case to an immense degree at present. As such, there cannot, he conceives, be a doubt, but that the present incomplete process of putrefaction, oxygenation, or solution of organic bodies, has been established by the great Creator of all things for wise and benevolent purposes; especially when it shall be understood, that the apparent imperfections of this (to a certain degree) insoluble system are, as they respect agriculture and vegetation, to be remedied, when necessary, by the ingenuity and industry of man." It is therefore supposed, that the vegetable matters which exist in soils, from their admitting different degrees of this process, and consequently becoming more or less insoluble, have different powers in forwarding the growth and support of plants. Where the exposure to these causes has been long, they are greatly more insoluble in their nature than where the contrary has been the case.

It has been stated that "to promote the formation of vegetable earth or mould, recourse should not only be had to such substances as accelerate the putrefactive process, but also such as have a tendency to increase the solubility of the vegetable mould or soil itself." And that "the first of these purposes may be attained "by the application of such materials as have been found useful in changing vegetable substances into the state of mucilage, such as the carbonate of lime, or effete lime, marle, chalk, and calcareous matters in general, and also some earthy saline substances as the refuse of salt manufactories, &c." And that "the latter is to be attempted by the use of different alkaline substances, such as the ashes produced by the burning of various green vegetable materials, the urine of animals, the liquor of dung-hills, night-soil, and other animalized matters."

There are, likewise, many other ways in which vegetable mould may be rendered more abundant in a soil; such as the growth of such kinds of crops as cover the ground in a close manner, so as to produce a stagnated state of the air; the consuming upon, or turning down of rich, full, and succulent green crops into the soil, by which much vegetable matter is speedily brought into decay; and by the destruction and evacuation of insects of various sorts, which are predominant in lands, by the use of substances which have the power of effecting these purposes.

It has, however, been remarked by the author of the Connection of Agriculture with Chemistry, that "too large a proportion of vegetable matter in soils, particularly where it is exposed to be much acted upon by the oxygen principle of the atmosphere, is liable to render the land too loose and open in its nature, for the growth of most sorts of crops of the grain kind; winter corns being especially, from the sudden alternations of frost and thaw, frequently thrown out of such soils and almost wholly destroyed. In cases of this nature, great advantage may, he says, be derived from the use of different matters of the saline kind, and lime in its saturated state, as by such means the vegetable parts of the soil will be brought to their most proper and productive state, in respect to the growth of crops."

Vegetable *Mould*, the fine earthy material into which vegetable substances are resolved and reduced by the process of putrefaction and decay. The mould of this kind has mostly a fine black appearance, and is capable of rearing most of the finer sorts of plants. See *Vegetable Earth*.

VEGETATION, the act whereby plants receive nourishment and growth.

The nature of vegetation has not perhaps yet been fully explained; it seems evident, however, that from the experimental enquiries of Mr. Gough in respect to grain or seeds, that during the act of vegetation they draw oxygen from the atmosphere, part of which is retained, and the remainder thrown off charged with a portion of carbon; and that of course in this process the substances of the seed lobes undergo a considerable change, an additional proportion of oxygen entering into their composition, while a portion of their carbon is dissipated. That by this alteration in the proportion of their constituent principles, the saccharine fermentation takes place, and sugar is formed, as demonstrated in the operation of malting grain. And that the sugar and carbonic acid, from their being more soluble in water than in the *oxyd* of farinaceous matter, easily combine with the moisture in the capillary vessels of the seed, and find a ready passage to the germ; the vegetative principle is thus brought into action by a *stimulus* adapted to the particular nature of it. By the decomposition of the seed lobes a nutritious fluid being thus formed and distributed through the infant plant, its organs are excited to

exet their specific actions in decompounding the nourishment conveyed to them, and in forming new *oxyds* from the elementary principles of it in order to the increase and evolution of the vessels and fibres.

In this manner it is supposed the first stage of vegetation commences, and which would seem to shew that in grain or seeds in order to their undergoing these different changes the most readily and in the most perfect manner, on which, perhaps, healthy vegetation depends, they should not only be properly deposited in the soil, but be so well ripened and filled with farinaceous matter, and possess such a degree of moisture, as may dispose them to undergo the changes in a speedy manner; while at the same time a due supply of suitable nutritious matter is afforded for the healthy germination and early growth of the infant vegetable.

Dr. Hooper concludes on the following grounds, that the two airs, of which the atmosphere is compounded, are absolutely necessary to the nourishment of vegetables, viz. the *vital air* or *oxygen*, and the *mephitic air* or *azot*.

It is found that "plants placed in *vital air* grow larger, become more powerful, and are greener than in atmospheric. If the seeds of the *phaseolas*, *pisum*, or *lepidium* be put into silicious earth, and sprinkled with water mixed with a small portion of the oxygenated muriatic acid (for in no acid does oxygen so abound and so laxly adhere), they germinate much sooner than if sprinkled with pure water: but if seeds be immersed in diluted muriatic acid, they become black and rugous, and never germinate."

But that "in no kind of air, deprived of oxygen, do plants vegetate; for if they be placed in azotic or mephitic air, carbonic or fixed air; they become flaccid by the heat of the sun, and gradually die away. In nitrous air plants become inactive in a few hours. From this it would appear that the portion of vital air imparts a natural stimulus which is highly necessary to excite the fibres and sustain the vital strength of the vessels of plants; and that lastly, vital air, with the peculiar acidifiable bases, generates the various acids which are found in plants."

It is added that "the vegetable gluten of the fibres consists of carbon, chemically combined with azot; hence it follows that the azotic air is absorbed by the plants, and thus it is that vegetables increase so rapidly in cemeteries and other places where animals and vegetables putrify in large quantities on the ground."

And that "*carbonic air* dissolved in water is also absolutely necessary to the vegetation of plants in order to obtain their carbonic principle, which is a constituent part of the fibres, oil, mucilage, and other vegetable principles."

It is suggested that "plants appear to obtain their caloric or matter of heat from the surrounding atmospheric air."

"Thus the shades of trees are so cool; and hence nothing is more healthy for almost all plants than tepid showers by which they obtain water together with this principle. Lastly, seeds do not vegetate in the cold, and many plants die in it."

Heat is obviously of much benefit in vegetation, as giving the natural colour to the foliage, flowers, and fruit, causing the flow and circulation of the sap juice, and increasing the saccharine matter, and promoting the flavour of most sorts of fruit.

And "*light* also contributes to the life of plants; for those which vegetate in atmospheric air deprived of its light as in the night and dark places, become pale and weak; but in the day time strong and coloured." The rays of light appear, likewise, to contribute to stimulate plants, with the various *gasses* or vapours they absorb from the air.

Thus water and air seem to have a great share in the vegetation and nourishment of plants.

Pure air has likewise been found by many to be essential to the production of perfect seeds, pulse, grain, and fruit, and that by its action upon or being taken up by the soil, it has very beneficial effects in promoting vegetation.

And water has been considered as indispensibly necessary to the process of vegetation, and as supplying the principal materials of vegetable juices. It is evidently the chief medium through which the various nutritious matters derived from the soil is conveyed to the plants which grow upon it. But it has been supposed more favourable to the growth of grass plants than those of the grain kind; as crops of grasses may be continually produced by watering, while with grain it has been found to be impossible. But it is found that soft water, such as that of rivers, rain, or which has been exposed to the action of the sun for some time, is more favourable to vegetation, than such as is hard, as that of springs, or which is impregnated with metalic substances.

And it has been stated by Dr. Darwin, that "when the seed falls naturally upon the earth, or is buried artificially in shallow trenches beneath the soil, the first three things necessary to its growth are heat, water, and air. Heat is the general cause of fluidity, without which no motion can exist; water is the menstruum, in which the nutriment of vegetable and animal bodies is conveyed to their various organs; and the oxygen of the atmosphere is believed to afford the principle of excitability so perpetually necessary to all organic life; and which renders the living fibres both of the vegetable and animal world obedient to the stimuli which are naturally applied to them.

"Whence," he thinks, "we may in some measure comprehend a difficult question; why the plume of a seed sowed upon, or in the earth, should ascend, and the root descend, which has been ascribed to a mysterious instinct; the plumula is stimulated by the air into action, and elongates itself, where it is thus most excited; and the radicle is stimulated by moisture, and elongates itself thus where it is most excited, whence one of them grows upwards in quest of its adapted object, and the other downward."

And he adds, that "the first source of nutriment

supplied to the seminal embryon, after it falls from the parent plant, exists in the seed-lobes, or cotyledons, which either remain beneath the earth, and are permeated by the umbilical vessels of the embryon plant, which absorb the mucilaginous, farinaceous, or oily matter deposited in them, as in the bean, (*pisum*); or the seed-lobes rise up into the air along with the young plant, as in the kidney-bean (*phaseolus*), become seed-leaves, and serve both as a nutritive and respiratory organ. These cotyledons or seed-lobes generally contain mucilage, as in quince-seed; or starch, as in wheat; or oil, as in lin-seed." Some of these nutritive materials are," he supposes, "probably absorbed unchanged, or dissolved only by the moisture of the earth; others are converted into sugar partly by a chemical process, and partly by the digestive powers of the young plant, as appears in the process of germinating barley, and converting it into malt; these reservoirs of nutriment are hence perfectly analogous to the white of the egg, a part of which is probably absorbed unchanged by the lymphatics of the young embryon, and a part of it converted into a sweet chyle for the nourishment of the chick, when it has acquired a stomach."

He further states, that "if the seed be deprived of these cotyledons soon after the root appears, it will continue to grow, but with less vigour, and is said to produce a dwarf plant from three to nine times less than the parent. Hence," says he, "the seeds of plants, which are liable to produce too vigorous roots, and thence have not time to ripen their fruits in the short summers of this climate, or which fill our hot-beds with too luxuriant foliage, as melons, and cucumbers, should in this climate be kept three or four years; by which part of the mucilaginous, or farinaceous, or oily matter of the cotyledons becomes injured or decayed, and the new plants grow less luxuriantly."

And "another source of nutriment for the seminal embryon of many plants exists," he says, "in the fruit, which envelopes the stone or seed-vessel, after the growing fætus has burst its confinement, and so far resembles the yolk of the egg, which becomes a nutriment to the chick, after it has consumed the white, and eloped from its shell. When mature fruit, as an apple or a cucumber, falls upon the ground, it supplies, as it ripens or decays, a second source of nourishment, which enables the inclosed seeds to shoot their roots into the earth, and to elevate their stems with greater vigour. Hence fruits generally contain a saccharine matter, or juices capable of being converted into sugar, either by a spontaneous chemical process, as in baking sour apples; or by a vegetable process, as in those sour pears, which continue to ripen for many months both before and after they are plucked from the tree, as long as life remains in them; that is, till they ferment or putrefy; and lastly, by the digestive power of the young embryon, as above mentioned."

However, "if the seed be deprived of the fruit, it will indeed vegetate, but with less vigour. Hence those seeds which are liable to produce too vigorous shoots for this climate, as the seeds of melons and cucumbers, should be washed clean from their pulp, before they are hoarded, and preserved three or four years before they are sown in hot-beds. But those seeds which are sown late in the season for the purpose of producing winter fodder as the seeds of turnips, should be collected and preserved with every possible advantage; and on this account new seed is much to be preferred to that which has been long kept."

And "many seeds when mature are dispersed far from the parent tree, for the purpose of their growth, by various contrivances. Some of these are surrounded with hard shells, which are impenetrable by insects, as they lie on the earth to take root, as peaches, nectarines, nuts, cocoa-nuts. Other seeds are furnished with an acrid covering to prevent the depredation of insects, as the peel of oranges and lemons, the outward husk and inward rind of walnuts, and of cashew-nuts, and the skin of mustard-seed and rape-seed; other seeds for the same purpose abound with bitter or narcotic juices, as the horse-chesnut, acorn, apricot, cherry, many of which supply materials to the shops of medicine, and may supply nutriment in times of scarcity, as the starch which they contain may be procured by grating them into cold water, and washing away the mucilage, and the poisonous material which adheres to it, and which is soluble in water.

In short "the plumula of the seed, or embryon plant, absorbs the nutriment laid up for it in the seed-lobes, by vessels which permeate them for that purpose, and have been termed umbilical vessels; and afterwards shoots its roots down into the fruit, or into the earth, in search of other nourishment; and expands it leaves in the air as an organ of respiration." Hence it appears," says Dr. Hooper, "that the same evolution which conducts an animal to that state of perfection which is proper to it, accompanies a vegetable; which, like the animal, may also be detected in miniature in the seed or bud."

But besides the above, other agents are necessary to the perfect vegetation and growth of plants, after they have been evolved, such as earth or soil, which is not only useful for the purpose of holding them steady and erect, but also for containing at least some part of the food on which they live, as derived from the atmosphere or other sources, and for the regular ramification of their fibrous roots, in order that it may be more certainly provided. It is, likewise, beneficial in receiving, retaining, and conveying moisture to them, as well as in receiving and reflecting the heat of the sun, dews, and exhalations of different kinds, by which their growth and perfection is greatly promoted.

For though some plants of the aquatic kind grow in water, the greater part of them have their roots in earth. And even marine plants, although they grow upon bare rocks or stones, are well known to be fixed to them, and that they derive their food from the sea-water in which they exist. It has been contended by some, that plants are actually

nourished by the earth alone, but numerous experiments shew the opinion to be erroneous, and that it is perhaps only the medium of their existence.

The assistance of dead organized materials is, likewise, requisite in the process of vegetation, as it seems to be a part of the beautiful and orderly arrangement of nature, "that nothing should have life in vain, and that the destruction of one plant, or animal should furnish food for others." Consequently, however useful air, water, light, heat, and earth may be to the growth of plants, it is, if not certain, at least questionable, whether they could ever come to perfection without the aid of matter that had been formerly organized. The richest soils it is well known, are full of dead animal and vegetable matter, and there is no soil that will not produce plants if a sufficient quantity of dead animal or vegetable substances be added to it. Under this head is comprehended all those manures which are found so useful in cultivation, more especially those to which some authors give the name of *mucilaginous, enriching*, or *nutritious*. These substances are highly beneficial, by correcting the tenacity of stiff soils and the over porosity of light ones, by producing a fermentation in them, and by affording nutritive matter to the roots of vegetables, as well as by retaining moisture in dry and expelling it in wet lands.

Saline substances have been supposed of much importance in vegetation by some, but it does not seem essential to the growth of any species of plants except the marine, and there are many productive soils in which little or no saline matter can be discovered. Salt may, however, be of use to vegetation, though not essential to it. It may operate upon plants as it does upon the human body, by assisting to digest the food, without furnishing nutriment itself. It is of use, mixed with dung, as an assistant to putrefaction. It is also serviceable by attracting moisture, destroying vermin in the soil, and putrefying the roots of any plants it first meets with, thus furnishing nourishment to the succeeding ones.

It is found that the culture of the earth is essentially necessary for the growth of plants to perfection, the health and vigor of both root and branch being thereby greatly increased. By dividing and reducing the particles of the soil, the roots can more easily penetrate and spread out in it, as well as more readily suck in the nourishment which it contains. By proper and effectual culture also, such weeds or useless plants as are apt to rise, are extirpated and destroyed, whilst stirring the earth, admits air and moisture more fully to the soil, and to those plants which have been sown. It is evident that young trees thrive much better, if the soil in which they are planted have been previously ploughed so deep, as readily to admit their roots and suckers. Even after they are planted, it is supposed to be of great service to cultivate potatoes and other roots among the young plantations with a view to kill weeds, and loosen the soil for the free admission of air and water. This practice seems to be generally well received, and to have much effect in promoting vegetation in most sorts of vegetables. See *Pulverization*, and *Fallowing of Land*.

The substances which have been hitherto found injurious to vegetation in soils are those of the *metallic, sulphureous, aluminous, and astringent* kinds. It has been remarked that where mines of iron, lead, or copper, are near the surface, no plants will grow to perfection, as is well known to be the case in mining districts. *Schistus*, in which generally there is a great deal of iron and alum, is found so unfavourable to vegetation, that any considerable quantity of it would destroy the fertility of the richest soil. The corroding and weakening effects of these substances on the tender roots of vegetables being such as frequently to cause their decay, destruction, and dissolution. Frequent fallowing, or the exposure of new surfaces of land to the air, and the use of lime, chalk, or other dissolving matters will, it is supposed, correct the noxious qualities of such substances.

The astringent or acidity in peat is so noxious to vegetation, that until any quality of that nature be subdued, though that species of soil be a mass of vegetable matter, yet nothing but heath and other miserable plants are capable of growing in it.

The vegetation and growth of plants is also much injured by the various sorts of vermin with which both the earth and the air abound, as grubs, slugs, maggots, moles, and insects of various kinds. Those which inhabit the earth, it is supposed, may be destroyed by salts, by acids, or by lime; also by snuff and sulphur mixed, tobacco water, night rolling, &c.

And for moles by trapping or terriers. See *Grub* and *Mole*.

In regard to the myriads of insects with which the air abounds, it is more difficult to point out a remedy.

It is not ascertained that the smell of any plant, in its natural growing state, is *destructive of* insects; but there are several plants which are, when dried and reduced to powder, or when burnt near to certain insects, are destructive of them, as those of tobacco, hemlock, rue, wormwood, henbane, &c.

But sometimes vermin are occasioned by the weakness of the plant, and the poverty of the soil in which it grows, of course the best remedies in such cases are those of more perfect culture.

VEGETO-ANIMAL *Matter*, a term applied to one of the principal constituent parts of the farina or flour of some vegetable seeds. It is found in the largest proportion in grain, especially wheat, existing in a state of mechanical mixture with mucilage or starch.

On washing wheaten flour in water this substance is found in an elastic tenacious state, but incapable of being dissolved in it. It has scarcely any taste, is elastic, ductile, and of a whitish grey colour. When drawn out it extends to the length of about twenty times its diameter before it breaks, and appears as if composed of fibres placed beside each other, according to the direction in which it has been drawn. If the force ceases it recovers its original form by its elasticity; when dry it is semi-transparent, and resembles glue in its colour and appearance. If it is drawn out thin when first obtained, it may be dried by ex-

posure to the air, and in that state has a polished surface resembling that of animal membranes.

If it be exposed to warmth and moisture while wet, it putrefies like an animal substance; it crackles, swells, and burns, exactly like a feather or piece of horn. By distillation it affords, like animal substances, alkaline water, concrete volatile alkali, and an empyreumatic oil. Its coal is very difficultly incinerated, and does not afford fixed alkali. From these facts it is obvious that it is a substance totally different from all the others known to exist in vegetables, and in many of its characters resembles the fibrous part of the blood. It does not appear to exist in any considerable quantity in other farinaceous substances, as rye, barley, buck-wheat, rice, &c. Mr. Berthollet, however, thinks that it contains phosphoric salt like animal matters, and that this is the reason of the difficulty with which it is incinerated, and Rouille the younger found a glutinous substance in the fecula of plants analogous to that of wheat.

The earl of Dundonald observes, that "different kinds of grain contain mucilage or starch, and this substance in different proportions, and the same sort of grain contains them in different quantities, according to the climate, season, and soil. But that good wheat generally contains $\frac{2}{5}$ths of animalized matter, and $\frac{3}{5}$ths of starch. And that good and well raised bread depends on flour containing a due admixture of these two substances. Hence, by mixing the flour of different sorts of wheat, better bread may at times be produced than from one sort only. Extensive benefits may also accrue to the processes of brewing, distilling, and making of vinegar, by a mixture of the different sorts of grain; and to that of distilling a further advantage would be derived by a mixture of different roots with the grain, such as potatoes, parsnips, carrots, &c. &c. if prepared in a proper manner."

VELL, a term sometimes applied to the calf's bag, or stomach, used in making "running" or rennet.

VELLING, the operation of ploughing, or cutting up the turf, or upper surface of the ground in order to its being burnt. See *Paring and Burning*.

VELLS, a term applied in some districts to the prepared stomachs or rennet for curdling cheese.

VENTILATION, the act of purifying or sweetening different sorts of matters, by means of the air. It is of great importance to have all sorts of corn and seeds occasionally well ventilated. And hay, straw, and other sorts of fodder are often rendered much more palatable by the free action of the air upon them.

Growing crops of different kinds may likewise be occasionally much benefited by a more perfect ventilation, by having the plants thinned out so as to afford a more free admission and circulation of the air.

VENTILATOR, the name of a machine by which the noxious air of any close place, as a chamber, granary, &c. may be changed for such as is fresh.

The noxious qualities of bad air have been long known, though not sufficiently attended to in practice; but the indefatigable pains taken by Dr. Hales, to set the mischiefs arising from foul air in a just light, and the remedy he has proposed by the use of his ventilators, are deserving of attention.

The ventilator invented by Dr. Hales, consisted of a square box, about ten feet long, five wide, and two deep; in the middle of which was placed a broad partition, or midriff, made to move up and down, on hinges at one end, by means of an iron rod fixed to the midriff.

Another box, of the same size with the former, having a like midriff, bar, &c. was placed near the former with its rod, both these rods were fixed to a moveable lever, so that by the alternately rising and depressing the lever, the midriffs were also raised and depressed alternately, by which means these double bellows were at the same time both drawing and pouring out the air.

That the midriffs may be rendered lighter, they may be made of four bars, lengthwise, and as many placed across them, each about three inches broad, and an inch thick, the vacant spaces being filled up with thin pannels of fir board. And in order to make the midriffs move with greater ease, and without touching the sides of the boxes, there is an iron regulator fixed upright to the end of the box. As very little air will escape if the edges of the midriff be within one-twentieth part of an inch from the sides of the box, there is no necessity for leathern sides as in common bellows. One end of the box must be somewhat circular, that it may be the better adapted to the rising and falling of the midriff; and the other end have a slip of leather nailed over the hinges.

These ventilators have eight valves adapted for the air to pass through, which are so placed at the hinge end of the box, that the midriffs may be alternately rising and falling, and two of the ventilators constantly drawing in the air, and two of them at the same time forcing it out at their proper valves. To the ventilators before the valves, is fixed a trunk as a common receptacle for all the air that comes out of these valves, which air is conveyed away through the trunk passing through the wall of a building, &c.

The same writer has suggested, that ventilators might be used in mines for guarding against suffocation arising from damps and in making salt; for which purpose there should be a stream of water to work them, or they might be worked by a windmill, and the brine be in long narrow canals, covered with boards of canvass about a foot above the surface of the brine to confine the stream of air, so as to make it act upon the surface of the brine and carry off the water in vapours. In which way it might be reduced to a dry salt, with a saving of fuel in winter and summer, or in rainy weather, or any state of the air whatever. He apprehends ventilators might also serve for drying linen hung in low long galleries, especially in damp or rainy weather, and also in drying woollen cloths after they are fulled or dyed, and in this case they might be worked by the fulling water-mill. They might also be an useful appendage to malt and hop kilns, and he is farther of opinion, that a ventilation of warm dry air from

the adjoining stove with a cautious hand, might be of service to trees and plants in green-houses, where it is well known that air, full of the rancid vapours which perspire from the plants, is very unkindly to them, as well as the vapours from human bodies are to men; for fresh air is as necessary to the healthy state of vegetables as of animals. Ventilators are also of excellent use for drying corn, hops, and malt.

Many fluids might, likewise, be purified by them.

They are of great use in some cases, in ventilating grain in ships, for which purpose the description of one is given in the eighth volume of the Bath Papers.

They may, likewise, be applied to many other beneficial purposes. The methods of forming them may be seen in Hales's Treatise on Ventilators.

VERJUICE, a very acid liquor obtained from grapes or apples, which are too acid for wine or cider. It is generally made from the juice of the crab, or wild apple. It is useful for bathing bruised parts, &c.

VERMIFUGE, in *Farriery*, such remedies as destroy or expel worms.

VERMIN, a collective name including all kinds of small animals, that are troublesome to men, beasts, corn, fruits, &c.

It has been observed by Mr. Young, in the thirteenth volume of his Annals of Agriculture, that rats and mice are much more prejudicial than the generality of farmers are aware of. "In proof of this opinion, it will probably be admitted, he says, that a single rat eats and destroys a quart of corn per week; he thinks this much under the real damage; which, notwithstanding it amounts per year to the large quantity of twenty quarters, two bushels, and four gallons, for the maintenance of one hundred rats; and he believes there are very few capital farmers but have many more than that quantity of rats belonging to them." See *Rat*.

"The damage sustained by farmers from mice, is probably, he says, nearly equal to that of rats. But an experiment may easily be made, and a more just idea of the expenses attending those destructive vermin ascertained, by confining a single rat and mouse, and feeding them with corn. Such an experiment would be of great public utility; as it would certainly induce farmers to be much more vigilant than they are, in the destruction of those vermin, if they formed proper ideas of the losses sustained by them; which, on the most moderate calculation, will be found to amount to the sum of forty pounds per annum to every capital farmer, and half that sum to a small farmer. So that the total value of the corn destroyed, amounts to such a sum of money as to be of great consequence to the nation."

And Mr. Marshall, in his Rural Economy of the Midland Counties, has given a striking instance of the industry and mischievousness of mice, which occurred in an intended plantation: This field was in autumn sown with wheat: the situation being an oat stubble, and had not borne wheat for many years; yet, on digging it, a large hoard of wheat was found, four or five yards from the fence of the wheat field, and between which and the spot is a very high bank and deep ditch, across which every grain must have been carried, and perhaps, one at a journey!

"The workman thinks the hoard consisted of near half a gallon of wheat; but if of one quart, it corroborates, he says, strongly, the idea of mice being more mischievous than moles, to the farmer."

It is further remarked by the same writer, that "in the field, the barn, and the dairy, mice are equally troublesome and destructive. In the field, the quantity of destruction is not easily to be ascertained; but it is probably much greater than the unobservant are aware of. At seed time and at harvest they not only feed freely upon corn, but fill their granaries with it, as a resource in less plentiful seasons. Much care is bestowed on the destruction of moles; and it might be worth while to endeavour to lessen the number of field mice, which he is of opinion are in their nature more injurious to the farmer than moles are. And in the rick yard, the barn, the dwelling-house, the garden, and the nursery-ground, their mischievousness is too obvious to be overlooked; and the utility of lessening their number in these places is too well known to require an enumeration of facts to enforce it.

"The method of destroying mice is, says he, a subject not unworthy the attention of any man who is interested in rural affairs. If some art or some natural enemies were not employed in lessening their number, the entire supply of human food would not be sufficient to support them. Even in their present state, he has heard it intimated by a man whose observations are frequently just, that it is a disputable point whether the mouse or tithe-man is a greater enemy to the farmer. This idea, however, is more applicable in a grassland country, where corn, being less in quantity, is more liable to be destroyed by mice, than it is in an arable country, where the proportion of corn is greater; where the barn is oftener emptied; and where pillar stack-frames and pillar granaries are generally more in use.

"The barn and the stackyard are usually put under the care of the cat: to set a mouse-trap in a barn full of corn has perhaps been considered as a thing so unlikely to be effective, that it has seldom been tried: he has never met with an instance of it, excepting one in this district, in which its success has been extraordinary. A barn which for many years had been remarkably infested with mice (notwithstanding a numerous guard of cats), has by a proper use of traps, been kept in a manner wholly free from them.

"It having been observed, during long experience, that these mischievous animals, uncontented with their destruction among the corn, attacked leather, grease, or other animal food, which happened to be left in the barn, traps were set in their runs and natural hiding-places, and baited with these substances. The success was every thing to be desired; for although a total extirpation has not taken place, an annual saving of some quarters of corn has been the consequence.

"Under an idea that it was a change of food which in the barn constituted the bait, the same principle was applied in the cheese-chamber, and with the same success. Here traps baited with corn were taken with avidity.

"In the garden it was observed, that much depended on the season of the year: therefore, here, natural hiding-places were sought for; and if convenient ones could not be found, artificial ones were made, in different parts of the garden, with logs, stones set hollow on-edge, boards, &c. In these hiding-places a variety of food is laid for several days, whenever mice become troublesome; and whatever food is preferred, with that traps are baited.

"By these means the entire premises have been kept in a manner wholly free from mice."

While the number is great, almost any kind of trap may be used, provided it be properly baited: but for taking a remaining artful few, a common shaped round steel trap, adapted to the size of the mouse, has been found to be the most effectual.

For the destruction of these vermin Mr. Lawrence, in his Calendar of Husbandry, advises that "every farm should be provided with a competent number of ferrets, and of true vermin-bred curs, such as are commonly kept by rat-catchers and labourers. And that an hour or two should be reserved, weekly, for a general hunt (in all accessible and likely places,) where the beer-can ought to pass about pretty briskly, to make the business go down with chearfulness, and to keep the hunters mindful of it as a pleasing task. The ferrets and dogs should be in the care of him among the servants, either the best skilled or most attached to the sport. The holes and haunts of the vermin, in and around the premises, should be diligently sought out, the master never failing to allow trifling premiums to those who make discoveries thereof. No respite to be allowed to the delinquents, but a war of extermination to be constantly carrying on from January to December." And that, "in aid of these measures, others also may be adopted, if necessary: traps for instance, but these ought to be of the cage kind, and by no means such as to endanger the cats, a most useful species of domestics, fully entitled to our care and kindness. The qualifications of a good cat are, that she will not touch young poultry, and will hunt for mere sport, rather than from the impulse of hunger. Eating their prey injures them and lessens their exertions."

He thinks "ferrets are best kept in huts like rabbits; their food is well known to be carrion, or offal of any kind, with, occasionally, a little boiled skim milk and bread."

And he supposes that "the same remedies apply equally to the field vermin, polecats and weasels, with their varieties, which, unless checked, commit such frequent considerable nightly depredations in the farm yard, taking even young pigs. Neither these nor the fox would, he says, be heard of near premises, were they well guarded by vermin dogs."

Mr. Marshall, in his Account of Kent, has, he says, favoured us with a good method of trapping field vermin. "A wooden box resembling a dog-kennel, divided in the middle by an open wire partition, running from end to end, and reaching from the ridge of the roof to the floor: one side of this partition is again divided into two parts or cages, one of them for a rabbit and the other for a live fowl, to allure the vermin, the other half formed into a falling box trap to take them." "This, whether new or old is, he thinks, an ingenious contrivance; but he wishes the amendment of it, which humanity requires, had proceeded rather from Mr. Marshall than himself. It is a most unnecessary piece of cruelty to expose a poor wretched fowl or rabbit to the sight and the claws of their dreaded enemy. Kill the baits, and the scent of the fresh blood is the greatest possible inticement." See *Rat* and *Mice*.

In regard to vipers, efts, toads, or any other poisonous class of reptiles, it is concluded by the same writer that, "if country people would be unanimous and steady in their endeavours, the intire genus of these animals might in time be extinguished. Would a single parish make the essay of rooting out all useless and dangerous vermin, they would soon, he says, find their account in it, and would undoubtedly be followed by their neighbour parishes. The only method is by allowing handsome premiums to those who shall produce the vermin, or discover their harbour or their eggs. Steps like these, it is well known, have been taken in various parts, but in so loose and indifferent a way as to be intirely nugatory. Was there a determined resolution to hunt out and destroy any species whatever, where is the possibility that it could long exist? These, and a thousand other evils are, he thinks, purely the offspring of a general indolence."

With respect to "birds of prey, such as hawks and carrion crows, which endanger the poultry and will even attack lambs, and bull-finches, pyes, and jays, so destructive to fruit, they can only be destroyed effectually by the gun. But some sorts of birds, particularly sparrows, have been said to be useful." Bradley relates, the above writer says, that he found a great number of caterpillars in the maw of a sparrow, and thence computed, that a pair of sparrows carry to their young, in the course of a month, 3360 caterpillars. And "rooks are also said to be a great defence against that devouring insect, the grub-worm.

But some sorts of vermin, as those of the insect kind, may be best destroyed by gathering with the hand as soon as they begin to appear, as all those of the caterpillar tribe; others by plentiful steaming or watering, such as those of the aphis kind; others by smoaking with tobacco, as those of the stirpes kind; still others by compositions of various kinds, such as soap-suds and sulphur, lime-water, &c. as the coccus, phalæna, &c. But there are others which are best caught by artifice, such as wasps, flies, earwigs, &c. And others may be devoured by the introduction of particular animals, as the grub by the rook, as suggested above, and the snail or worm by the duck or gull, &c. See *Blight*.

It is remarked in the General View of the Agriculture of Middlesex, that "the worms and slugs which

feed on the new roots of corn, &c. may probably be mostly destroyed by a clean fallow, continued so long as to occasion their death by want of food. It is probably a mistaken notion that lime spread in such a quantity as to be beneficial to the soil, will destroy these reptiles. In Kent, near the chalk hills, and even on a calcareous soil, they lime, he says, frequently, and very liberally, without being at all relieved from the ravages of worms. The earth worm feeds on herbs, and as its size is much larger, so it is probably more destructive than the wire worm."

The white slug often abounds much on bean and pea stubbles, on strong land if sown to wheat, and in wheat after clover and beans. They have white bellies with a bluish skin on the back. They are also very destructive to rye crops in some districts.

Mr. Middleton, in the excellent Survey of the above county has made the following estimate, of the damage produced by vermin and game, on a farm of 200 acres, half arable and half grass, without sheep walks.

Expences and Damage.

	L.	*s.*	*d.*
"*Mole-catcher* paid by the year one guinea, notwithstanding which, they will do damage to the amount of half a guinea - - - - -	1	11	6
Ratcatcher, paid by the year two guineas, and they will do damage to the amount of a guinea more - - - -	3	3	0
Mice, if a verminkiller be employed, will cost as much as for rats, and the remaining damage will be as great, *viz.* 3 guineas. If they are not so destroyed, they will do, in the buildings, corn-stacks, barns and fields, 20*l.* worth of damage.	3	3	0
Sparrows, and other small birds employ five boys to keep them off 50 acres of corn: a fortnight at sowing time, and another at harvest, with powder, rattles, &c. 5 guineas. They damage thatched buildings all the year, they are also mischievous in the gardens to the amount of one guinea more. In this county they quit London, and the other towns, villages, and single houses, and attack every corn field in flocks of thousands together. If not kept off by rattles, &c. they would clear whole fields; but, under the best management, their damage amounts to upwards of one shilling an acre on the whole farm." The damage, however, he puts down at - - -	5	5	0
The first sort of these birds, he says, "feed on both animal and vegetable diet, doing good by reducing the number of grubs, caterpillars and butterflies, and much harm by destroying the blossom of cherries and gooseberries, and the ripe fruit and peas in our gardens, and the corn in our fields.			
Carry forward - - -	13	2	6

	L.	*s.*	*d.*
Brought forward	13	2	6
The fields must be watched against *rooks*. The boys employed in keeping off sparrow, jays and pigeons, will, in a great measure, keep these off, and the little damage they do about harvest time is much more than made up to the farmer by their feeding on worms, slugs, and grubs, all the rest of the year.			
Jays are particularly destructive to bean crops near the harvest time; *pigeons* are so to tares both at sowing and at harvest time. Twenty-five acres in 2 fields will require two boys a month, with rattles, powder, pistols, &c. -	1	1	0
Magpies, carrion crows, ravens, kites, hawks, and dogs: every good farmer would be glad to insure against damage by these creatures at - -	2	2	0
Game is supported by feeding on all the farmer's crops; he is not allowed to destroy it if unqualified; and if qualified, it will cost him 3 guineas for a licence, and one guinea in ammunition, and still damage will be done to the amount of one shilling an acre, or 10*l.* Hunters and shooters are a large species of vermin, who prey upon game; and on an average of years, damage such a farm to the amount of 10*l.* together 20*l.* or two shillings an acre for the article game -	20	0	0
The earth worm, the wire worm, the grub of the cockchafer, the slug, the turnip fly, the black canker caterpillar, the black insect, which destroys beans, and the yellow maggot, which feeds on the ears of wheat, are of numerous families, and not less mischievous than any of the foregoing. They will once in five years cut off the turnips, and once in ten the clover and tares, and do 4*s.* an acre damage to the corn crops. These losses, on an hundred acres of arable land, amount to 20*l.* a year, but he shall include damage done by them to the whole farm, and say only" - - - -	13	14	6
Total *L.*	50	0	0

Hence he concludes that the amount is nearly "five shillings an acre on the whole quantity of land, which sum will perhaps average the cultivated corn and grass land farms of Britain; and as there are nearly forty millions of acres in this state, these depredations amount to 10 millions per annum."

It has been stated in the original report of the same county "in respect to game, that the breeding, rearing, turning loose and cherishing mischievous animals, make part of the employment of every fox-hunter, which he does to the manifest detriment of the farmer, and of the community, merely for the wanton sport and fictitious glory of destroying them afterwards, in a manner that aggravates the injury done to the defence-

less and disregarded husbandman. Hunting in a well cultivated country is an expensive system of barbarity, exercised in destroying the property and torturing the feelings of a valuable class of men. A true sportsman is not studious how to put a speedy end to the sufferings of the animal he pursues, but in what manner to prolong its terror, until it has tried all the efforts agonized nature can dictate, and until the utmost exertions of its strength is painfully exhausted: his mode of destruction is beyond brutal, it is filling up the measure of cruelty to its utmost limits."

But Mr. Middleton adds, that "the earl of Egremont, whose merits towards the rural economy of his country were before very great, has lately sold, or given away, his fox-hounds, on account of the injury which he could not avoid perceiving that the hunting unavoidably did to the labours and inclosures of the farmer in his neighbourhood."

And the same writer states, in the report noticed above, that "thieves of every description keep dogs, frequently of the bull-dog kind. They discover and give their master notice when any person is in the way, who might interrupt him either in committing the theft or in his carrying off the plunder. Thus all gypsies and persons who live in tents under hedges, by an union of begging and thieving, are always accompanied by dogs, many of which are as great thieves as their owners, and are as regularly taught to hunt, with as much avidity as spaniels and pointers after game, round respectable looking houses for small articles of clothes or other things, which they carry to their masters. He thinks it obvious that every man whose labour is insufficient for the support of his family, and who keeps one or more dogs, must do it to assist him during the time he is committing depredations." And adds that "the exemption of dogs of the foregoing description from the lately imposed tax, operates as a licence for thieves, as they could not carry on their present depredatory systems without the assistance of these animals. It also encourages the worrying and destroying of many sheep, and is the principal cause of canine madness.

"Useless dogs, says he, are the greatest nuisance imaginable. Canine madness has produced so many lamentable effects that a remedy is loudly called for. The safest remedy would be to reduce the number of dogs. Not one instance in a hundred is made public of the persons who die by canine madness in Britain. There are some hundreds who thus perish every year. If all such cases were regularly published in the news-papers, or otherwise, they would touch the hearts of the people so very sensibly as to produce the annihilation of dogs."

It is further noticed by the intelligent writer, that "Mr. George Barrenger, of Tulsehill Farm, Lambeth, has lost upwards of 50 pounds worth of sheep and swine that died mad; the effect of having been bitten by a dog. Mr. Barrenger observes that every fellow who lives in a cellar, a garret, or on a common in a tent, and that does not pay any taxes, can keep a couple of bull-dogs, who occasionally mangle a farmer's stock; while the husbandman is not allowed to keep a dog, even for the protection of his family and cattle, without being taxed for it."

He justly suggests that "the industrious poor ought not to be allowed to expend their earnings on any thing so useless to them as dogs.—Many there are whose dogs have cost them the price of a cow. Their saving in dog-keep might, and ought to be, more prudently employed in the keeping of bees, poultry, and pigs; with a little management, these things would produce a cow, whose milk would feed their children."

VERNAL, something belonging to the spring season.

VETCH, the name of a well known plant, much cultivated in many districts, and of which there are several species.

In different districts they prefer the autumn to the spring for sowing crops of this kind but they can seldom be fed sufficiently early to admit of the subsequent process of a good fallowing of the land. Some, however, sow them in the spring and mix a few oats with them, which keep the vetches erect and in good state for cutting green with the scythe. See *Tares*.

It has been suggested that there are probably many species or varieties of the vetch kind, that may be introduced into cultivation, perhaps with benefit to the farmer, either in the view of affording good pasturage, or as supplying large quantities of green food; though they have not yet been sufficiently subjected to the test of experiment, either in the soiling, feeding, or pasturing of animals, to fully decide on their merits or utility in any of these applications.

They are in general, plants which are not only very productive in regard to the quantity of food, but from various trials, extremely nutritious and fattening. And they have mostly, in addition the very desirable property of being fed upon by almost all sorts of live stock; and it is not by any means to be concluded from their appearing of a coarse quality, that they may not be of advantage even as pasture herbage, as it is well known that close and judicious feeding is capable of bringing the coarsest kinds of herbage into a fine and grassy state.

Of these kinds of plants the bush vetch (*vicia sepium*) is a species which promises much benefit as a pasture plant. It is asserted that its roots spread much laterally just below the surface of the soil, and send forth numerous stems in the spring of the year, close to each other, which, as they have a broad tufted top, covered with many leaves, a close pile is formed without the assistance of any other plant. It is not found to rise to any great height; but from its growing up rapidly, after being cut over or cropped by animals, it would appear not ill suited for pasturage. On soils of the fertile kind, however, it grows to a good height for the purpose of hay; but as the stalks grow so closely together, there is some danger of its rotting at the bottom in moist rainy seasons. It affords abundance of seed, but which is very apt to be destroyed in the pod by insects in their vermicular or worm state. Dr. Anderson says, it would seem to succeed best in clayey soils, where it abounds pretty much in foli-

age, affording seeds similar to those of the common tare. And it is stated in the Bath Papers, that it has been found to shoot earlier in the spring than any other plant eaten by cattle, and to vegetate late in the autumn, continuing green all winter. A small space in a garden sown with it in drills may, in the second year, be cut five times, producing at the rate of twenty-four tons per acre of green food, which would be nearly four and a half tons, when dry and made into hay.

The principal difficulty in the introducing the plant, arises from the seed being so apt to be devoured by the *larvæ* of a species of *attelobus*, as has been shown by Mr. Swayne.

And another species which might be useful in this way, is the tufted vetch *(vicia cracca)* which from its rising to a considerable height in the stem, and affording much foliage, produces a large proportion of green fodder for cattle, and the plant is easily cultivated, and might also be made to yield a great deal of hay.

Plott, in his Natural History of Staffordshire, has long ago remarked it to improve the condition of poor lean cattle, beyond any other plant then known. See *Tare*.

VETERINARY, a term signifying that part or department of farriery, which relates to the cure of morbid domestic animals.

VETERINARY-*College*, an institution first established in the year 1792, at St. Pancras, near London. It is observed by Mr. Boardman in his Dictionary of the Veterinary Art, that " the public are indebted for this truly national foundation to the discernment and patroitic exertions of the Agricultural Society of Odiham, in Hampshire. The first professor was Mr. St. Bel, a Frenchman, who had previously signalized himself in this country as a veterinary anatomist, by dissecting the famous race-horse Eclipse.

" This college, says he, is supported by public subscription. The annual contribution is two guineas, but payment of twenty guineas at once constitutes a subscriber for life. In some recent instances, the institution has also shared the bounty of parliament; an important saving having resulted to the nation from the appointment of veterinary surgeons to the different regiments of British cavalry.

" The views and objects of the college appear in the following statement, printed by the authority of the governors:

" The grand object, they observe, is the improvement of veterinary knowledge, in order to remedy the ignorance and incompetency of farriers, so long and universally complained of. For this end, a range of stables, a forge, a theatre for dissections and lectures, with other buildings, have been erected; a gentleman of superior abilities has been appointed professor, with other requisite officers.

" The anatomical structure of quadrupeds, as horses, cattle, sheep, dogs, &c. the diseases to which they are subject, and the remedies proper to be applied, are investigated and regularly taught; by which means enlightened practitioners of liberal education, whose whole study has been devoted to the veterinary art in all its branches, may be gradually dispersed over the kingdom, on whose skill and experience confidence may be securely placed.

" Pupils to the college, in addition to the lectures and instructions of the professor, and the practice of the stables, at present enjoy (from the liberality of some of the most eminent of the faculty) the advantage of free admission to their medical and anatomical lectures. These pupils, previous to leaving the college, are strictly examined by a medical committee, from whom they receive a proper certificate; and several examined and approved, have already left the college, and are at this time practising in various parts of the country with great success.

" Subscribers have the privilege of sending their diseased animals to the college, without further expense than that of their daily food, and these in general form a sufficient number of patients for the practice of the professor and pupils. On fixed days, the professor prescribes for animals belonging to subscribers who find it inconvenient to spare them from home, provided the necessary medicines be furnished and compounded at the college; subscribers horses are also there shod at the ordinary prices.

" His royal highness the commander in chief having been pleased to appoint a board of general officers to take into consideration the objects of this institution, they have reported the continual loss of cavalry to have been very heavy, from the total ignorance of those who have hitherto had the veterinary department in the army. This report his majesty has approved, and henceforward, to qualify for the military service, a veterinary surgeon must be provided with a regular diploma from the college. A number of gentlemen, subscribers to the institution, attend once a fortnight for the purpose of inspecting the discipline of the stables, and seeing that the regulations are duly complied with."

VERTIGO, in *Farriery*. See *Apoplexy*.

VESSIGON, in *Farriery*, a term applied formerly to *wind-gall*. It is sometimes written *vession*.

VINE, a plant from which the grape is produced.

It would seem not improbable but that the culture of the vine might be conducted with advantage in many situations in this country, especially as a part of it is well known to be nearly within the vinous latitude, which is found to extend between the twenty-fifth and fifty-first degree in the northern hemisphere. In Germany it is found by experience, that all such vineyards as are situated within the latter of these limits, are capable of being cultivated with considerable profit; but that where they stretch beyond it, their success is very doubtful.

In the business of establishing vineyards in this country there are four things, Mr. Spreckley says, which ought materially to be considered, viz. 1st. The situation; 2d. The soil; 3d. The kinds of vines which are the most fit to be planted; and 4th. The mode of their management.

An elevated situation, where there is a gentle declivity to the south or south-east, is esteemed preferable to low grounds, which are generally subject

to damps and spring frosts, even at times when the adjoining high grounds are entirely free from both.

A vineyard should be well sheltered to the north, as also to the north-west and north-east. In an hilly country there are generally many favourable spots, where nature has given important advantages, and these should be still further improved by art.

Plantations of forest trees, judiciously formed, would, he supposes, contribute much to give warmth and shelter; but these should not be placed too near the vineyard, so as to confine the air, which would prove very prejudicial.

It is well known, that in wine countries, vineyards are not only confined to gentle declivities, but that they often are formed on slopes, on the sides of hills and rocks, which are sometimes so steep as even to border upon precipices, and that vineyards thus situated, produce grapes uncommonly rich, yielding wines of the most excellent quality.

From the hills which border upon the English channel, having declivities which tend towards the south, they would seem to be highly proper for the growth of the vine. And the excavations in them, from which chalky materials have been taken, where they have a southern exposure, would likewise appear well calculated to answer the same purpose.

It is observed, that the vine delights in such gravelly and rocky soils as are frequently found on the sides of steep hills and rocks, and that it has sometimes been known to flourish among mere stones and gravel. It delights in a light, dry, sandy, or gravelly soil, which is perfectly free from stagnant moisture; consequently it may be remarked, that the introduction of vineyards into this country would have no bad effect respecting agriculture, as all strong and deep lands, which are best adapted for tillage, are the most unsuitable for vines being cultivated upon.

But besides gentle declivities and light soils, such as are proper for vineyards, vines grow in situations and soils, where the land could hardly be rendered profitable in any other way. And thus though vines would not grow robust on the steeps of poor gravelly and rocky soils, still they would be more prolific than when planted on rich lands, and the fruit would be greatly preferable. All such hills as have the above aspect, and are composed of either slate, gravel, scaley rock, or limestone, are highly proper for being planted upon.

It is evident, therefore, that there is a considerable portion of soil in the southern districts of the kingdom, that is well adapted for the growth of vines.

But the success of a vineyard in this country would most essentially depend on the kinds of vines which are propagated.

It is believed, that it has been a prevailing but surely an erroneous notion, that the sweet early kinds of grapes are the best to plant for the purpose of making wine in this country. And that most or all of the modern trials have been made from vines brought from *France*.

Among the abundant variety of grapes, Mr. Spreckley does not doubt but there are peculiar sorts, which are by nature singularly adapted to make wines in different climates.

Thus the different sorts of grapes propagated in the Madeira and Canary Islands, might not be found, if tried, to make good wines in *France*.

Hence he concludes, that as the southern part of this island is almost on the verge of the vinous latitude, it should seem reasonable to suppose, that there would be the greatest probability of success from those kinds of grapes which have been known to thrive and prosper best in the most northern latitudes. He should, therefore, recommend the kinds of vines cultivated in *Germany*, and particularly the sort producing the grapes of which the *Rhenish* wine is made, in preference to any kind cultivated in *France*.

He has remarked above, that the early sweet kinds of grapes are improper for making wine in this country: his reason is, that though such grapes yield a sweet juice, it is not calculated to undergo fermentation.

It is found by experience, that *good-bodied*, or generous wines, can be made from grapes of an austere taste, and that too even before they are quite arrived at a state of maturity. But then wine from such crude grapes, requires to be kept to a good age.

The case is similar with respect to apples. It is well known that the sweet kinds of apples, which ripen in the summer months, are very unfit for making of cyder. And that the noblest cyder (such as the *Styre* and *Cockagee*) is made from apples not much better than wildings. Mr. London, however, observes, in speaking of the culture of the vine, that "the general imperfection of English grapes, is their defect of saccharine matter, and want of sweetness. This is, perhaps, in part owing to the humidity of the atmosphere, more than to its coldness, as very sweet grapes grow, and spirituous wines are made, in much colder and more northern latitudes than a great part of England. Another reason why the fruit of English vines possesses considerable acidity, is the general taste for large globular grapes, without regard so much to the delicacy of their flavour, as the grandeur of the appearance. This species of vine, does not produce delicious grapes in the hottest climates, and consequently ought not to be so generally cultivated in this. The grapes most abundan in saccharine matter, are always round, as those of the *currant grape*. It must be confessed indeed, that the more exposed the vine is to the intense meridian sun, so much sweeter will be the grape, and the greater the quantity of saccharine or spirituous juice that it will contain.

The sorts most suitable may, probably, be the Chassilas or common white Muscadine; the berries of which are not large or very sweet; the Morillon, Noir Hatif, which is a small round black berry of a sugary juice, is much esteemed for being early, ripening in September.

The Malmsey Muscadine somewhat resembles the preceding; the juice is very sweet, and of a high flavour; it is a good bearer, and a fine grape.

The Black Sweet Water, which has a small roundish berry of a sweet taste; but, being apt to crack, is not in much repute. The birds are fond of it. It ripens in September.

The Small Black Cluster, which has small oval berries; the leaves are covered with a hoary down. It has a very pleasant fruit.

The Early White Grape from Teneriffe; the berries of which are of a middling size, and the flesh remarkably sweet and juicy. The Auverna, or True Burgundy Grape, sometimes called the Black Morillon, which is an indifferent fruit for the table, but is esteemed one of the best for making wine. And the White Sweet Water, which has a large berry of a white colour, and very agreeable juice; it is esteemed an excellent grape, and ripens in September.

From some of these the cultivator may probably find a proper grape for cultivation in the intention of making wine.

In regard to the culture, as even the most southern parts of this island are but nearly on the verge of the vinous latitude, every possible advantage should be consulted respecting the formation and management of a vineyard.

The vineyards abroad are formed by planting the vines in rows, and by training them in a perpendicular direction. But in this country Mr. Speechley should greatly prefer the mode of training the vines in a lateral or horizontal form, similar to the method practised in *Holland*, with vines in frames. There would be little difficulty in this method, as the vines would readily be trained along small poles, not thicker than those used for hops; these should be fixed nearly parallel to the ground. Vines thus trained, would derive, he apprehends, many advantages, not only by means of warmth and shelter, but that they would most easily also be protected from spring frosts by applying the boughs of trees, particularly of evergreens. The grapes also, he observes, would be greatly benefited by the reflection of the soil underneath.

When vines are intended to be planted on the steeps of hills, and on the sides of rocks, the ground should be prepared and formed in the manner of steps, which it is absolutely necessary should be lower at the inner angle, as without this, the vine plants would lose the advantage of such rains as fall hastily and perpendicularly. It is easy to conceive that much advantage would be gained from a situation thus formed, as the back would be nearly equal to a wall. And the expence attending the formation of the ground could not be very considerable. The work should be begun at the top, and the soil taken out be thrown down the hill. It would likewise be further beneficial to have a little good soil, put in at the angles before the vines are planted.

The plants may be provided either by seeds, cuttings or layers, but the two last are the best methods. When they are raised from seed, after they have had a year's growth, they should be planted out, about the latter end of March or beginning of April, against the trellis to which they are to be trained, when from seeds ripened in this country; but when from such as are imported from the vine countries, too many should not be planted till their value be known. When they have been planted, they should be cut at the third eye, if strong; but at the second if weakly, at the same time rubbing off the lower end with the finger and thumb.

When by cuttings, they should be chosen from the shoots that are best ripened, and have the shortest joints; always having one or two joints of the last year's wood, cutting it perfectly smooth, and a little rounding at the lower end, and as near to a joint of the old wood as possible. The upper end should also be cut smooth and sloping towards the trellis.

They should afterwards be trained according to circumstances. It has been advised also that choice should be made of cuttings after a warm and dry season, when the wood ripens well; each cutting having two inches of the old wood with one eye of the new. When the old vines are pruned, there is great choice, they should therefore be then selected of a middling size, and the wood round.

But in raising vines in the layer manner, a method usually made use of, lay stools in an open situation in the same mode as for forest trees and shrubs; but the best way, according to Forsyth, is to take layers from such as have been trained.

They should be cut so as to leave one or two strong eyes on each, and when the shoots begin to run, be trained to the trellis. Those which have the strongest and most vigorous shoots, should be selected for this purpose.

They should afterwards be carefully trained and pruned according to circumstances, always remembering that much in the goodness of the grapes depends upon the living wood being strong and well ripened.

The vines may be set in rows at suitable distances according to the soil, situation and mode of training which is practised, but mostly about three or four feet distant in the rows, and five, six, or more from row to row. The intervals between the rows, should be kept quite clean, and free from weeds, by frequent hoeing and digging. And after the vines have been thus raised and carefully pruned and trained for three years, they mostly produce crops of fruit, which when for wine should be well ripened before it is used.

In the culture of vines in Madeira, the following method is said to be practised. The best season for planting, is supposed to be from the middle of November to the end of February; the slips or cuttings are to be from a foot and a half to two feet and a half long, they are to be set two feet in the ground, about three feet distant, in straight rows or trenches about four or five feet asunder. After one trench is opened, and the earth taken out or laid on one side of it, forming a bank, the butt end of the vines are to be put into the bottom of the trench, and the small

ends extended sloping up the bank, then the trench is to be filled with earth dug from the sound land, the depth of the trench, breaking the clods, taking out the stones, hawling all the earth towards the vines, and thus making a second trench at the distance above mentioned from the first; in the same manner proceed to plant the whole vineyard. Thus the ground will be lightened all over as well as where it touches the vines, and will be cleared of stones, the roots of trees, shrubs and grass, which are all to be carefully picked out. A vineyard planted in this manner will last fifty or sixty years in that island.

The young vines are not to be pruned till they have been two or three years planted. The season for pruning is from the middle of November to the end of January, or later: in doing this, no part of the vine is to be cut but the new shoots, which are to be cut off every year, at the end of every second or third joint. The largest of these cuttings are to be saved for planting, and will keep several weeks above ground; but if they should be cut early, and not planted till late, the butt end should be covered with earth.

"Supporting the vines, &c. is done to the height of three or four feet, by sticking stakes in the ground from end to end of the rows, then lashing long slender poles near the heads of them; and across the poles are to be laid, both ways, reeds or canes, at the distance of two or two feet and a half, which are to be tied to one another, and the poles where they cross, with split-willow twigs; the canes, if full grown and hard, will last two or three years. The second or third year after planting vines, they are to be raised and fastened to the stakes and poles with twigs, and the branches spread open, and loosely tied to the poles and canes, so that they may not be too thick in some places, and too thin in others."

And it is directed that "the vineyards should be dug up with the narrow billing hoes every spring and fall, and the clods broken; this work is very laborious, as the people are obliged to perform it on their knees under the canes; but sometimes the canes are untied, and after the ground is dug, tied on again.

"The third year after the vines have been planted they generally produce a pretty good crop of grapes fit to make wine. When they are almost come to their full size, they are to be gradually exposed to the sun, by frequently thinning the leaves, till every branch lies open to the sun some part of the day. But if this should be done while the fruit is green, or, all at once, when nearly ripe, it would wither the grapes, and the juice would never be rich. The grapes must hang till they are very ripe, and many, on almost every branch, begin to turn to raisins, otherwise the wine will be weak, harsh, or rough, and without much flavour; hence, it is evident, the grapes should not be promiscuously gathered all at once, but two or three vintages made, gathering only what are ripe each time.

In such soils as are hot, dry, and poor, the culture may be effected in another way, as by their growth being limited, their tendency to fruiting is greatly increased; of course they may be cultivated by being kept in a dwarf state, in the manner of the currant, and by having hand glasses placed over them. This last method has been found to succeed very well in some late trials.

It would seem from many circumstances that the cultivation of the vine should be more attended to in this country than has been hitherto the case, in the view of procuring wine from its fruit. In some situations it would probably afford a better profit than the hop, and with much less expense of cultivation.

VINEGAR, an acid penetrating liquor, prepared from wine, cyder, beer, &c.

It is found that the qualities depend much on the method of exciting and conducting the fermentation. The wine which is generally converted into vinegar, and which for its cheapness is generally employed for this purpose, is such as has become already sour; although the better and the more spirituous the wine is, and also the more of the vinous spirit that can be retained in the vinegar, the better and stronger it will be.

Several different methods are practised by manufacturers for making vinegar, who are generally believed to be possessed of some secret for that purpose. Nothing more, however, seems requisite in the preparation of good vinegar, than to employ good wine, and to conduct the fermentation in the most advantageous method; in the same manner, as good wine can only be made from good must, and by a well-conducted fermentation. The principal part of these operations is performed by nature.

In regard to the making of vinegar, it consists in mixing the wine to be fermented with its dregs and its tartar, and in exposing this liquor to a heat of about seventy or eighty degrees. This fermentation seems to require more heat than the spirituous. It also excites more heat and tumult; and although it ought to be allowed to proceed briskly, yet it is necessary from time to time to check it.

In preparing vinegar the following process has been advised: take two large oaken vats or hogsheads, and in each of these place a wooden grate or hurdle at the distance of a foot from the bottom. Set the vessel upright, and on the grate place a moderately close layer of green twigs or fresh cuttings of the vine. Then fill up the vessel with the foot stalks of grapes, commonly called the cape, to the top of the vessel, which must be left quite open.

Having thus prepared the two vessels, pour into them the wine to be converted into vinegar, so as to fill one of them quite up, and the other but half full. Leave them thus for twenty-four hours, and then fill up the half filled vessel with liquor from that which is quite full, and which will now, in its turn, only be left half full. Four and twenty hours afterwards repeat the same operation; and thus go on, keeping the vessels alternately full and half full during every twenty-four hours, till the vinegar be made. On the second or third day there will arise, in the half filled vessel, a fermentative motion, accompanied with a sensible heat, which will gradually increase from day to day. On the contrary, the fermenting motion

is almost imperceptible in the full vessel; and as the two vessels are alternately full and half full, the fermentation is by that means in some measure interrupted, and is only renewed every other day in each vessel.

As soon as this motion appears to have entirely ceased, even in the half filled vessel, it is a sign that the fermentation is finished, and therefore the vinegar is then to be put into casks close stopped, and kept in a cool place.

And a greater or less degree of warmth accelerates or checks this, as well as the spirituous fermentation. In France, it is finished in about fifteen days, during the summer; but if the heat of the air be very great, and exceed the 25th degree of Reaumur's thermometer, the half filled vessels must be filled up every twelve hours, because if the fermentation be not so checked in that time, it will become violent, and the liquor will be so heated that many of the spirituous parts, on which the strength of the vinegar depends, will be dissipated, so that nothing will remain after the fermentation but a vapid liquor, sour indeed, but effete. The better to prevent the dissipation of the spirituous parts, it is a proper and usual precaution to close the mouth of the half filled vessel in which the liquor ferments, with a cover made of oak wood. As to the full vessel, it is always left open that the air may act freely on the liquor it contains; for it is not liable to the same inconveniences, because it ferments but very slowly.

There is another method by which a very good vinegar is commonly made at Paris, from the lees of wine. For this purpose all the wine contained in the lees is pressed out and put into large casks, the bung-holes of which are left open. These casks are put into a hot place, and if the fermentation proceeds too fast, it must be checked by adding more fresh wine. The process is very similar to that mentioned above.

It has been stated, that the most general conditions requisite for the formation of good vinegar are, 1st. a certain degree of liquidity in the materials to be acidified.

2dly. The access of the external air into the vessel which contains the liquid intended to become acid.

3dly. A temperature higher than that of the atmosphere.

4thly. The addition of substances which perform the office of a ferment.

In regard to the first, there should be a certain degree of liquidity in the fluids, in order that they may take on the acid fermentation with the greatest advantage.

The access of the atmospherical air is so indispensably necessary to the formation of vinegar, that this acid cannot be produced without it. Neither can the necessity of the concurrence of heat be called in question; but the heat ought to be moderate, in general it ought not to exceed 18, 20, or 25 degrees of Reaumur's thermometer: if a higher temperature is applied, it injures the quality of the product.

And the addition of substances proper for forming ferment, is a condition so indispensably necessary to the production of the acetous fermentation, that it would be difficult to prove that it can be omitted without detriment.—It is well known that the great art of the manufacturer of vinegar consists in establishing at one and the same time in the whole mass of vinous fluid an internal motion, which agitates its constituent principles, compelling them to separate from each other and afterwards reunite into combinations different from those in which they previously existed. It would be in vain for us to expect to obtain such a motion by leaving the wine to itself; a part of this fluid might indeed become at length acidified, but, before the whole could be completely so, it would require a great length of time, and then the first portions of acid that had been formed would be very near to a state of decomposition. Be that as it may, the choice of the substances proper for forming ferments is by no means a matter of indifference, and this choice ought always to be determined according to the quality of the fluid upon which the operation is performed.

And it is further necessary, as just observed, to employ wines of good quality, if we wish to obtain excellent vinegar, as experience shews that the best kinds of vinegar are those that have been manufactured from generous wines.

It is observed that the appearances which accompany the acetous fermentation resemble much those that occur in the spirituous fermentation. In both fermentations, an intestine motion, a swelling, a hissing noise, and an ebullition, may be perceived. There are, nevertheless, essential differences between them: besides that, the products of the vinous and acetous fermentations differ exceedingly, the heat produced by the former is scarcely sensible, while that produced by the latter is considerable. Again, there is reason to believe that the vapour which exhales from vinegar during fermentation is not noxious, as the vapour of fermenting wine is; at least, it has not been observed to produce such bad effects; on the contrary, as the acid of vinegar more and more disengages and unfolds itself, it seems to acquire more power to retain the basis of a fixed air, which is the truly dangerous part of the vapours of fermentation. Lastly, vinegar does not deposit tartar as wine does, even although it has been made with wine that has not deposited its tartar. But the sediment of vinegar is a viscid, oily, and very putrescent matter. The grape stalks used in the making of vinegar to promote and increase the fermentation, are covered over with this matter during the operation. They are generally washed clean, and carefully preserved to promote the fermentation of more vinegar, because the acid with which they are soaked, acts powerfully as a leaven or ferment. The casks also which hath been used for the preparation of vinegar, are to be cleansed from the above mentioned viscid matter, and kept for the same use, as they are rendered fitter than new casks for the preparation of vinegar.

It appears that the strength of vinegar is impaired by too speedy fermentation in vessels not at all stopped; most probably from the escape of ardent spirit, which certainly contributes to its formation. Hence small casks or vessels imperfectly closed, are best suited to this process. In England, the vinegar makers use several hundred casks disposed in the open air, with the bung hole upwards, and covered each with a tile to exclude the rain. Beer is brewed of a proper strength from malt for this express purpose, and the addition of hops is not here used.

With regard to the means of preserving or preventing the decomposition or injury of vinegar; they consist in defending it against the influence of the external air, by keeping it in proper vessels, well closed, and placed in a cool situation. And its alterations may also be farther retarded by depriving it of a portion of the water which it contains; for which purpose nothing more is necessary than to let it boil for an instant; but the vessels which are employed in this operation must not be made of copper. And the process proposed by Scheele, with a similar intention, is very simple; it consists in filling with this acid glass vessels which are placed in boilers full of water. The water is then made to boil for a full quarter of a hour, after which the vinegar is taken out, and may then be kept for several years without undergoing any alteration. Distillation has also been recommended as a means of preserving vinegar, but besides that it is a tedious and difficult process, it deprives the acid of the agreeable smell and taste peculiar to it in its natural state, and which is always desirable. And the same is the case with vinegar that has been concentrated by freezing. The acid by this simple process becomes much stronger and may be kept for a greater length of time, but it acquires an empyreumatic smell and taste which renders it unfit for being employed for domestic purposes.

And there is another substance, which is sea-salt, or muriate of soda, which some have recommended to be added to vinegar as being able to preserve it, and which sometimes succeds well enough; however it is not without its inconveniences; for the vinegars that contain this saline substance, grow turbid and at length lose their primitive qualities. But though it may not succeed quite so perfectly as we could wish, we may still employ it in certain cases with advantage, especially if the quantity of salt to be added to the vinegar be not used in too considerable a proportion.

In respect to the signs by which vinegar may be known to be good, adulterated, or spoiled, they deserve attention, as nothing is more common than to meet with vinegars of bad quality. Two causes principally contribute to their being in that state: the first, that they have been manufactured with weak wines, or such as are already spoiled; the second, that they have been mixed with acrid substances, such as pimento, &c. or mineral acids; such as the sulphuric and muriatic having been added to them. But nothing is more easy them to detect such frauds, it being sufficient to saturate a given quantity of potash with the vinegar that is suspected of adulteration and to compare the quantity of vinegar that we have been obliged to employ before we could obtain a complete saturation, with that consumed in a similar experiment made with vinegar, the good quality of which is well known; and by evaporating the solution afterwards, the nature of the substance employed may be ascertained. And as to the acrid vegetable substances that may have been mixed with it, they will readily be recognized by their taste, which will be altogether different from that of the vinegar, and which will become the more perceptible the more the acid has been concentrated by evaporation.

However, in general, vinegar that has not been adulterated, or which has not been spoiled by an incipient decomposition, is readily known by its acid taste, its transparency, and its agreeable smell, which becomes still more developed when some of the vinegar is rubbed between the hands.

It is stated in regard to the use of vinegar, by Mr. Middleton, on the authority of a manuscript paper of Sir William Pulteney's, that "during the American war, the interruption given by our cruizers to the trade of that country, and other circumstances, prevented the Americans from procuring supplies of molasses for their distilleries, and a distress was experienced, particularly in harvest time, from the want of rum to mix with water, which was the drink of their labourers.

"It is known that cold water is dangerous, when used by persons heated with labour, or by any severe exercise, and yet it is necessary to supply the waste of perspiration in some mode or other. When rum or wine is added in small quantity to water, it may be used, even if cold, with little danger; it would however be safer if a little warm water were mixed.

"Dr. Rush of America, after making experiments, recommended in a publication, that instead of rum, which could not be had, the labourers in harvest should mix a very small proportion of vinegar with their water. Some years after, in a second publication, he mentioned that the practice had been adopted, and had succeeded even beyond his expectations; indeed so much so, that in many places vinegar was continued to be used, though rum could easily be had. He accounts for the preference of vinegar to rum in this manner: severe labour or exercise excites a degree of fever; and the fever is increased by spirits or fermented liquor of any sort; but vinegar, at the same time that it prevents mischief from drinking cold water during the heat and perspiration occasioned by exercise, allays the fever; and the labourers found themselves more refreshed and less exhausted at night, when vinegar was used instead of rum.

"The writer says he has forgot the proportion of vinegar, but he thinks it was not more than a teaspoonful to a half pint of water.

"The discovery was not altogether new, for the Romans used vinegar to mix with water, for the drink of their soldiers."

And Mr. Middleton further adds, that Mons.

Denon, a celebrated French draftsman, who accompanied their army while it was in Upper Egypt, experienced the advantage of vinegar in that burning climate; which he relates in the following manner: 'I cooled the heat of my blood with vinegar, which I mixed with water and sugar, and drank of it largely.'

In farriery, vinegar is of much utility as an application in different cases of bruises and slight swellings, from blows, &c.

VINE-PRESS, a sort of press and vat constructed for the purpose of squeezing and receiving the liquor from the grapes where wine is to be made from them. It may be formed from six to nine feet square, according to the largeness of the vineyard, being made of planks about eighteen or twenty inches broad, and two and a half or three inches thick, so fixed to a bottom of the same, or of "greater thickness, that they may be capable of being pressed close to it, and one another, at the corners, by the help of posts or studs, and wedges; it may, where necessary, also be caulked."

On one side a spout is to be placed, on which a wicker basket is to be hung to strain the liquor as it runs into a tub, which is often placed half way in the ground to accommodate it to the height of the vat. When the grapes are gathered, they are thrown into the vat of the press, and the spout being stopped, receive a gentle pressure; and then the spout is opened and the juice drawn off as long as it will run without further pressing; when the spout is again stopped, the grapes are again subjected to a stronger pressure, somewhat in the manner as by the cyder-press. See *Wine*.

VINEYARD, the place or spot of ground on which vines are grown. The situations and sorts of soil most proper for this purpose have been already noticed. It is evident from numerous records and accounts that there have been formerly vineyards in different parts of this island, especially, near abbies and religious houses of different descriptions; the lands in some cases still retaining the name: the causes of their being afterwards eradicated and destroyed, do not however appear to be well known. See *Vine*.

VINKISH, in *Farriery*, a disease in sheep which is distinguished in Scotland by different names, as *Pining*, *Daising*, &c. It is a distemper which though it in some measure resembles the rot, is very different from it in its nature. It is the most severe in young sheep. Mr. Hogg remarks that the "rot is the consequence of too sudden a fall in condition on soft grassy grounds, while this is occasioned by a too sudden rise in condition on coarse heathy soils." And that "in the rot, the blood grows too thin, and though the animal continues to feed most greedily, it pines daily away to a mere skeleton. But that in this the blood grows too thick, and though the sheep affected by it likewise continue to feed greedily, they continue as fast to pine away and decay. And he adds that "it fixes always on the best of the flock, but removing them to fine land especially such as hath been recently limed, cures them immediately; and they never fail in future to become excellent sheep and remarkably healthy. It is supposed from its being mostly occasioned by a sudden advancement in condition on coarse, heathy, and mossy soils (for the deer-hair and heather when young fatten sheep amazingly fast) that the "finer breed of sheep are not nearly so apt to take it as the black-faced Scottish breed." This is a fact it is said "which has of late been sufficiently proved on some farms in Galloway, where this disease prevailed to such a degree in the autumnal months, that if the farmers had not been possessed of some finer and more dry pastures the disease would in all probability have exterminated the stock." But that "on the same farms having been taken by farmers from the east country and stocked with the Cheviot breed, scarcely a single instance of it hath occurred." It is further remarked that "in that country most farmers who have extensive muirs or mossy farms, think themselves obliged to have a grassy farm, cost what it will; and without a prospect of this they will not take a farm of the former description. They are commonly necessitated to change the pasture every week, in July, August, and September."

Besides this change of pasture some advantage in the cure of the disease may probably be derived from having recourse at first to small bleedings.

VINNY, a term signifying mouldy, when applied to hay, &c.

VIPER, the name of a well-known serpent, common in many places. These reptiles should always be destroyed as much as possible. The bite of such animals should be carefully guarded against. The continued and free use of spirits of hartshorn has been advised as the best remedy for bites of this reptile, being taken internally as well as applied externally to the part affected.

VIRGILIAN *Husbandry*, a term made use of by some authors to express that sort of husbandry, the precepts of which are so beautifully delivered in Virgil's Georgics. Formerly the husbandry in this country was Virgilian, as is shewn by the method of paring and burning the surface, of raftering or cross ploughing, and of the care in destroying weeds, upon the same principle, and by much the same means. In those parts along the southern coast, where the Romans principally inhabited, not only the practice, but the expressions, are in many respects the same with those of the ancient Romans; many of the terms used by the plough-men being of Latin origin; and the same with those used by those people on the like occasions. Tull, who has established a new method of husbandry, observes, that it is upon the whole so contradictory to this old plan, that it may be called the *anti virgilian husbandry*, and that no practice can be worse than the Virgilian.

VITAL-AIR, a term applied to pure air, by chemical philosophers. It supports the respiration of animals, and is one of the constituent parts of atmospherical air. See *Air*, and *Oxygen*.

VITRIOLIC *Acid*, a name formerly applied to what is now termed the sulphuric acid.

It is observed by Lord Dundonald, that all acids, in the new nomenclature, are named from the peculiar bases or substances of which they are formed, by the combination of pure air, or oxygen; the presence of which in all cases is necessary to constitute an acid. It is added, "that the vitriolic is the most powerful of all the acids. It disengages or expels other acids, when in a state of combination with metallic, earthy, or alkaline substances. When concentrated, it acts in a similar manner to that of alkaline salts, in the resolution or destruction of vegetable and animal substances, disengaging from them certain gasses, and forming therewith certain saponaceous and saline compounds. These solutions or extracts are of a reddish brown colour, similar to that produced by the action of alkaline salts on oxygenated peat. The vitriolic acid may be used beneficially to decompose and to bring into action the soluble matter accumulated in soils, by the combination of the phosphoric and soreline acids with calcareous matter. The vitriolic acid will join with the calcareous matter, and form gypsum; whilst the phosphoric and soreline acids, in consequence of their disengagement, will combine with other matters in the soil, particularly with magnesia, forming salts which are very soluble, and conducive to the growth of plants."

It is, however, further suggested, that "the endless series of processes adopted by nature do not finish here; for, on a supposition that the phosphoric and soreline acids had been fully disengaged from the calcareous matter, with which they had formerly been united, and that in the state of phosphate, and oxalate of potash, soda, ammoniac, or magnesia, they had expended themselves in the process of vegetation; still the gypsum remaining in the soil would, on a renewed application of dung, animal or vegetable matter, be brought from the state of gypsum, which is insoluble, to a state approaching to that of a hepar of lime, which is soluble; and as the vitriolic acid and calcareous matter are contained in, and form a part of the compounded residuum of vegetable matters, it may hence be inferred, that these matters were not generated in, but were taken up, when in a state of solution, by the roots of plants. Thus may the good effects of gypsum in America be accounted for. To these beneficial effects, from the combination of inflammable substances with gypsum, forming what is called a hepar or liver of sulphur, may be added the large share of nourishment, which trefoils, and plants of a certain formation of stem and leaf, receive by the hepatic air disengaged from hepars when they, by the process of oxygenation, are again returned to the state of neutral salts, of which such hepars had been formed by the combination of inflammable or carbonaceous matter. See *Oxygenation*.

VIVES, in *Farriery*, the name of a disease in horses, which differs little from the strangles.

VOIDER, a term provincially applied to a kind of open work, shallow basket.

VOMITING, in *Farriery*, the act of discharging the contents of the stomach by the mouth. Of this the horse is incapable, on account of a peculiarity of structure. Dogs, cats, and other animals, however, vomit very readily.

VOOR, a term applied to fallow land. See *Fallow*.

VORRAGE, a word applied to the earth collected for "melling" or mixing with lime.

W

WAD, a term applied to black lead. This substance is made use of in many districts for marking sheep with. It is likewise sometimes used to signify the plant woad or would. It is also sometimes applied to the light tufts of hay which are shaken together, and which is then said to be wadded.

WADDLE, a name applied to a flatted hurdle of split-wood.

WAGES, a term signifying the price or hire paid to labourers or servants, for performing different sorts of farm-work. See *Servant*, and *Work*.

These differ greatly, in different districts and situations, and according to the goodness of the workmen, but in all they are considerably increased within the last fifteen or twenty years. They may perhaps be stated, as varying under different circumstances, from nine to eighteen shillings by the week, and from nine pounds to fifteen or eighteen by the year.

In speaking of the bad effects of public houses on labourers, Mr. Middleton, in his Survey of Middlesex, remarks it as a general rule, that, "the higher their wages, the less they carry home, and consequently, the greater is the wretchedness of themselves and their families. Comforts in a cottage, says he, are mostly found where the man's wages are low, at least so low as to require him to labour six days in every week. For instance, a good workman, at nine shillings per week, if advanced to twelve, will spend a day in the week at the ale-house, which reduces his labour to five days, or ten shillings; and as he will spend two shillings in the public house, it leaves but eight shillings for his family, which is one less than they had when he earned only nine shillings. And that if by any means he be put into a situation of earning eighteen shillings in six days, he will get drunk on Sunday and Monday, and go to his work stupid on the Tuesday; and should he be a mechanical journeyman of some genius, who by constant labour could earn twenty-four shillings or thirty-shillings per week, as some of them can, he will be drunk half the week, insolent to his employer and to every one about him.

"Further, should his master have business in hand that requires particular dispatch, he will then, more than at any other time, be absent from his work, and his wife and children will experience the extreme of hunger, rags, and cold. And it has been suggested by Mr. Ruggles, if greater wages are given, they will be given for expenses in articles widely different from the necessaries of life—they will be given for the encouragement of idleness, and for the encrease of the excise revenue. Idleness is the root of all evil; articles of excise are the moisture which nourishes that root."

The following table exhibits a view of the advance of wages in the principal farm-servants from the year 1790 to 1804, as given in the Survey of Essex, from a great number of communications:

WAGES.

Communication.	Head Man's Wages, 1790. Per Ann.	Head Man's Wages, 1804. Per Ann.	Second Man's Wages, 1790. Per Ann.	Second Man's Wages, 1804. Per Ann.
	£. s. d.	£. s. d.	£. s. d.	£. s. d.
No. 1.	0 0 0	0 0 0	0 0 0	0 0 0
2.	8 8 0	12 12 0	6 0 0	10 0 0
3.	0 6 0 Per wk.	0 9 0 Per wk.	0 6 0 Per wk.	0 9 0 Per wk.
4.	0 9 0 Ditto	0 12 0 Ditto	0 8 0 Ditto	0 10 0 Ditto
5.	0 9 0 Ditto	0 12 0 Ditto	0 8 0 Ditto	0 10 0 Ditto
6.	0 12 0 Ditto	0 15 0 Ditto	0 10 0 Ditto	0 12 0 Ditto
7.	10 10 0	12 12 0	8 8 0	10 10 0
8.	0 10 0 Per wk.	0 14 0 Per wk.	0 9 0 Per wk.	0 13 0 Per wk.
9.	0 12 0 Ditto	0 16 0 Ditto	0 9 0 Ditto	0 13 0 Ditto
10.	0 9 0 Ditto	0 10 6 Ditto	0 7 0 Ditto	0 9 0 Ditto
Average	9 9 9¼	12 18 2¼	7 18 6¾	10 12 5¼
Per Cent.	3 ½		35¼	

And in the county of Norfolk, as below:

Communication.	Head Man's Wages, 1790. Per Ann.	Head Man's Wages, 1804. Per Ann.	Second Man's Wages, 1790. Per Ann.	Second Man's Wages, 1804. Per Ann
	£. s. d.	£. s. d.	£. s. d.	£. s. d.
No. 1.	0 9 * 0 Per wk.	0 12 0 per wk.	0 8 0 Per wk.	0 11 0 Per wk.
2.	0 12 0 ———	0 13 6 ———	0 9 0 ———	0 10 0
3.	10 0 0	12 10 0	8 0 0	10 0 0
4.	7 0 0	11 0 0	4 0 0	7 0 0
5.	11 0 0	13 0 0	8 0 0	9 0 0
6.	9 9 0	10 10 0	7 7 0	8 0 0
7.	10 0 0	10 0 0	4 0 0	5 0 0
	8 8 0	10 10 0	4 4 0	5 5 0
9.	9 0 0	10 0 0	7 0 0	8 0 0
10.	0 7 6 per w.	0 11 0 per w.	0 7 0 per w.	0 10 6 per w.
11.	7 7 0	9 9 0	5 5 0	6 6 0
12.	10 10 0	12 12 0	8 0 0	10 0 0
13.	0 10 6 per. w.	0 15 0 per w.	0 9 0 per w.	0 12 0 per w.
14.	9 10 0	11 0 0	6 10 0	7 10 0
15.	0 10 6 per w.	0 15 0 per w.	0 7 6 per w.	0 12 0 per w.
16.	8 0 0	10 0 0	5 0 0	7 0 0
17.	0 9 0 per w.	0 13 0 per w.	0 8 0 per w.	0 12 0 per w.
18.	9 9 0	10 10 0	5 0 0	7 0 0
19.	0 7 6 per. w.	0 12 0 per w.	0 6 6 per w.	0 10 0 per w.
20.	10 0 0	14 0 0	7 0 0	10 0 0
21.	0 9 0 per w.	0 12 0 per w.	0 8 0 per w.	0 11 0 pe rw.
22.	9 9 0	12 12 0	5 5 0	7 7 0
23.	9 0 0	12 0 0	6 0 0	8 0 0
24.	0 7 6 per w.	0 10 6 per w.	0 7 0 Per w.	0 9 6 per w.
25.	9 0 0	12 12 0	6 0 0	8 8 0
26.	9 0 0	12 0 0	6 0 0	8 0 0
27.	9 0 0	14 0 0	6 0 0	9 0 0
28.	0 8 0 per w.	0 12 0 per w.	0 7 0 per w.	0 12 0 per w.
29.	0 8 0 ———	0 12 0 ———	0 7 0 ———	0 10 0 ———
Average	9 2 0	14 8 0	6 8 0	8 6 0
Per Cent.	58 22/91		29 1/16	

* The shillings per week are reckoned as pounds, to form the average: thus 10*s.* 6*d.* per week, stands for 10*l.* 10*s.* being in the same proportion.

WAGGON, a vehicle or carriage, of which there are various forms, accommodated to the different uses which they are intended to serve.

In the business of husbandry, waggons constructed in different forms, and of various dimensions, are made use of in different districts or parts of the kingdom; and mostly without much attention to the nature of roads, or the articles which are to be conveyed by them; being, in general, heavy, clumsy, and inconvenient. There is, however, a waggon much employed in Berkshire, which is constructed on a more simple and convenient principle than those mostly met with in the other southern parts of the island, not having the height or weight of them, while it possesses sufficient strength, and is easy in the draught. But an improvement has been suggested in it, by the writer of the Survey of that district, which is that of leaving the space sufficiently deep in the body or bed for the fore wheels to lock round in the shortest curve, as in the present manner of its construction, a great deal of time is lost in turning at the ends of the swaths in carrying hay, and on many other occasions; as in this way the inconvenience may be removed without doing the smallest injury to the symmetry or strength of the carriage. But those employed in Gloucestershire are preferred to any others in the kingdom, by Mr. Marshall, who has attended much to the subject; "as by means of a crooked side-rail, bending archwise over the hind wheel, the bodies or frames of them are kept low, without the diameter of the wheels being much lessened. The bodies are likewise made wide in proportion to their shallowness, and the wheels run six inches wider than those of most other waggons, whereby advantages in carrying top-loads are evidently obtained." And Mr. Rudge, in his valuable survey of the above district, says, that in many districts, waggons are the principal carriages employed in getting in the hay, and "are either full-bedded, or with three-quarter beds. The former have the advantage of a greater length of bed, but are not so convenient for turning; the latter, though diminished in size, has the convenience of locking the fore wheels, and turning in almost as narrow a compass as a chaise, in consequence of the bed being hollowed out on each side near the middle, to admit the exterior part, or felloes of the fore wheels. Both waggons are capable of carrying nearly the same weight, though the former being deeper in the bed, is somewhat better adapted for the carriage of heavy articles, such as bags of corn, &c. For the purpose of harvesting, or carrying hay and straw, their length and width are increased by light ladders before and behind, and of similar contrivances "rathes," the whole length of the sides. The ladders are put on and taken off at pleasure, in both kinds, but the side additions are generally fixed; except in the strait-headed, which are in use on the western side of the Severn, in these they are made removeable, so as to leave the bed quite naked."

In Norfolk, according to Mr. Young, Mr. Denton, of Brandon, has found a considerable saving by the use of light caravan waggons for two horses abreast, with which he carries a chaldron and half of coals, and other loads proportioned. "And he thinks, that every man who reduces the teams of any country, will be sure to do this till he arrives at perfection in a one-horse carriage."

Waggons require much more power in the draught than carts, which is certainly an objection to them, though they carry a much greater load, and are far from being so handy and convenient; and Mr. Parkinson is of opinion that more work may be done in any particular time, with the same number of horses, by carts than by waggons, in the general run of husbandry business, especially where the distance is small between loading and unloading.

But that where waggons are used for husbandry, they should be made wide and low. Manures may be carried in this sort of waggons almost as well as in carts. Broad wheels are improper for passing and repassing upon tillage lands; for, if in fallow, they press the land too much, and make it so hard as to prevent its being ploughed till wet comes; but on grass land broad wheels are proper for all uses.

Waggons are probably the most proper sort of conveyances for different sorts of heavy loads to a distance; but for home business, especially harvest and other work, which requires to be speedily performed in the field, carts with proper shelvings may be preferable.

It is observed by Mr. Pit, in his Survey of Staffordshire, that the reduction of the weight, particularly to those who are common carriers, is highly advantageous, being not less than 50*l.* a year gained by each team constantly employed on the road; and, if made with good materials, a light waggon will last as long as a heavy one.

Price of a narrow-wheeled waggon, 26*l.*; six inch, 36*l.*: axle-tree most commonly of wood.

Mr. Donaldson, in his Modern Agriculture, remarks that waggons are chiefly used in getting in the hay and corn harvests, carrying the grain and hay to market, and bringing manure and coals from a distance. They are generally drawn by the whole team on the farm, where one only is kept, whatever number it may consist of; and two men and a boy are necessary to attend them.

And he adds, that in performing distant carriages, when the roads are level and substantially made, and the waggons at all times fully loaded, one of them may probably be as advantageously used as two or more carts of less dimensions. But where the labour is required to be performed with expedition, as in hay and corn harvest, these unwieldy machines are certainly ill calculated for the purpose; and on every occasion, when they return half or a third loaded, it is evident the farmer sustains a considerable loss. Instances have occurred to him, in more than one open field parish in this country, where a waggon (with three or four persons, and as many horses) has been dispatched to collect and carry home scattered parcels of hay from the ends of ridges, which, after perambulating a great extent of the parish, returned only partly loaded. Considering the very high rate of labour, and the shamefully

extravagant manner in which, in hay or corn harvest, labourers and farm servants are maintained in that kingdom, it is surprising, he thinks, that every farmer does not exert himself to devise means whereby he may perform his work with greater expedition, and at less expence."

"Some, however, think that this sort of conveyance, however well constructed, from its great weight and unwieldiness, as well as its expence, is far from being advantageous to the interest of the farmer; as while it is highly destructive to the roads, it requires great power to draw it, which must be procured at much expence, without affording an adequate compensation in the increased quantity of materials which it carries."

At *fig* 7, *Plate* XL. is a representation of a light waggon of the Berkshire kind, which is well calculated for harvest and other similar purposes, where lightness is an object. And at *fig*. 6, is another waggon, which partakes in some degree of the properties of the cart and waggon, whence it has been appropriately denominated *Hermaphrodite*: it is frequently employed in Norfolk, when the pair of fore wheels and shafts *a a*, are occasionally attached to a common cart at *b b*, by a pole connected with the axle, to which are added the ladders *d d*. It is light, cheap, and convenient, being capable of carrying nearly as much hay or straw as the waggon represented at *fig*. 7.

It is observed in the 11th Number of the Agricultural Magazine, that from its having been long a complaint among gentlemen, farmers, and others, whose business requires the constant use of carts, and only the occasional use of waggons, that the waggon, however well preserved by a shed or building, is daily decaying while out of use, particularly the iron work of it, which is shortly destroyed by rust; in like manner, with those whose concerns require the almost constant use of waggons, and but the occasional use of carts; the latter, while unemployed, bear a very considerable proportion to the wear and tear of carts, which are in constant use. These circumstances have induced Mr. Rood to bring to perfection, at a considerable expence, a contrivance whereby the same carriage may, in a few minutes, be made by the carter into two complete tip carts of the common dimensions, and applicable to all the uses of carts in general, or into one waggon, so complete that a narrow inspection is necessary to distinguish it from a common waggon.

And that there are no complication of parts in the patent waggon, the whole being so contrived, that none of its parts are ever out of use, consequently, not liable to be mislaid or lost. The carts have a contrivance to render them more safe and easy to the horse in going down a hill, and have moveable side-ladders, which will be found of great use in carrying corn, bark, &c. It may be constructed with perfect facility by the wheelrights of any county, its shape and particular dimensions can be suited to the wishes of the owner, or to the local fashion of his neighbourhood. The result of considerable experience and enquiries, enables Mr. Rood to state that it may in any county, be completed for about 5*l*. more than the cost of two common carts.

It must however be admitted to be somewhat more clumsy than a common waggon.

It is represented at *figs*. 4 and 5, both in its combined and separate state.

No. 1. Pin securing the carts together on the near side.

A, Eye to receive pin No. 2, for the same purpose, on the off side.

No. 3. Pin securing the shetlock of hind cart to the pole of fore cart.

B, Hole in shetlock of fore cart, for pin No. 4, to secure it to the pole of hind cart.

C, Hole in hounds, to which the shafts or blades are removed when a cart.

D, Tip-iron of fore cart.

E, Tip-strap, through which tip iron D passes to be received on hook F, when a cart.

GG, Ends of shafts, or blades of hind cart.

H, Tip-iron for hind cart.

I, Head-board for hind cart.

K, Tail-board of fore cart.

L, Side ladder to enlarge the waggon and secure corn, hay, or bark in carriage.

MMMM, Hooks to fix side ladders to.

It is observed that if these hooks are fixed on the under side of outer raves, the side ladders will be much easier fixed.

N, Lord Somerville's friction drag.

Instructions to disunite the waggon.

1st. Remove the pins Nos. 3 and 4 from shetlocks, and pass them through the bed in fore axle.

2d. Remove the shafts or blades back on the hounds, and receive the struts, or hounds pin, as in *fig*. 5.

3d. Take out pins Nos. 1 and 2, and the waggon is disunited.

Nos. 1 and 2, pins securing head-board of hind cart.

No. 3. Pin passing through the bed into fore axle.

AA, Tip-irons in their places.

B, A stay secured to bed of cart, and received in hounds pin.

N, Lord Somerville's friction drag.

Instructions to unite the carts.

1st. Having removed the head and tail boards, place the carts on such level ground as may be convenient, and trig the wheels of either, then run the other to it and unite them with pins No. 1 and 2.

2d. Remove the shafts forward on hounds, as described in *fig*. 4, and turn the struts up under the bed.

3d. Remove pins No. 3 and 4 from bed of fore cart, and place them in the holes of meeting shetlocks.

WAGGONER, the person who has the care of driving the waggon team.

WAIF, an old feudal term signifying an estrayed animal, &c. which, for want of the owner's appearance after it has been cried and published in the neighbouring markets, is forfeited to the lord of the manor.

WAIN, a term applied to an ox cart, without any side rails, or ladders, in some districts; but in others shelvings are added, and the body is large and open. They are rarely met with at present. In Gloucestershire they adapt them to harvest work by fixing ladders and rathes on them. In the lower part of the vale they are called *dung-pots*; but in the forest district, where drawn by oxen, wains.

WAINHOUSE, a term applied to the waggon or cart house, in some places.

WALK, in *Horsemanship*, one of the paces of a horse. It is the slowest and least raised of all, and performed, as any one may observe, by the horse's lifting up his two legs on a side, the one after the other, beginning with the hinder leg. Thus, if he leads with the legs of the right side, then the first foot he lifts is the far hind-foot, and in the time he is setting it down, (which in a step, is always short of the tread of his fore-foot on the same side) he lifts his far fore-foot, and sets it down before his near fore-foot. Again, just as he is setting down his far fore-foot, he lifts up his near hind-foot, and sets it down again just short of his near fore-foot; and just as he is setting it down he lifts his near fore-foot, and sets it down beyond his far fore-foot. This is the true motion of a horse's legs in a walk; and this is the pace in which many animals are best taught in breaking. For instance, when the horse is to be taught to turn to the right and left, or from one hand to another, he is first to be taught it on the walk, then on the trot, and finally on the gallop.

WALKER, a term used to signify a fuller.

WALK-MILL, the name of a fulling mill.

WALL, the principal part of a building, as serving both to inclose it, and support the roof, floors, &c. It is also made use of as a means of inclosure. See *Fence*.

Walls are distinguished into various kinds, from the matters of which they consist, as plaster or mud-walls, brick-walls, stone-walls, flint or boulder-walls, and boarded walls.

Brick-walls are the most important and usual. In these, particular care is to be taken about laying of the bricks; that in summer they be laid as wet, and in winter as dry, as possible, in order to make them bind the better with the mortar-that in summer, as fast as they are laid, they be covered up, to prevent the mortar, &c. from drying too fast; that in winter they be covered well to protect them from rain, snow, and frost, which are all enemies to mortar; that they be laid joint on joint in the middle of the walls as seldom as may be; but that good bond be made there as well as on the outside. Care is to be taken that the angles be firmly bound, which are the nerves of the whole edifice. In order to which, in working up the walls of a building, it is not advisable to raise any wall above eight feet high, before the next adjoining wall be brought up to it; that a good bond may be made in the progress of the work. It may be worth notice, that a wall, a brick and a half thick, with the joint, will be in thickness fourteen inches or very near; and in which one hundred and fifty or one hundred and sixty bricks will lay a yard square measure upon the face of the building; and to the square of ten feet are usually allowed seventeen hundred or eighteen hundred bricks. Flint, or boulder-walls, are much used in some parts of Sussex and Kent, for fence-walls round courts, gardens, &c. A right and left-handed man fits well for performing this work, as they have a hod of mortar poured down upon the work, which they part between them, each spreading it towards himself, and so they lay in the flints. The mortar for this work must be very stiff. See *Fence*.

WALL *of a Stack*, the stem or that part which extends from the eaves to the ground.

WALLACE, provincially, the withers of a horse.

WALL-EYES, in *Horsemanship*, are those in which the iris is of a very light grey colour. These are not deemed handsome; but Gibson says, that horses which have wall-eyes are generally good.

WALLSPRINGS, such as break out through some rocky strata, or on cold, spewy, or springy wet grounds.

WALNUT TREE, the name of a well-known deciduous tree, formerly held in great esteem in this country for its wood, which is often very finely veined; but on account of its aptness to be worm-eaten, it has now given place to the mahogany. And as a fruit tree, independent of its timber, which is, however, still of much value, it merits attention. Also in the view of ornament, it is likewise an useful tree. There are several species capable of being cultivated with advantage both for their wood and fruit; as the common walnut, the white walnut, and the black walnut tree.

In respect to the first, it is a very large and lofty tree, which has strong spreading boughs; the leaves are pinnate, with a very strong but not unpleasant smell; the leaflets three pairs (sometimes two or four), nearly equal, except that the odd one is larger, they are entire, smooth, and shining; the male flowers are in close, pendulous, subterminating filaments; the females scattered, frequently two or three together; fruit an ovate, coriaceous, smooth drupe, inclosing an irregularly grooved nut, which contains a four-lobed, oily, eatable kernel, with an irregular knobbed surface, and covered with a yellow skin. This tree is a native of Persia.

It has been noticed by Martyn, that as "they all vary again when raised from the seed, and that as nuts from the same tree will produce different fruit; those who plant the walnut for its fruit, should make choice of the trees in the nurseries, when they have their fruit upon them."

The common walnut has several varieties, as the *oval walnut*, the *round walnut*, the *large walnut*, the *small-fruited walnut*, the *double walnut*, the *early walnut*, the *late walnut*, the *tender thin shelled walnut*, and the *hard thick-shelled walnut*.

The second sort is a tree which has the leaves composed of two or three pairs of oblong lobes, ter-

minated by an odd one; these are of a light green, and serrate; the lower pair of lobes are the smallest, and the upper the largest: the fruit is shaped like the common wallnut, but the shell is not furrowed, and is of a light colour. According to some, it is a tall tree, and in North America, where it prevails, it is termed Hiccory nut-tree.

The third kind is a tree that grows to a large size: the leaves are composed of five or six pairs of leaflets, which end in acute points and are serrate; the lower pair is the least, the others gradually increase, but the pair at top and the terminating leaflet are smaller: these leaves when bruised emit a strong aromatic flavour, as does also the outer cover of the nuts, which is rough, and rounder than that of the first sort. The shell is very hard and thick, and the kernel small, but very sweet to the taste and agreeable. The two last sorts are less hardy than the common kind.

In regard to culture, the whole of the sorts are capable of being increased by planting the seed or nuts, which in the first kind should be of the best varieties when intended as fruit trees, after they are become perfectly ripe, and have been preserved in dry sand till about the end of February, either in slight drills, five or six inches apart in the rows, and a foot distant, or by the dibble, at the same distances, putting them in the earth to the depth of two or three inches, the ground having been previously well dug over for the purpose. When the plants have had two years growth in the seed-bed, they should be removed into nursery rows, shortening the tap roots, but preserving the tops entire, putting them at the distance of two feet and a half from row to row, and a foot and a half in the rows: they should remain in this situation till they have attained five or six feet in height, training them with single stems; after which they may be removed into the situations where they are to grow for fruiting.

But Mr. Boutcher recommends, in raising them as fruit trees, to put flat stones, tile-sheds, or slates, eight inches deep under the nuts when they are set: the distance to be six inches, and the depth two inches. After two seasons they should be removed early in autumn, and planted fourteen or sixteen inches asunder, on the same kind of bottom, or any hard rubbish, to prevent them from striking downwards, and to induce them to spread their roots on the surface. At the end of two or three years this should be repeated again, making the bedding at the depth of fifteen or sixteen inches, and planting them two feet asunder: here let them remain three or four years, when they will be fit to remove for the last time.

The soil for fruit-trees of this sort should be dry and sound, with a sandy, gravelly, or chalky bottom. The trees managed in this way, he says, will have higher flavoured fruit, ripen earlier, and bear a plentiful crop twenty years sooner than in the usual method. The best manure for them is ashes, spread the beginning of winter, the land having been first ploughed or dug over in an effectual manner.

And as plants raised from the nuts of the same tree bear fruit of very different qualities, he advises the inarching one of the best sorts on the common walnut tree; by which method the planter is secure of his sort, and will have fruit in one-third of the time that he would obtain it from the nut. This method can, however, be practicable only in few situations. The length of time in which the walnut bears well from the nut is about twenty years.

Mr. Knight has suggested that this tree will bear much sooner when raised by grafting, with bearing branches, by approach.

But where the trees are intended for timber, it is a good practice to plant them out at once where they are to grow, as they thrive faster, and form better trees in that method of raising them.

The nuts of the other sorts are procured from America by the nurserymen, and should be such as have been well ripened.

These trees should not be planted nearer together than forty feet, and more may be better, if they are designed for fruit. They delight in a firm, rich, loamy soil, or such as is inclinable to chalk or marle; and they will thrive very well in stony ground, or on chalk hills, as is evident from those large plantations near Leatherhead, Godstone, and Carshalton in Surry, where great numbers of these trees planted upon the downs produce annually large quantities of fruit, to the no small advantage of their owners.

In order to preserve this fruit it should be left upon the tree till it is thoroughly ripe, and then, as it would be exceedingly troublesome to gather it by hand, it may be beaten off, but not with such violence as is commonly used, from a mistaken notion that the tree is improved thereby; for most certainly it cannot be benefitted by that rough way of forcing off the young wood upon which this fruit grows.

The first species is cultivated for ornament, as well as the nut or fruit which it affords. The fruit is used in two different stages of its growth: as when green, to pickle; and when ripe, to eat the kernel. For the first purpose, the young green walnut, when about half or near three parts grown, before the outer coat and internal shell shall become hard, is most excellent; for which they are generally ready in July or the following month, and should be gathered by the hand, chusing such as are as free from specks as possible. But the fruit is discovered to be fully ripe by the outer husk easily separating from the nut, or by the husks sometimes opening, and the nuts dropping out; it is usually about the latter end of September, which, in trees of considerable growth, is commonly beaten down as mentioned above with long poles; for as the walnuts grow mostly at the extremity of the branches, it would, in very large spreading trees, be troublesome and tedious work to gather them by hand. As soon as gathered, they should be laid in heaps a few days to heat and sweat, to cause their outer husks, which closely adhere, to separate from the shell of the nuts: then be cleaned from the rubbish, and deposited in a dry room for use, covering them over close with dry straw, a foot thick, where they will keep three or

four months. They are always ready sale at market, in large towns, where, at their first coming in, they are brought with their husks on, and sold by the sack, or bushel, but afterwards cleaned, and sold both by measure and the thousand.

Plantations of these trees are therefore profitable, in their annual crops of fruit, while growing, and in their timber, when felled or cut down.

It is stated in the Gloucestershire Report, that "it will grow almost in any soil, wants no pruning or care, and in less time than the oak will make a large tree. The wood is too valuable to apply to the usual purposes of timber trees, but is always used either in cabinet work or for gun-stocks; for the latter indeed, so great has been the demand for a few years past, from the Birmingham gun-makers, that the county has been ransacked for this wood, and high prices have been held out to tempt the sale of it. In consequence of this, the stock has been much diminished, and with very few exceptions, only here and there is a solitary walnut tree seen growing. In the parish of Arlingham there are more, perhaps than in many other parishes combined; so abundant indeed, is the fruit this year (1805) that it is become an article of commerce, and two vessels are now (October 11) being laden with wallnuts for Scotland, at Arlingham, as low as 4*s.* or 5*s.* a 1000. Even at this price the produce of a tree is highly valuable, as 20,000 are not considered an extravagant calculation for a large tree."

Were it only for the oil that these nuts afford, the trees which produce them would be worth some care. It has been observed by Evelyn, that one bushel of them will yield fifteen pounds of peeled kernels, and that these will yield half that weight of oil, which the sooner it is drawn, is the more in quantity, though the drier the nut, the better in quality. He adds, that the lee, or marc of the pressing, is excellent to fatten hogs with. Certainly it would be good manure for land; as are the cakes of linseed, rape, &c. after the oil has been squeezed out of them. The green husks boiled, without any mixture, make a good colour to dye a dark yellow. The kernel being rubbed upon any crack or chink of a leaking vessel, stops it better than either clay, pitch, or wax.

WALSH, a term applied provincially to the insipid taste of some vegetables, roots, &c.

WANG-TOOTH, a term applied to the jaw-tooth of an animal.

WANT, a provincial term applied to a mole. See *Mole*.

WANTY, the name of a broad girth of leather, by which the load is bound upon the horse.

WAPENTAKE, a term signifying the same with what is commonly called a hundred, and generally used in the northern counties beyond the Trent.

WARBEETLES, a term provincially applied to the large maggots which are bred in the backs of cattle.

WARBLES, in *Farriery*, small hard tumours on the saddle part of a horse's back, occasioned by the heat of the saddle in travelling, or its uneasy situation. Also maggots in the backs of horses, cattle, &c.

A hot greasy cloth at first frequently applied, will sometimes it is said remove them. Camphorated spirits of wine are also very effectual for this purpose to disperse them, especially if a little spirit of sal ammoniac be added to the camphorated spirit. If there be a necessity for working the horse, care should be taken to have the saddle nicely chambered.

WARK, provincially, work.

WARK-DAY, provincially, a working day.

WARP, a term when applied to cows, signifying to miscarry or slink their calves.

WARP, a slimy deposit let fall upon land by the sea tides in particular situations. The term is also sometimes applied to the ooze or slimy matter thrown up by the sea.

WARPING *of Land*, a mode of fertilising and improving tillage lands practised in particular situations on the borders of large rivers and waters into which the sea tides flow, and where the level of the ground is such as to admit of their being overflowed by them with great facility. It is a novel method of management which has been hitherto confined to the districts of Lincolnshire and Yorkshire. It is observed by Mr. Young, in his Calendar, "that the waters of the tides that come up the Trent, Ouze, Dun, and other rivers which empty themselves into the great estuary of the Humber, is muddy to an excess; insomuch that in summer, if a cylindrical glass, 12 or 15 inches long, be filled with it, it will presently deposit an inch, and sometimes more, of what is called warp. Where it comes from is a dispute: the Humber, at its mouth, is clear water; and no floods in the countries washed by the warp rivers bring it, but, on the contrary, do much mischief by spoiling the warp. In the very driest seasons and longest droughts, it is best and most plentiful. The improvement is perfectly simple, and consists in nothing more than letting in the tide at high-water to deposit the warp, and permitting it to run off again as the tide falls: this is the aim and effect. But to render it efficacious, the water must be at command, to keep it out and let it in at pleasure; so that there must not only be a cut or canal made to join the river, but a sluice at the mouth to open or shut, as wanted; and that the water may be of a proper depth on the land to be warped, and also prevented flowing over contiguous lands, whether cultivated or not, banks are raised around the fields to be warped, and from three or four to six or seven feet high, according to circumstances. Thus, if the tract be large, the canal which takes the water, and which, as in irrigation, might be called the grand *carrier*, may be made several miles long: it has been tried as far as four, so as to warp the lands on each side the whole way, and lateral cuts made in any direction for the same purpose; observing, however, that the effect lessens as you recede from the river; that is, it demands longer time to deposit warp enough for producing benefit."

It is however observed, that "the effect is very different from that of irrigation; for it is not the water that works the effect, but the mud, so that in floods the business ceases, as also in winter; and it is not

to manure the soil, but to create it. What the land is, intended to be warped, is not of the smallest consequence: a bog, clay, sand, peat, or a barn floor; all one: as the warp raises it in one summer from six to sixteen inches thick; and in the hollows or low places, two, three, or four feet, so as to leave the whole piece level. Thus a soil of any depth you please is formed, which consists of mud of a vast fertility, though containing not *much* besides sand; but a sand unique."

It is further stated, that "Mr. Dalton, of Knaith on Trent, sent some to an eminent chemist, whose report was, that it contained mucilage, and a very minute portion of saline matter; a considerable one of calcareous earth: the residue is mica and sand; the latter in far the largest quantity: both in very fine particles. Here is no mention of any thing argillaceous; but from examining in the fields much warp, the writer is clear there must be clay in some, from its caking in small clods, and from its cleansing cloth of grease, almost like fuller's earth. A considerable warp farmer told him that the stiffest warp was the best; but in general it has the appearance of sand, and all glitters with the micaceous particles."

This is a practice which begins in the month of July, and which proceeds during the summer season, and as this sort of business can only be performed at that season, every occasion of having it executed should be embraced, by having the work in perfect repair, that every tide may be made to produce its full effect. With regard to the advantage of doing this work in the summer months, it may be remarked that at these times the lands not only become the soonest dry, a circumstance which must always fully take place before the process of cultivation can be carried on, but the tides are less mixed with fresh water, in which situation they are constantly found the most effectual.

In respect to the method of executing the work, it is described in the following manner in the Agricultural Survey of the West riding of Yorkshire, by lord Hawke:

"The land to be warped must be banked round against the river. The banks are made of the earth taken on the spot from the land: they must slope six feet; that is, three feet on each side of the top or crown of the bank, for every foot perpendicular of rise: their top or crown is broader or narrower, according to the impetuosity of the tide, and the weight and quantity of water; and it extends from two feet to twelve: their height is regulated by the height to which the spring tides flow, so as to exclude or let them in at pleasure. In these banks, there are more or fewer openings, according to the size of the ground to be warped, and to the choice of the occupier; but in general they have only two sluices; one called the flood-gate, to admit, the other called the *clough*, to let off, the water gently; these are enough for ten or fifteen acres: when the spring-tide begins to ebb, the flood-gate is opened to admit the tide, the clough having been previously shut by the weight of the water brought up the river by the flow of the tide. As the tide ebbs down the river, the weight or pressure of water being taken from the outside of the clough next the river, the tide water that has been previously admitted by the flood-gate opens the clough again, and discharges itself slowly but completely through it. The cloughs are walled on each side, and so constructed as to let the water run off, between the ebb of the tide admitted, and the flow of the next; and to this point particular attention is paid. The flood-gates are placed so high as only to let in the spring-tides when opened. They are placed above the level of the common tides.

"Willows are also occasionally planted on the front of the banks, to break the force of the tides, and defend the banks by raising the front of them with warp thus collected and accumulated: but these willows must never be planted on the banks, as they would destroy them by giving the winds power to shake them."

It is stated that the first cost of a sluice for warping, that is, five feet in height and seven feet in width, may be estimated at from 4 to 500*l*. And that such a sluice will in general be adequate to the warping of fifty acres annually; and where the soil is contiguous to the river, for seventy or more.

The nature of the culture, crops, and various other circumstances, are well shewn in the observations below, which were taken by the same author on the farm of Mr. Webster, at Bankside, Lincolnshire, who has made so great an improvement by warping, that it merits particular regard. "His farm of 212 acres, is, he says, all warped; and to shew the immense importance of the improvement, it would be necessary only to mention, that he gave 11*l*. an acre for the land, and would not now take 70*l*. an acre; he thinks it worth 80l. and some even 100*l*.: not that it would sell so high at present; yet his whole expense of sluices, cuts, banks, &c. did not exceed 2500*l*. or 12*l*. per acre; from which, however, to continue the account, 1500*l*. may be deducted, as a neighbour below him offers 5*l*. an acre for the use of his sluice and main cut, to warp 300 acres, which will reduce Mr. Webster's expense to 1000*l*. or about 5*l*. an acre. Take it, however, at the highest 12*l*. and add 11*l*. the purchase, together 23*l*. an acre; if he can sell at 70*l*. it is 59*l*. per acre profit. This is prodigious, and sufficient to prove that warping exceeds all other improvements. He began only four years ago. He has warped to various depths, 18 inches, 2 feet, 2½ feet, &c. He has some that, before warping, was moor-land, worth only 1*s*. 6*d*. per acre, now as good as the best. Some of it would let at 5*l*. for flax or potatoes; and the whole at 50*s*. He has 20 acres that he warped three feet deep, between the beginning of June and the end of September, and 18 acres, part of which is three feet and a half deep. He has applied it on stubbles in autumn by way of manuring; for it should be noted, Mr. Young says, as a vast advantage in this species of improvement, that it is renewable at any time; were it possible to wear out by cropping or ill-management, a few tides will at any time restore it. As to the

crops he has had, they have been very great indeed; of potatoes from 80 to 130 tubs of 36 gallons, selling the round sorts at 3*s.* to 3*s.* 6*d.* a tub; and kidneys at 5*s.* to 8*s.* Twenty acres warped in 1794, could not be ploughed for oats in 1795, he therefore sowed the oats on the fresh warp, and scuffled in the seed by men drawing a scuffler; eight to draw, and one to hold: the whole crop was very great: but on three acres of it measured separately, they amounted to 14 quarters one sack per acre." This intelligent writer observes that he little thought of finding exactly the husbandry of the Nile in England. He had however, before heard of clover seed being sown in this manner on fresh warp, and succeeding greatly.

He adds, that Mr. Webster "warped 12 acres of wheat stubble, and sowed oats in April, which produced 12 quarters an acre. Then wheat, 36 bushels an acre. His wheat is never less than 30." And that "six acres of beans produced 30 loads per acre, or 20 bushels: one acre, measured to decide a wager, yielded 99 bushels. Has had 144 pods from one bean on four stalks; and Tartarian oats seven feet high. One piece warped in 1793, produced oats in 1794, six quarters an acre: white clover and hay seeds were sown with them, mown twice the first year: the first cutting yielded three tons of hay an acre; the second one ton; and after that an immense eddish. Warp, Mr. Webster observes, brings weeds never seen here before, particularly mustard, cresses, and wild celery, with plenty of docks and thistles. Also flax, 40 to 50 stone per acre."

In the same report it is likewise further remarked, that "Mr. Nicolson, at Rawcliff, takes the levels first; builds a sluice; if a quarter of a mile or half a mile, 60 acres may be done the first year; the drier the season, the better. The clough, or sluice, 400*l.* eight feet wide, and five or six feet high; a drain 14 feet at bottom, and as much more at top, 30*s.* to 40*s.* an acre, of 28 yards: banks four to eight feet high, and expence 7*s.* to 20*s.* an acre of 28 yards." And that he "begins at Lady-day till Martinmas; but all depends on season; the depth will depend on circumstances. If a landlord warp, it should be deep at once; if a tenant, shallow and repeat it, as good corn will grow at six inches as six feet; at three inches great crops; the stiffer the warp the better. Some seasons sow corn the year after. Warp is cold, and if deep, takes time: a dry year best: great seeds. Crops ought to be, beans 20 loads; oats 10 quarters; wheat 10 or 12 loads: never barley. After six years, potatoes, and good flax: he makes it worth 40*l.* to 50*l.* an acre."

And Mr. Young considers "Mr. Wilson's idea of warping as very just: to exhaust the low lands in favour of the hills; then to warp six inches deep, to exhaust that to make the hills; then to warp again; and by thus doing to keep the warp land in the highest order, and at the same time to work a great improvement to all the higher grounds."

The following is given as the substance of a note by a commissioner employed in warping. "Warp leaves one eighth of an inch every tide on an average; and these layers do not mix in an uniform mass, but remain in leaves distinct.

"If only one sluice, then only every other tide can be used, as the water must run perfectly off, that the surface may incrust; and if the canal be not empty, the tide has not the effect. At Althorpe Mr. Bower has warped to the depth of 18 inches in a summer.

"Ten quarters an acre of oats, on raking in the seed on warp; the more salt in it the better; but one fallow in that case necessary to lessen the effect, or it hurts vegeta ion."

It is remarked that "as a sort of new soil is created by this mode of practice, it is of but little consequence what the original nature of the land may be, almost all kinds being improved by it." But at the same time it may be the most beneficial in such light soils as are very open and porous, and such stiff ones as are defective in calcareous matter, and which require substances of this kind to render them less tenacious." And that "land, when once well warped, will continue for a vast length of time in a good state of fertility; but still, it is suggested by some experienced warpers as a better practice, to apply a small portion of warp whenever the land is in the state of fallow, which will be about every five or six years, as by this means the farmer will be more secure of having good crops. The depth to which the lands are covered by the tides must be regulated according to their levels, and the height of the tides in the rivers from which they proceed.

It is stated in the Report of the West Riding of Yorkshire, that where "it can be done, it may be admitted to the height of three or four or more feet; but the deposit of sediment is in some measure proportionate to the height of the water; though the same effects may be obtained from much smaller quantities of water, by continuing the process a great number of tides." And that such lands as "have been subjected to this mode of improvement should constantly be kept in the state of tillage for some length of time afterwards, in order that it may be brought to a proper condition for the production of grass."

In regard to the expence of this mode of improving lands, it must differ much in different cases, according as the circumstances of situation and distance vary; but it can seldom exceed twelve or fifteen pounds the acre, according to Mr. Young, and in most instances it must be greatly below such estimates. But "it is remarked by Mr. Day, in the Agricultural Survey of the same district, that no estimate can be made without viewing the situation of the lands to be warped, and the course and distance it will be necessary to carry the warp to such lands; as, 1st. The situation of the lands must be considered. 2dly. The quantity of land the same drains and cloughs will be sufficient to warp. 3dly. The expence of building the cloughs, cutting the drains, embanking the lands, &c. An estimate of which expence being made, then it will be necessary to know the number of acres such cloughs and drains will warp, before any estimate per acre can be made; therefore it will be easy to conceive the

greater quantity of land the same cloughs and drains will warp, the easier the expence will be per acre. In his opinion there are great quantities of land in the country, which might be warped at so small an expence, as from 4*l.* to 8*l.* per acre, which is nothing in comparison to the advantages which arise from it. He has known land which has been raised in value by warping, from 5*l.* to upwards of 40*l.* and 50*l.* per acre; therefore it is easy to conceive that the greatest advantages arise upon the worst land, and the more porous the soil the better, as the wet filters through, and it sooner becomes fit for use. The advantages of warping are very great; as, after lands have been properly warped, they are so enriched thereby, that they will bring very large crops for several years afterwards, without any manure; and, when it is necessary, the lands might be warped again, by opening the old drains, which would be done at a very trifling expence, and would bring crops in succession for many years, with very little or no tillage at all, if the lands were kept free from quick grass, and other weeds, which must be the case in all lands where they are properly managed; besides the drains which are made for the purpose of warping, are the best drains that can be constructed for draining the lands at the time they are not used for warping, which is another very great advantage in low lands."

It is observed by Mr. Young "that a very great object in the husbandry of warping, is the application of it in other districts. They have much warp, he says, on all the coast from Wisbeach to Boston, &c. and through a long succession of ages has formed a large tract of warp country, called there *silt*, yet no attempts that he has heard of have been made to warp artificially there. He therefore suggests to the proprietors living near a muddy river, that they should consider the position of their grounds well, and try the amount of the subsidence of the water in a cylindrical glass jar, as a treasure may be near them without their knowing any thing of it."

Warped lands are found capable of growing most sorts of crops in great plenty, but particularly oats, beans, wheat, flax, potatoes, and grass seeds.

WARPS, a word applied to flat, wide, beds of ploughed land in some districts.

WARRANT, in *Horsemanship*, a term applied to the assurance of a horse being sound when purchased. Those who sell horses are frequently required to warrant them; that is, to refund the money that was given for them in case they sell them when under such infirmities as may not be capable of discovery on the view of the buyer. But they do not warrant them clear of such infirmities as may be seen and discerned; for the rule of law in England is, *caveat emptor*, unless the seller expressly warrants. See *Buying*.

WARREN, a franchise, or place privileged, either by prescription, or grant from the king, to keep beasts and fowl of warren in; as rabbits, hares, partridges, pheasants, &c.

By statute 21 Edw. III. a warren may lie open, and there is no need of closing it in, as there is a park.

In the forming a warren, great caution is to be used for the fixing upon a proper place, and a right situation. It should always be upon a small ascent, if possible, and exposed to the east or the south. The soil that is most suitable, is that which is sandy; for when the soil is clayey or tough, the rabbits find greater difficulty in making their burrows, and never do it so well; and if the soil be boggy or moorish, there would be very little advantage from the warren, for wet is very destructive to these animals. See *Rabbit*.

WARTS, in *Farriery*, horney excrescences of the same nature with scratches; rat-tails, and other excrescences of the legs and pasterns in horses, are more or less hurtful, as they are situated nearer, or at a greater distance from, the larger sinews. See *Scratches*, *Rat-tails*, &c.

They may be destroyed by touching them with any caustic; or they may be cut off, when they are superficial.

For the cure:

Put three ounces of powder of copperas into a crucible, on a charcoal fire, keeping the matter stirring from time to time; but take care to avoid the steams; continue a pretty smart heat till the matter grows somewhat reddish; then take it off the fire, and when it is cooled, break it, and beat the matter to a very fine powder; then incorporate four ounces of this powder with five ounces of album rhasis, and make an ointment to be applied cold to the warts; anoint them lightly every day, and they will fall off like kernels of nuts, without causing any swelling in the least.

But care must be taken to touch nothing but the warts; nor should the horse be worked or rode during the application of the ointment.

WASH, a refuse liquid remaining after distillation, which has been lately found beneficial in the fattening of cattle. It was formerly used for swine. See *Stall-Feeding*.

WASHER, the name of a thin flat piece or circular ring of iron put upon the end of the axle-tree of a carriage, between the linch-pin and small end of the nave, to diminish the friction of the nave to keep the wheel from having too much play, and prevent the nave rubbing against the linch-pin so as to wear. It is also applied to thin rings or pieces of iron used for other purposes, in a similar intention.

WASHING *of Sheep*, the practice of having the wool cleaned by washing in clean running water previously to the clipping of the sheep. See *Sheep*.

WASPS, are small insects of the bee kind. They are very troublesome by their sting. But they may be destroyed by smoking them with any combustible article. By putting cyder, verjuice, wine, or any sour or sweet liquor into a short-necked phial, many of them may be taken. And by laying sweet apples, or treacle, in an earthen dish, mixed with a little water, or any liquid they like, numbers of them may be destroyed.

Thrusting pieces of lighted brimestone-rags into the

nests of wasps, and immediately covering their holes with earth, will destroy them.

WASTE, a name given to such lands as are not inclosed but lie in the state of common.

Much land of this sort is met with in different districts of the kingdom, which is highly capable of being converted to a state of cultivation without any very heavy expence, after it has been inclosed. See *Waste Land.*

Waste *Land*, that sort of ground which lies in a state of unproductiveness and without inclosure. All lands were perhaps originally in this condition, being fed upon by the live stock of the people in common. This mode of occupation is attended with so many inconveniences, and the advantages of inclosed land so perfectly understood, that at present a pretty general desire prevails to have the whole inclosed and brought into a state of cultivation, circumstances which are perhaps only delayed by the obstinacy and interested or selfish views of a few tithe owners and lords of manors.

The extent of lands in this state is very considerable, being stated by different writers, as drawn from the best authorities, at upwards of six millions of acres, four of which are at least capable of being brought into cultivation.

It is suggested by Mr. Pitt in an excellent paper on the "Production and Consumption of Corn, &c." in the fifth volume of Communications to the Board of Agriculture, that if this addition of land were cultivated, "it would very much extend our productive territory, and as it must be cultivated for tillage, would be a timely and desirable addition to our corn land." And in answer to the position of a late economical writer, that "in any instance where a certain quantity of dressing and labour employed to bring new land into cultivation, would have yielded a permanently greater produce if employed up on old land; both the individual and the nation are losers by cultivating the new," he observes, that new land ought not to be improved at the expence or by the neglect of the old, but in addition to it, and from new resources, as by marle, lime, and agricultural operations; and by degrees by dung and compost made by live stock from its own produce, and not from manure produced by land before in cultivation; the labour and capital employed ought also to be in addition.

Keeping these objects in view, the culture of waste lands may be undertaken with much profit to the farmer and advantage to the public.

And it is remarked by the writer of the Argyleshire Report, that, "as there is reason to believe that many landlords do not advert to the gain of improving waste lands, it may be proper to state it, and to shew that in no other way can money be laid out to such advantage. Whenever it is laid out with judgment (as it always may), the risk is less and the gain greater than in manufactures or in commerce. When the manufacturer or the merchant disposes of his goods at six or twelve months credit, he risks the stock altogether, and his gain when he gets it is generally but ten per cent.; whereas the improver of land is, in the first place free of all hazard; and in the next place, may be supposed, in general to gain at least twelve or twenty per cent. upon his outlays.

"The average expence of draining or improving waste ground is commonly estimated to be under 3*l.* per acre. Now if by this 3*l.* land worth only from 1*s.* to 3*s.* is raised to 15*s.* or 20*s.* the improver has at the lowest rate twelve per cent. for his money, or in other words, by laying out 3*l.* he adds 15*l.* to his stock, as every shilling per annum which the acre is improved, is worth at least 25 years purchase.

"Inclosing and manuring are not reckoned, as lands already in tillage need these meliorations as well as those that are yet uncultivated. The only expence peculiar to the improvement of waste lands, is that of draining and reducing the surface to an arable state; and this it is believed was stated fully high, as the value of the improvement is probably stated too low. At least this is generally estimated higher wherever it has taken place, as might be shown in numberless instances throughout the kingdom. The few instances of such improvement with ourselves, may serve sufficiently to shew that what could not feed a sheep may be made to feed a cow, and the expence is allowed to have been moderate; although the improvers have not been at pains to ascertain it, as such things are done by servants or labourers occasionally, and not by the piece."

It is often said, the author observes in speaking of the above district, that "the soil and climate are more adapted for producing grass than corn. The truth is, says he, the soil and climate of the greater part of it are well adapted for either; and wherever toil and skill are exerted in raising either, they are sure of being well rewarded. But supposing grass should be the great object, ought we not then to put more of our land in a capacity for raising it? Our meadows are bad but we may mend them, they are few, but we may add to them and almost to any degree we please, create both pasture for the summer and provender for the winter. By such improvement of our waste lands, and by the introduction of green crops, it is possible enough that in half a century some parts of this county might rear more than double the black cattle or sheep that are reared at present. In the last century the isle of Anglesea (not a third larger than the district of Kintyre) was only beginning to be improved, as we are now; and its annual export of black cattle was but about 3000. But such was the progress of its improvement, that before the middle of this century its exports rose to 15,000 cattle (and other articles in proportion), reserving still a stock of 30,000 at home. It is impossible to say what our quantity of waste land, if improved, might one day be made to produce. It is certain that much of it would be found to be more productive than a great part of what is in tillage at present.

"Profitable, however, as this business would certainly turn out, both to the individual and to the public, it is to be regretted, says the writer, that they who are able, are not often disposed to attempt it. Instead of this, they choose to buy more, and to enlarge

their quantity of wilderness, rather than to improve what they already have. If they would duly weigh these two plans, they would probably make a different choice." For "it is indeed a common observation in this county, that proprietors seldom make much of farming or improving land. If the remark has any foundation, the reason of it may be, that proprietors must do many things at a greater expense than ordinary farmers, as advantage is often taken of their inexperience, and they cannot so narrowly look after their servants: and, if they want skill, or will not give attention, they would as little succeed in any other business as in this. The fault is in them, and not in the subject.

"To improve one acre of waste ground, may perhaps cost as much as would buy two in the same state: but then it will afterwards yield the rent of six: and a compact estate is more desirable than a larger one that is but equally productive. It is more, for the saving of seed, labour, and fencing, may render one acre that is worth 10*s*. a more profitable concern than three that may be worth 5*s*. each. Land cannot be bought under 25 or 30 years purchase; while the profit on improving it may be generally obtained for less than a fifth of this price, and give a revenue equally certain; and a revenue, too, which is not like the purchase of land, subject to any taxes." The income tax not having then been laid on.

But a statement in the Agricultural Report of Montgomeryshire in North Wales, shews that the advantage of improving waste lands is much greater than is here stated. "Mr. Corbet now draws 50 per cent. per annum for the money laid out in improving his mossy or turbary lands; which is the same as buying an estate at two years purchase. The soil is generally of a mossy nature. The main drains are very deep and wide, and constitute a part of the fence. The smaller or covered drains, are four feet deep, and two wide at top, sloping to three inches at bottom. The turf inverted, is laid eight or nine inches from the bottom, leaving a vacuity for the water. Within these twelve years, Mr. Corbet has thus improved 261 acres, the average rent of which was formerly only 9*d*. per acre, *L*.9 15 9

"Present value 144 acres and a half, at 30*s*. per acre, and 116 and a half, at 40*s*. per acre, - -	450	2	6
"Additional rent gained,	*L*.410	6	9

Expense of the Improvement.

"Embanking 1980 yards, at 2*s*. 6*d*. and 2310 yards, at 1*s*. 3*d*.	*L*.418	17	6
"Draining 12,452 yards, at 7½d.	389	2	6
"Sundry other improvements,	40	6	3
	L.348	6	3

"Mr. Corbet has still a great quantity of waste lands to improve, which can be done at a still smaller expense, as no embankment is necessary. The peat, or mossy land, by frequent ploughing, application of lime, and flooding, is now almost converted to a rich loam. The writer should think it worth almost double the highest value put upon it, as it is flooded. He pastures it till the beginning of June, and cuts hay the beginning of August."

"It is obvious, that the greater part of the above expense arises from the embanking, for which there will rarely be any occasion. Were it not for this, the profit, which, as it is, exceeds 50, would be above 100 per cent. per annum."

And in the Agricultural Report of the northern counties it is observed, that "A spirited farmer, who not many years ago, took in lease a tract of 1400 acres of waste ground, says, that some of the worst of these acres are now very cheap at 40*s*. each in pasture; that 100 of them are worth more than the whole farm when he took it; and that, though formerly covered with heath, and in a high and unsheltered situation, the parts improved were brought, in one or two years, at a moderate expense, to produce as abundant pastures as any near the banks of the Clyde."

The first writer therefore conceives that "in every view, the improvement of waste lands is a gainful business to the owner. It is found to be so even in England, though the improvement upon an acre of land is often taxed with from 5*s*. to 10*s*. a year of tithes and poor rates. This of itself, would be no small gain; but we have it over and above that of our neighbours. It is evident, therefore, that he who is able should lose no time in improving his waste land; and that he who cannot do it otherwise, would find it his interest rather to sell the one half, in order to improve the other, than that the work should be left undone.—When a proprietor is not disposed to improve his waste grounds himself, he ought to give the most liberal encouragement to tenants and labouring poor to do it for him. What this encouragement should be, must depend so much on the varying circumstances of soil, situation, evenness of surface, depth, declivity, and access to natural manure, as lime, water, sea-ware, &c. that no general rule will apply to all cases. Every proprietor might employ some skilful and judicious person to ascertain the value and extent of his waste improveable lands, and to draw regular plans and estimates of the proposed improvement; after which he could judge of the terms on which they should be given to be cultivated. The foundation of the encouragement, however, ought certainly to be a long lease to poor, honest, and industrious labourers; with a small matter to build a house, and to help them to live till they can raise food to support themselves; after which they should pay interest for the money, and a small rent for the ground. Proprietors should, he thinks, give any encouragement short of their own loss, rather than allow these lands to lie any longer as they are."

It may be here observed, that "in improving waste lands, the open drains or ditches may be made to serve for fences; so that the expense of inclosing may be saved."

"The converting waste lands, whether into tillage, plantations or meadows, must depend on their peculiar circumstances. But in portioning out the land, the conveniency of draining and watering should be considered in the first planting of it, as this will save future expence and trouble. Few instances will occur, in which the ditches for the necessary fences may not be made useful drains, and often the only ones necessary; and there can be few large tracts allotted for meadows or pasture, of which at least a part may not admit of being watered."

There are obviously different sorts of land of this description, and which must require different methods of management to bring them into a proper state of cultivation, and of course demand more or less expence in making the improvement. They may, however, be principally arranged under the following heads:

1. Elevated barren lands, covered with different sorts of coarse plants.

2. Low lands of the swampy, boggy, or morassy kind, infested with various descriptions of coarse vegetable productions.

3. Mossy lands, of which there are many different kinds.

Under each of these heads many varieties will obviously be met with in the practice of improving them, which should be constantly kept in view, and be fully regarded, in order to effect the business in the most easy and effectual manner.

The first division of waste lands comprehends all sorts of moory, heathy, mountain, and would lands, however diversified by the particular circumstances of situation, herbage, &c. With regard to the nature of the soil, where the ground is covered with fern, heath, furze, &c. the following interesting remarks have been suggested by Mr. Phillips, in his excellent paper on the improvement of waste lands in North Wales.

Mr. Phillips, in speaking of the improvement of waste land, of the barren mountain kind in Wales, covered with furze (*ulex Europæus*) and fern, says, that "the thin soil upon these wastes seems to have been created by the annual decay of portions of the gorse; a plant admirably calculated to produce, and afterwards to detain, in spite of rains and storms, the vegetable earth upon these steep declivities. Around each bush of gorse is always found a heap, more or less high, of excellent soil. And so completely do the prickles of this plant defend the grasses that grow among it from the attacks of sheep, that the earth produced by the successive decay of vegetable matter, constantly accumulates and renders land, which a few centuries ago would probably have been unproductive, proper for the growth of corn. It is, says he, impossible to traverse our mountains, without observing how wisely these things are contrived by *Him* who provides for us all. The highest mountains of North Wales, where the rock does not every where appear, are clothed with heath. As ages roll by, the soil produced by the annual decay of portions of the heath, becomes fit to produce gorse. If the water has a ready fall, and the land is dry, gorse appears in abundance on the most exposed sides of the mountains. Where soil has accumulated in sufficient quantities, the next protector and fertilizer of the mountain is fern. Wherever this plant flourishes, still richer quantities of vegetable earth are every year added to the surface soil; and the ground is rapidly prepared for the plough."

The mode of inclosing and laying out lands of this kind, as well as that of the erection of the necessary farm buildings, must be regulated by the nature, situation, and circumstances of the ground.

It is remarked in the Argyleshire Report, that they have there "a great deal of moorish land, covered sometimes with heath, and sometimes with benty grass and *sprots*, and that as this kind of land has commonly a good descent, and rests upon gravel, at no great distance from the surface, which is generally a black peat earth, it may be cultivated with the plough at no great expence." It is directed that "it should first be ploughed in summer, in narrow ridges; and soon after either cross-ploughed, or well broken with spades.—It should then be covered with lime, or some other manure, receive a gentle harrowing, and lie in that state till it get the seed-furrow in spring. It is found that lime is peculiarly suited to heathy, mossy, and new land; as, by its caustic quality, it converts these and other vegetable substances into fine mould. The effect of lime upon new land is much greater than upon old. The summer's drought, the winter's frost, and the fermentation caused by the manure, will, in most cases, make it mellow and manageable enough by that time. If, in any case, it should not, it is best to let it have another summer ploughing, and to let it lie till the next year, when the crop will be so much the better as to pay for the delay. After the ground is sown and harrowed, the plough should be run lightly through all the furrows, in order to carry off superfluous moisture, and keep the ridges dry. With the second crop, it should be laid down with grasses for pasture, and the furrows well cleaned. If the ground be of a good staple, three crops may be taken, provided the middle one be turnips, with dung. It is observed in the twelfth volume of the Statistical Account of Scotland, that in this way Mr. Barclay, of Ury, has improved 300 acres of barren land. This, after the lime given to the first crop, will leave the land in better heart than if only two white crops were taken with the lime only."

And the writer of the above report remarks, that "the improvement of lands of the above description is so cheap a purchase, that even tenants upon a 19 years lease, having access to lime, might pursue it to great advantage. A few of them do so, and more, it is hoped, will follow their example. Some of the Duke of Argyle's tenants, in the parish of South-End, have of late years done much in this way, by which their farms and their profits are enlarged, and the face of the county beautified. But the greatest improvement of this kind that has yet taken place in

the county, was by the late Sheriff Campbell, of Stonefield, who rescued, mostly from the barren heath, a large farm of many hundred acres; which now of itself would be no small estate. And yet it may be said this vast improvement cost him nothing; for he used to tell that the work always defrayed its own expence. He had, besides, the pleasure of giving employment to a number of labouring poor, and of doing much good to all around him, by furnishing them with seed corn; which is found to answer best when taken from new lands: a consideration which ought to recommend the improvement."

It is observed, by Colonel Capper, in a tract on the cultivation of waste land in South Wales, that "one of the first agricultural objects which attracted the attention of the public in his neighbourhood, was a large tract of barren heath, situated about two miles north of Cardiff. About four years since, application was made to parliament for a bill to inclose it. This seemed to him a fair opportunity of cultivating to advantage a portion of that waste, part of which lay contiguous to one of his farms. The land sold on an average at the rate of twelve guineas per acre, and it appearing, that in general the soil would admit, at a moderate expence, of considerable improvement, he determined to purchase about one hundred and fifty acres of it.

"When this plan was first adopted, he had, he says, almost every thing to learn respecting the cultivation of waste land, and of course it was incumbent on him to acquire, from the most approved authors, what information he could on that subject. Some of them strongly recommended the denshiring system of paring and burning, whilst others of equal experience and respectability, in unequivocal terms, condemned it. However, having already seen this process successfully carried on in Devonshire, he at length adopted this plan, and shall now report both the manner of conducting it, and the result of his experiment; but previous to entering into the particulars respecting the management of the soil, it seems necessary to make a few observations on the divisions of the fields, and also on both the manner and expence of making the fences.

"The principal drains and roads were judiciously laid out by a regular surveyor, under the orders of commissioners. The fields were afterwards divided and fenced by the purchasers. The course of the drains and roads in some measure influenced the shape and extent of the fields; but, a few instances excepted, no field exceeds twelve acres, nor is less than four. The major part of them are between four and eight, which appear to him neither too large nor too small for any farmer; that is, they are spacious enough for cattle to graze in, are easily ploughed, and yet are not liable to many objections made against either very extensive or very small inclosures.

"The banking, ditching, and backing, cost, altogether, twenty-pence per pearch, of eighteen feet each. The bank is nearly four feet high, and between two and three feet broad, including the backing; the ditch eighteen inches deep, and two feet wide; planting young quicks two-pence per perch, and the price of good quicks in general, is about half a guinea a thousand. In most places, especially on the outside fences, he has put the roots of old thorns, hazel, birch, holly, horn-beam, and other plants suited to dry banks; but in wet marshy places, he has of course planted alders, withy, and other aquatics. In the hedge rows he has also planted oak, elm, ash, birch, and larch trees. The larch has failed only in a very few instances, the ash thrives very well, and also the birch, but the oak and the elm have not succeeded. The failure of the two last may probably be partly ascribed to their being planted on the banks in new ground, and perhaps they require to have their roots at least in the old natural ground properly prepared. Many people object to having trees planted in hedge rows; this subject however has been ably discussed by others, and therefore he shall not expatiate upon it in this report.

"His first attempt was made on a field of ten acres. The labourers undertook to breast-plough or pare the field, and then to burn the turf and spread the ashes, at three guineas per acre. The person he consulted on this subject fixed this high price, in order to induce the labourers to undertake a work but little understood in Glamorganshire; but he afterwards found that it might be, with great propriety, reduced to the following rate: thirty shillings for paring or breast-ploughing, ten shillings for burning the turf, and five for spreading the ashes. At this price, an industrious labourer may earn, without injury to his health, from eighteen shillings to a guinea per week, and the women, who are generally engaged to burn the turf, about fifteen or eighteen pence per day, which would afford each of them a comfortable maintenance, leaving nothing to either for idleness or dissipation. Strong men should, he thinks, invariably be employed in spreading the ashes, and they also should be carefully watched, otherwise this essential part of the work will be imperfectly performed, for the ashes ought to be strewed equally over the ground, and the stool (that is, the place on which the turf was burned,) should be carefully scraped and spread abroad. A great variety of opinions prevail also respecting the thickness of the turf, but this must necessarily, in a great measure, depend upon the soil. Where there was a sufficient depth, he has preferred cutting the turf about an inch and half, or even two inches thick, by which means a large quantity of ashes are acquired, and the fern and furze root, as well as those of other weeds, are more effectually eradicated. Those who burn the turf are much disposed to put it into large heaps, especially when the same persons are not employed to spread the ashes; and some excellent philosophers and farmers even have approved of this method, as producing by a smothered fire, in a large heap, a greater quantity of carbonaceous substance. Nevertheless he preferred moderately sized heaps, rather small than large, which being more generally diffused, cover a larger portion of the ground. The heat of these small fires opens,

but does not bake the ground to a brick, yet still has sufficient strength to destroy the roots of weeds; and as to carbonaceous substance, if the heaps of turf are sufficiently closed at the top with a slow fire, as in making charcoal, the vegetable matter will be effectually converted into a carbonaceous substance, retaining all the fertilizing qualities justly ascribed to these ashes. The labour of spreading the ashes from a number of small heaps is likewise considerably lessened, and consequently the ashes are more likely, by this mode, to be equally spread over the surface.

"We employed all our strength immediately to plough-in the ashes, which was done as lightly as possible, but the hardness of the ground, and the toughness of the various roots, together with the number of large stones, made it difficult when thus attempting to work superficially, to keep the plough in the ground. From these different obstacles in the first breaking up of the land, with working generally nine hours, we could seldom finish with one plough above three-fifths of an acre per day. When the ploughing was finished, we employed all hands to get off the stones and roots; the former, when of a proper size, were kept for building, the smaller stones were put on the roads. The next step was to cross-plough the field, and take out the remainder of the stones and roots; and this was followed by dragging and harrowing, so as effectually to mix the ashes with the soil. Although the ground in general broke up kindly, we thought it would be better to break the clods with a heavy roller, and in this manner prepare the ground for lime. Over-persuaded by his servants at the commencement, he was induced to use rather too much lime. On the first two fields he put ten dozen sacks on an acre, each sack containing three Winchester bushel, amounting to three hundred and sixty bushels an acre. Lime in most parts of this county is cheap, and therefore we are the more easily induced, even on old established farms, to be rather profuse in the application of it. Half the quantity, assisted with the ashes, he has since found to be sufficient at first, and another five dozen of effete lime, mixed with earth and dung, may be added when the land has been properly cropped, after the ground has been ploughed up a second time. The lime was spread when it was properly slaked by the rain and dew, and ploughed and harrowed in without delay, and thus the field was prepared for sowing; but notwithstanding the wholesome advice of letting the sower follow the plough as soon as convenient, we postponed this part of the work to the proper season for sowing wheat, which he believes farmers, in well-conditioned land, generally consider to be one week before and two weeks after Michaelmas. When the proper time arrived, we sowed under furrow about twenty gallons, that is a Welch bushel of wheat per acre. These three fields produced upon an average about eight Welch, that is, twenty Winchester bushels per acre. In some spots where the soil was good, or where it had been accidentally better prepared by a greater quantity of ashes, the crop was partially equal to twelve or even fourteen Welch bushels per acre; but on some others, where the lime had been left too long, or was not properly spread, it was in some particular small patches almost entirely barren. The wheat sown was, for the most part, red lammas, which seemed to thrive better on the heath than on any other sort. After having sown wheat on the ten acres, he resolved to try a different mode of culture on the two other fields; but for perspicuity's sake, we will continue to state what was done on the ten acres from the commencement to the present period.

"The soil of this field, we found, was become a light sandy loam, with about fourteen inches of this kind of earth on a gravel. In this soil, for a second crop, we sowed barley, about twenty gallons per acre, and at the same time about twelve pounds of red clover per acre. The first appearance of the crop in the month of June was very promising, but it afterwards gradually fell off, and at last produced very indifferently. Two acres of the west side of the field, which was under the shelter of a hedge of an adjoining farm, produced at the rate of about forty Winchester bushels per acre, the rest was overrun with grass and weeds, mixed with the barley and clover. When, therefore, it was nearly ripe, we cut the barley and clover of this part of the field together, to serve as fodder for the oxen and horses during the winter, and thus he believes it amply repaid him the expences.

"The third year, the first crop of clover varied, as the barley had done the preceding year; about four acres of the sheltered part of the field was an excellent crop, which was mowed, the remainder was grazed by sheep penned with hurdles. The whole of the second crop of the third year was afterwards in like manner sheep-grazed. On about two acres of the middle of this field, which had not been properly managed, or which had suffered for want of shelter, and consequently the crops of barley and clover in some degree failed, small quantities of fern appeared after the grazing of the sheep on the third year, but they were easily removed by hand-weeding in a couple of hours.

"On the two adjacent fields, after having previously pared and burnt them, we first sowed Poland oats without the addition of lime, and had from the ashes alone an excellent crop in each of them. These we ploughed again in the autumn, and in the following spring put about ten load of lime and earth mixed on an acre, and in the smallest field a few cart loads of dung, all we could conveniently spare from the old farms. In May we drilled some Swedish and white round turnips into the four acres, and in the following month sowed the five acres broadcast with tankard and white round. They both succeeded pretty well, and the turnips of each field were eaten off by sheep hurdled, and in wet or very severe weather we also gave them some good hay. Although they remained in these grounds the whole winter in a very exposed situation, we lost only one ewe, which was almost broken-mouthed; but it is proper to observe, that the major part of the flock

consisted of strong young wedders, all of them in very good condition, thirty of which were sold to the butcher in the following spring.

"The turnip crop was followed in both fields by barley with ray grass and clover. The form of these two adjoining fields is nearly the same; the summit is about thirty yards, then follows a gradual descent to the north, which finishes with a sudden fall of about ten yards, and the whole terminates in a bottom of a few yards, bounded by the main drain of the heath, through which there is a constant run of water.

"On the summit and breast of these fields, where the turnips succeeded best, and consequently the sheep were longest confined in eating them off, the ground having been well manured and trodden, the crop of barley was excellent; on the declivity it diminished, nor was it much better in the bottom, where the turnips partly failed, and where some spots of peat earth made it unsafe to keep the sheep in wet weather; nevertheless, he must here observe, that waste land thus situated in a bottom, where it constantly receives the washing of the upland, is, in his opinion, capable, in the course of a few years by good management, of being rendered the most fertile part of the field."

These were the only fields he could bring into cultivation himself the first year, but a friend sold him some pieces adjacent, of which the following is a faithful report of his management.

"His first attempt was on three pieces, one of seven, another of six, and a third of eight acres. He likewise adopted the denshiring system. After the two first had been pared and burnt, and manured with about eight dozen of lime per acre, he sowed them with white and red round turnips, which produced a good crop; these were fed off with sheep hurdled, and the second year he sowed them with Poland oats, the first with clover only, and the other with ray-grass and clover. The third field he pared and burnt, and then sowed it with wheat without liming. In this state, these and some other fields, which will be hereafter noticed, fell into his hands.

"The second year, both the first crops of ray-gras and clover only were mowed, and the third year they were fed off with sheep hurdled. The first year the wheat, which had not been properly limed, did not succeed, producing little more than five Welch bushels per acre, about twelve and a half Winchester, of small ears and meagre grain. In the following autumn, he put a small dressing of lime on this piece, and sowed it with pease in the spring, which proved to be an excellent crop, not less than sixteen waggon loads, but it produced likewise an immense number of weeds, which we ploughed up and burnt on the field.

"The third year we manured part of this field, as much as we could, with dirt and ashes from the town of Cardiff, and sowed the whole of it with Poland oats and ray grass and clover. That part of it which had been manured as above mentioned, produced extremely fine crops of oats and clover, nor did the other part by any means fail, although neither the oats nor the clover were so abundant as in that part which had been previously manured.

"It is needless to repeat circumstantially what was done the second year on ground treated in the same manner, and with nearly similar success; he shall therefore conclude this part of the report with observing, that one small field, on which his friend had adopted the plan of mixing the lime with the ashes, and sowing wheat at the beginning of October, succeeded perfectly well, producing on an average about twenty Winchester bushels per acre. On this field, which was part of his purchase, he afterwards ploughed up the wheat stubble, and sowed some winter vetches, which answered very well; but for want of hurdles, and on account of his being impeded by a variety of other business, these vetches, instead of being fed off, as perhaps they ought to have been, were suffered to ripen; but they produced a fair crop, which was mowed and kept for seed.

"When the same plan of sowing wheat had been followed on some other fields on this new land on the heath, he determined to sow two of the wheat stubble fields, with vetches and oats. These, it occurred to him, might be converted to use in three different ways; either in grazing them with sheep when perfectly green, or cutting them as hay just before the oats hardened, and when the vetches were still in blossom, or allowing them both to ripen, or rather to be mowed when the oats were ripe, and the vetches began to pod. Not being much in want of early spring feed for the sheep, he adopted the two last of these plans, and cut the oats and vetches as hay for winter food for the horses and working oxen, which seems to anwer perfectly well, especially in a new inclosure, where winter fodder is likely to be scarce; and the ray grass affords plenty of food both for autumnal and subsequent spring grazing. At the same time it must be remembered, that the vetches being of a very succulent nature, they are much longer drying than the oats, and consequently, unless they are cut in very dry weather, it is difficult to make them together into good dry hay; but when they do succeed, they afford very palatable and nourishing food, both for working oxen and young cattle."

It is added that "without entering further into a minute investigation of the various arguments suggested by different philosophers, on the subject of the cheapest and most effectual mode of breaking up waste land in general, he does not hesitate from the preceding and following well-known facts, to pronounce, that paring and burning will be the cheapest and most effectual method of bringing land similar to that on Cardiff Heath into cultivation. In every instance this mode of proceeding has fully succeeded with him; and on the contrary, ploughing, simply, without paring and burning, the turf, has under his own eye, constantly failed. In a field adjoining to one of his, the plough only was used: it was ploughed, cross-ploughed, dragged, and harrowed, at an immense expence of labour and harness,

and the first year it was sown with wheat, of which it literally did not return the seed, whilst in a field, separated from it only by a low bank with a young quick hedge, which had been pared and burnt the same year, there was a very fair crop of wheat, not less than ten bushels an acre. His neighbour who had suffered himself to be dissuaded from paring and burning, endeavoured to repair his mistake, by putting on the field a sufficient quantity of both lime and dung, on which in the second year, he sowed barley with ray-grass and clover in one part, and oats with seed on the other. The former proved but an indifferent crop, the latter was a fair average crop, and the ray-grass fully answered the proprietor's expectations. His crop on the adjacent field was oats and vetches, and was equal to any crop of that kind he ever saw. But it is scarcely fair to judge by one example only; he shall therefore mention another, where a gentleman, on the opposite, or north-west side of his farm, put himself to the expense of digging the ground with the spade at the rate of eight-pence per perch, rather more than five pounds per acre, without its having been previously pared and burnt. He sowed turnips there, but did not gather ten roots upon an acre. From these two examples of failure in ground not pared and burnt, adjacent to others which were pared and burnt, and which invariably succeeded, he feels himself fully justified in concluding, that in soils similar to that on Cardiff Great Heath, the paring and burning is the least expensive and most effectual mode of proceeding to bring waste lands speedily into cultivation.

"This first step gained, we will, says he, in the next place, consider what crops apparently succeed best, and also by what means those crops are most easily obtained. His first attempt, as before observed, after having spread the ashes, and mixed them in the manner above mentioned, with a proper quantity of lime, was wheat. His reason for it was to obtain re-payment of his expenses, by cultivating the most valuable crop whilst the ground was well manured, or, as a farmer would say, was in good heart; nor was he disappointed, as the following statement will shew:

	L.	*s.*	*d.*
Breast-ploughing, burning, and spreading the ashes, at 2*l.* 3*s.* per acre, for ten acres is - - - -	21	10	0
Ploughing, cross-ploughing, and dragging, at 10*s.* per acre each -	5	0	0
Five dozen of lime, for each acre, at 10*s.* 6*d.* per dozen - - -	26	5	0
Removing stones, six days, at 10*s.* per day	3	0	0
Seed-wheat, one bushel per acre, at 20*s.* per bushel - - - -	10	0	0
Expense of sowing - -	5	0	0

He is not aware that, in his account, any material expense is omitted, nor any one that is stated undervalued. The total expense then of sowing ten acres with wheat amounts to 68*l.* 2*s.* 6*d.* The average produce was eight bushels per acre, estimated at the same rate as the seed-wheat, amounts to 80*l.* But it must be remembered, that wheat for some time past has sold for 30*s.* per Welch bushel, and consequently the crop, at that rate, produced a clear profit of more than 51*l.* 17*s.* 6*d.* besides what arose from the subsequent crops."

It is observed, that "objections have been made to cultivating wheat in the first instance; but for his own part, it appears to him the most profitable mode of proceeding. This crop should be followed by turnips, or else by oats with ray-grass and clover; but he should in general greatly prefer the former, especially if a sufficient quantity of old dung is near at hand; and barley with seeds may then be tried after the turnips, especially if the crop of turnips succeeded, so as to keep the sheep a sufficient time on the field. By these means the course of the crops will run thus: wheat, the stubble carefully ploughed in the autumn; then turnips, and these followed by barley or oats, and ray-grass and clover. The first crop of ray-grass and clover will be grazed by sheep or horses, as may be judged most convenient. When a field thus managed is broken up a second time, he does not entertain a doubt of its becoming, in a short time, nearly equal to most other land in the neighbourhood; but we must not expect that a child should at once acquire the strength of a man.

"With a great many acres to cultivate, it may be necessary, in order to gain time, and for many other reasons, to vary the crop. In some cases it may answer to begin with turnips, in others with oats and seeds, and sometimes with oats only In some lands, where mucilage seemed wanting, he has tried buck-wheat, and ploughed it in with great success, especially when afterwards mixed with lime and dung. But in all cases where the option was left him, he began with wheat, and proceeded in the manner above described; and in this manner he should always recommend others to proceed whenever circumstances will permit. Wheat, when the ground is properly prepared, will always amply repay the expense of paring, burning, and spreading the ashes; and green leguminous crops, eaten off by sheep or cattle, will afterwards improve the land considerably, even without the help of dung from the farm yard, which, however, is also to be used when it can be procured at a moderate expense."

In speaking of the second kind of waste lands that are capable of cultivation, as that of soft bog, or morass, of which there is a great deal in the county, the author of the Argyleshire Report says, "this is more difficult to improve than moor; but then it will better pay for the expense. It is a collection of rich mud and sediment, washed from the higher grounds, and now mixed with so much stagnant water, that neither man nor beast can tread on it with safety. This kind of soil, when well drained, is the richest of any. Nor is the draining of it so difficult as may be at first apprehended. Sometimes the water which poisons it comes from higher grounds, so that it can easily be intercepted, and afterwards made to serve it, in the way of irrigation, as an excellent mature. Sometimes the water is supplied by

springs within itself; which will easily be discovered, after the bog has got an outlet at the lower side, to which the springs may be conducted by open drains as the mud subsides; after which it may be regularly drained, and converted into valuable pasture or arable land, as the owner chooses.

"A considerable tract of ground in the neighbourhood of Campbelton he observes partly a lake and partly a morass, was thus brought to be excellent arable land, by the late Colonel Charles Campbell. Besides the advantage to the owner, the draining of such marshy grounds conduces to the healthiness of the neighbourhood, by removing their putrid exhalations."

And Colonel Capper, in the tract above alluded to, remarks "that the improvement of boggy ground of course required more attention, and likewise more expense, than such as above, to bring into cultivation. In five or six fields, under the management mentioned above, there were small spots of bog arising from springs on the breast of the opposite hills, which have been long choaked, and have made temporary swamps a few yards around them; but these have been tapped and surface drains made from them, to conduct the superfluous, or rather top water, by the side ditches to the main drains, and in some particular instances by strong covered or open deep drains to the same channel. Since they have been thus treated, these fields have been sown with wheat, and have borne this year very excellent crops. At the bottom of these hills, on both sides, runs a small brook, which has been converted into one of the main drains of the heath; on each side of the brook, the earth has been gradually washed down from the adjacent hills, and consequently it deposited a quantity of black mould about two feet and a half, and in some places three feet deep; underneath this soil is generally a fine white sand upon a gravel, but in some places the mould covers only a common peat earth. Various experiments have been made on these different soils: with a mixture of lime we have obtained a tolerable crop of wheat, even from the peat earth, and on the remainder, by the same means, we have had an abundant crop of oats. It is his intention, next year, to try if cabbage will thrive in these bottoms, by the help of a mixture of lime and dung. Nor has he the smallest doubt, but in the course of a few years these vallies will throw up abundant crops of excellent grass, which, in many places, already begins to appear. The first year after it had been drained, we were able to plough one half of this boggy bottom, the remainder has been either planted with withys and other aquatics; or, after having been dug with spades, has been sowed with oats."

And for wastes of this sort, where there is much coarse, rushy herbage, and they are sufficiently dry, the following method is advised by a writer in the fourth volume of Communications to the Board; which is, "in the months of April and May, to pare and burn; after the ashes have been equally spread upon the surface, the land is to be turned over with a very ebb furrow, and at the proper season to be sown with turnips broadcast. From the entire absence of root weeds, they will require little care in hoeing or dressing. This crop is to be consumed upon the ground, by folding sheep upon them in flakes. So soon as the land is cleared of the turnips, it is to be ploughed with a good furrow, and so to remain until the season for turnip sowing again arrives. If well worked and laid into drills or stitches of the usual breadth of two feet and a half asunder, the dung derived from the sheep that consumed the first crop of turnips, will give a superior turnip crop the second season. The second crop of turnips is, like the first, to be consumed by folding sheep upon it in flakes; that done, the land is to be ploughed and laid into ridges for a corn crop, which is to be either barley or oats, according to the quality of the soil and situation of the lands. The lands, if rich and well-sheltered, ought to be cropped with barley; if otherwise, with oats; in either case to be sown off with grass seeds for pasture. Under this process, the smallest possible expence is incurred, and the lands, at the end of three seasons only, are thrown into pasture in high condition, while in the course of the process, one valuable corn crop, and one valuable crop of turnips, have been obtained, together with a less valuable crop of turnips; which last, however, may be sufficient to defray all the expenses of tillage attending it, over and above that of the paring and burning. The expense of preparing for the second turnip crop, and for the corn crop, will amount to no more than the price of ordinary light tillage; and the lands, from being thrown into grass in high condition, will not only afford abundant and profitable pasture, but at the same time will be ready, when broken up at a future period, to afford luxuriant corn crops."

And with another cultivator in the same work, in low wet bottoms, the most beneficial mode that he has tried is, to pare and burn for turnips to be eaten by sheep; then he sows oats, and afterwards lays on five chaldron of lime per acre, as a preparative for turnips to be eaten by sheep; after which he sows oats, and seeds in the quantity of sixteen pounds of white clover, five pounds of rib-grass, and a quarter of good hay-seeds per acre. The land so managed will carry considerably more stock than it did in its original state. If the drainage be complete, those seeds may be broken up at the end of two years (or as soon as they appear to decline in value), for wheat, and put into the four-shift husbandry, viz. turnips after wheat, to be succeeded by barley, clover, turnips and wheat again. Till the land grows tired with red clover, there cannot in his opinion be a more judicious mode adopted than the four-shift husbandry. When it is tired with red clover, which it will invariably be, after two successive rounds, either beans, peas, or seeds, may be substituted. The two former are meliorating crops, and will be found advantageous on strong land, particularly the former, where the land is not strong enough for beans. The best substitute for red clover is small seeds for two years, which throws it from the four into the five-shift husbandry.

It is remarked by Colonel Capper, that from the preceding state of facts, extracted from his farming diary, which shall be open to the inspection of any neighbour disposed to examine it, it appears that paring and burning the surface, with the addition of a moderate quantity of lime, is also an effectual mode of preparing waste land of the above kinds for cultivation. From the same documents it may also be inferred, that wheat, with a succession of green leguminous crops fed off by sheep, will amply repay the expence of cultivating a new inclosure. But farmers, who, from an intimate knowledge of the business, are best able to undertake such a task, seldom possess either capital or confidence enough to carry it on with proper spirit; and gentlemen who have money, seldom have leisure or inclination to attend to the details of farming. For these reasons, principally, one of the most useful branches of agriculture has been hitherto too much neglected.

"When, says he, a gentleman determines to undertake personally the management of a farm, he must, in the first place, appropriate a certain portion of his fortune for this particular use, and of course the sum must be in proportion to the nature and extent of his farm. In a cultivated arable and pasture farm of one hundred acres, it is his opinion he ought not to commence his operations without being able to appropriate a capital expressly for this purpose of at least 1000*l*.

"Horses, oxen, cows, sheep, and pigs, must be purchased, then follow implements of husbandry, without reckoning additional stables, sheds, perhaps a barn and threshing machine. It must likewise be remembered, that before any receipts come, other considerable disbursements must be made. Labourers for twelve, or even eighteen months, must be paid, taxes, tithes, church and poor's rates, wear and tear of implements and tools, saddlers' and farriers' bills, &c. must also be paid in advance, as likewise the purchase of grain and other seeds, especially in an arable farm. It would be useless to enter into the minutiæ of all these expences, the general view of them is sufficient to shew, that a capital of 1000l. is scarcely sufficient for a farm of one hundred acres. But we must not suppose that the expences of a farm increase in the same proportion, according to the number of acres. He believes 1500l. would suffice for one of 200 acres, and probably 2000l. or less, would answer for one of 300 acres. Hence it is evident that if, during the first two years, a man, alarmed at the constant expence, should stop short, he will find it a losing concern; but should he persevere, and act with industry and intelligence, on the third year he ought to gain a profit of twenty, or if he sustains no unexpected losses, perhaps of thirty per cent. for his capital: we will content ourselves with stating the former. In the course of a few years, then, he will consequently be reimbursed his capital, and with the advantages derived from experience, whilst he evidently benefits the community, he ought annually to add very considerably to his own private fortune."

With regard to the third description of waste land, and that in which they most abound in Argyleshire, it is, the writer says, "moss; of which there are in every parish large tracts, useless in their present state, but capable of cultivation. They are of different depths, from two or three to eight or ten feet, and of different dimensions; so that some of them may be reckoned not by the number of acres, but of square miles which they contain. One of these immense mosses lies in the neighbourhood of Campbelton, to which it must some time or other be of infinite service. At present, its thousands of acres are almost good for nothing, excepting furnishing a few peats; which (as is the case in most mosses) have been so irregularly cut, as to add much to the difficulty of improving it. Still however it may, and soon ought to be improved. It has every advantage from its situation, near manure, and near market. Mountains of lime stone lie near it on one side, and mountains of sand and sea-ware on the other. A large water runs through the middle of it. Master-drains, or large ditches, at such distances as to serve also for inclosures and divisions of fields, might be made to fall into this water; and lesser lateral drains or ditches might be conducted to those larger ones. The water, by deepening a few fords, might perhaps be made to run two or three feet lower than its present level, which would greatly facilitate the draining. As the water runs on a bed of sand or gravel, it is probable that the moss is no where deeper than the level of this stratum; so that the master drains could easily be made to reach the gravel, and give vent to the under-water in every quarter. The lesser drains or ditches might also be bored or tapped to that depth, at small distances, and the weight of the moss would soon press up the superfluous water, and force it to take its departure. As for the extraneous water from the higher grounds, it could not only be kept off by a ditch (which would serve also for an inclosure), but made subservient to the valuable use of watering and manuring the moss, as soon as it would be in condition to receive it." See *Moss*.

It is observed that "wherever clay, sand, or gravel, may be found within two or three feet of the surface, a coat of it ought to be thrown over the moss, as it will greatly improve it. This may easily be done by forming the ground into the shape of broad ridges, and throwing first the mossy stratum of the furrow ditch to fill up hollows on either side; and then, after the surface is levelled, the clay or sand over all. On the moss of Kincardine, one method of reclaiming the moss is, to dig ditches, or *goats* as they are called, at such distances, and of such depths, that the clay dug from them is sufficient to cover the intermediate spaces of moss to the depth required. This makes the most substantial improvement, especially if any considerable quantity of clay was raised; as, in that case, it formed a new soil, which compressing the moss by its weight, its sponginess produced no bad effect. Moss improved in this manner, after producing some crops of grain, has continued for forty years to be good pasturage. When these

ditches, or square drains, stand open for two or three years, it is probable that the ground will be so far dried, as to allow them to be nearly filled up, by slanting down their edges; if not, they may, where necessary, be easily formed into hollow drains. In the first instance, it is probable the most, if not all of the ground, must be dressed with the spade, as it may be too soft to bear the plough, as well as in need of levelling. But the difference is not considerable, where labourers may easily be got, as here, in the intervals between the fishing seasons. After the ground is levelled and dug, and has had some time to dry, it should be well limed; after which it cannot fail of giving two good crops. Grasses should be sown with the second crop; and no cattle, except sheep, should for a year or two be allowed to tread it. These sheep, feeding on one part, might by folding, be made to manure and improve another, till all should be brought in at no great expense. The straw too, raised on one acre, would create dung for another; so that the work wants only a beginning, which it is hoped some of the proprietors, or some spirited farmers, will soon give it. A small farmer on the duke of Argyle's property, bordering on this moss, has already made several little purchases from the skirts of it, by which he has made his own circumstances easy, and given proof to others, that they may do the like, and have larger profits, by working on a larger scale.

"No part of the improvement here proposed is very difficult, much less impracticable. Similar undertakings have been executed to advantage in many places, and are just now going on in others, with every prospect of success and profit. Not long ago, a moss in the Isle of Man, six miles long, three broad, and from ten to twenty feet deep, was drained and improved, and is now the most profitable land in the island. In the neighbourhood of Paisly, of Carnwath, and of Stirling, the like great improvements are rapidly going forward.

"From what improvements have been made in this county, on moss or peat-bog, by the duke of Argyle, and several other proprietors, near their houses, it may be seen that this species of ground, though useless in its present state, may yet be turned to great account. There is reason to hope, that the advantage of improving it is now beginning to be more generally attended to. The proprietor of the great moss of Crinan (Mr. Malcolm) proposes to begin immediately to improve it; and there is no doubt of his doing it with ease, and to great advantage. This improvement is since begun, and considerably advanced. Such a subject is capable of being made of itself a great estate. Many such are in the county, especially in the upper parts of it, and some of greater extent. A sheet of moss on only one farm there, is computed to be no less than ten or twelve miles square. One can hardly indulge the hope that such a subject, and so situated will ever be improved. But surely in the highest habitable situations in the county, some portion at least of this kind of ground might be profitably cultivated. There arable and meadow lands are scarce. Moss might be made to supply the deficiency, and yield, what is much wanted, a sufficient quantity of hay. Even with a view to pasture, one acre might thus be made to produce more than twenty or thirty in their natural state. The situation does not forbid such improvement. It is believed that no habitation in this county is much higher than the Lead-hills, and yet there, one acre of waste ground, originally not worth one shilling, has been brought to feed two cows. This shows what culture will effect, even in a wilderness."

"Mossy land is best adapted to the raising of grass: and for that purpose, more than of raising corn, ought it to be improved. Clover will grow in it, if it is sufficiently dry; and rye-grass better, as it is less delicate. But the kind of grass that suits it best, is the meadow soft grass or Yorkshire white (*holcus lanatus*). This grows close and quickly, keeps the ground well, and is equally fit for pasture or for hay.

"In most of the farms occupied by small tenants and cottagers, considerable parcels of new and mossy ground is brought into cultivation, by planting potatoes in the lazy-bed way. Wherever dung can be easily applied to such land, this is certainly the easiest and cheapest way of improving it. But by their usual mode of managing, the principal benefit that should be derived from this improvement is lost, and the ground left in a worse state than it was before. Two, if not three crops of oats are taken after the potatoes, and then the ground is left to Nature, to make what she likes of it. Instead of this the ground, before it is broke up, ought first to be sufficiently enclosed; generally by a ditch, which would keep off foreign water, and help to drain it of its own. Whether this should be done by the tenants or landlord, or both, must depend on circumstances. As soon as the potatoes are dug, every two ridges (or every three, if the lazy-beds are narrow, and the ground pretty dry) should be made into one. This is easily done, by slanting off the outer edges of the intended ridge, and throwing back the stuff into the intermediate furrow or furrows, taking care that the new ridge be sufficiently raised in the middle, to let the water fall off into the furrow that is left, which ought to be well cleaned, and, if necessary, deepened. In this state it should lie till the beginning of April, when it should be stirred a little with the spade, and sown with oats and soft grass-seed. A second crop of oats may be taken; but the grass, by getting the ground in better heart, if it be sufficiently reduced and pulverized, will more than make up for the want of it. Next year the grass should have a slight top-dressing of lime, if none was harrowed in with the crop the year before; or, if that is not convenient, the ashes of the peats burnt in the house might be kept dry in a small shed, and used in place of it. No cattle heavier than sheep should be allowed to pasture the ground for a few years, till the sward is sufficiently strong to bear them. By this management, the improvement would be great and permanent: for, though moss will bear the same rotation of cropping with other lands, yet it will

make a better return by putting it early and in good heart under grass. Corn upon moss lands is apt to lodge, which would prevent its filling, and make it less fit for meal than for seed."

The following method has been detailed by Sir John Sinclair as the mode pursued by Mr. Wilkinson of Castlehead in Lancashire on what is termed a *flow* moss of the deep unfavourable kind: In the first attempts "the surface was breast-ploughed and then burnt. Sod kilns were erected to burn lime to be spread on the moss, the surface of which had been thus cleared off. But the plan did not answer, as the proper management of these kilns was not then understood. It was necessary therefore to follow a different plan, the particulars of which it is proper next to detail.

"It is in the first place essential to make a sufficient number of *large open drains*, both to carry off the stagnate water, and to promote a consolidation of the moss. There must also be *covered small drains* made with sods, which have been dried for about three weeks or more according to the season. In soft spongy moss the covered drains ought to be at first nine yards distance, and when the moss is consolidated, covered drains must be made first between and afterwards across the covered drains that are first made.

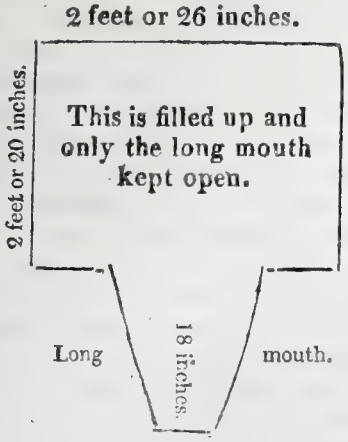
In the following sketch the nature of the system that has been found to answer best is shewn. No. 1. denotes the open main drain, or division fence; No. 2. the first covered drains at nine yards distance; No. 3. covered drains made between No. 2. or at four yards and a half distance, and executed about two years after No. 2. No. 4. are covered drains quite across the field, and are made when the moss is pretty well settled. They should be from a foot to eighteen inches below or deeper than Nos. 2. and 3. and if properly placed will complete the solidity of the moss.

(1) The main drain or division fence.

The drains marked No. 2. are from two to three wide and two feet deep.

These drains lay open sometimes for a year. The sods dried for covering the long mouthed drain as it is called, which is eighteen inches deep and four wide at the bottom.

The nature of this sort of drain will appear from the following plan:



It has been supposed by some, that "moss-land can be made too dry, but that has not been found to be the case at Castlehead. The moss being so deep, there always comes a damp from it, which keeps the land moist enough."

He has been extremely successful in making good roads over the softest moss.

In cutting the drains a *tom spade* is made use of, and a second sort of tool is a plough of the common swing kind, but having a steeled coulter, and the sock fourteen inches broad is also steeled, being both kept quite sharp, by which they can cut the surface as thin as an inch. They also make use of a tool for cross-cutting the surface before the plough is used, which affords much advantage by dividing the sods into small pieces. They have likewise recourse to a *horse patten* for the hind feet, especially in the first ploughing of the moss. By this contrivance horses can be employed at first instead of men.

After draining and other operations previous to laying down with grass seeds, the following plan was had recourse to:

"1*st Year*, to burn the heath with any hillocks which were cut off in order to make the surface plain and fit for ploughing. Plough the moss seven inches deep, then cover it with clay, sand, or mould, (1000 single horse carts per Lancashire acre) as many of these articles may lie most convenient for carriage, which is the point to be principally attended to. And this year turnips may be sown if the season and other circumstances are favourable.

"2*nd Year*, after a slight ploughing, sow oats, and the crop will in general be excellent.

"3*d Year*, another slight ploughing, burn any clods that may appear, and lay down with turnips in drills.

"4*th and* 5*th Years*, Then a fourth ploughing for another crop of oats. When the oats are cut, spread a light compost over the stubble, and after a slight ploughing sow winter rye, which always produces a good crop, and in April when the frosts are over, sow grass seeds on the winter rye and roll them in. The land is thus brought into grass, in perfect good order, and may be pastured with much advantage for five or six years, when the grass may be renewed, without ploughing up the land again by which the drains might be disturbed. It is observed that the advantage of this succession is, that you are pretty certain of four or five good crops (two of oats, one of winter rye, and one or two of turnips,) which will pay a considerable share of the expense of the improvement. But besides these crops, barley has been tried and answers well, and the potatoes raised on mossy land, are of a quality peculiarly excellent. And it is suggested that cole-seed would certainly produce good crops.

"*Expense of the above process.*—No particular estimate has hitherto been made of the expense. The covering at the rate of a 1000 cart loads per Lancashire acre, may be calculated at 8*l*. 15*s*. or 2*d*. per cart. The expense of draining, making roads, &c. must depend upon various circumstances.

"*Kind of oat.* The best kind of oat for the first crop is the Scotch dun, or the *Nanny pye oat*. Afterwards a heavier sort may be tried.

"*Grass-seeds.* Red clover does not answer, and the land when laid down to grass, produces white clover of itself. The following has been found the best proportion of grass-seeds, 10lb. of trefoil, 10lb. rib-grass, and 6 bushels of hay-seeds.

"*How to renew the grass.* In the course of five or six years the grass is very apt to get foggy. It may be renewed by the following process. Spread at the rate of 40 Lancashire or 120 Winchester bushels of hot lime, per Lancashire acre, and as hot as possible in the month of July. Immediately after liming, run it over with a short sharp toothed harrow. The hot lime and the sun will destroy the fog and new and finer grass will spring up.

"*What manures.* Neither lime nor dung had any material effect upon the moss till it was reduced to soil. The stagnate water in moss called in Lancashire *aedle water*, is highly pernicious, and is injurious to animals that drink any water with which it is mixed. By ploughing the moss often, exposing it to the atmosphere and mixing it with other substances the *canker*, as it is called in some districts, is extirpated. The frost has a great effect in reducing moss to soil, and after the moss is frosted, the influence of the sun is beneficial. The moss must be rendered dead matter, before it can become productive. Lime has then an effect, and dung still more. But nothing has answered better than burnt clay. Low canal field containing about four acres was manured with burnt clay at the rate of eighty single horse carts per Lancashire acre. It has ever since been mown annually and is the best meadow land for hay in the parish.

For turnips the burnt ashes answer particularly well, and it has been observed that the fly never attacks the turnips where they have been manured with ashes, more especially if the seed has been pickled, as wheat usually is previous to its being sown.

Shelter. Birch, alder, plane, black poplar, and mountain ash, thrive well on mossy lands, and if

where quicks are planted, the moss is properly mixed with clay or sand, they will also thrive well.

"*Grass, how managed.* The land must at first be tenderly dealt with, and it is in general much better to pasture than to mow it. Sheep have not been tried. The highland sorts are much liked both as they are light, and feed quickly, but the galloway are on the whole preferred, being tamer and doing less mischief. Sometimes young cattle from the neighbourhood are taken in to graze and that plan pays well.

"*Present value.* For pasture in its present state the new improvements would let from 30*s.* to 40*s.* per Lancashire acre, and the land that was improved some years ago at double that sum.

With regard to the "*extent of the moss improved,*" it is observed that "Mr. Wilkinson has already brought or is in the course of bringing into cultivation, no less a quantity than about 500 *Lancashire* acres of this kind of soil."

On the estate of Langwell in the county of Caithness, the following is stated by the author of the above paper as the best system of converting mossy land into a productive state.

"*Preparation.* Begin with draining the land so as to put it in a state fit for being ploughed without rendering it at the same time too dry. Burn the heather, then make use of the fen ploughs for paring the surface. What is pared off may either be made into turf walls, for sheltering the ground, or employed to fill up the hollows or burnt, though the ashes of the surface are in general so light as to be of very little service as a manure. When the surface is cleared, then take a common Scots plough, and during the months of September and October, and all the winter months whilst it is practicable plough the moss from six to nine inches deep, exposing it as much as possible to the frost. The frequent use of the roller (and the heavier the better) is of the greatest importance in the cultivation of moss rendering it much sooner capable of producing abundant crops of grain or grass than otherwise could be expected, and effectually banishing that noxious weed *sorrel* with which it is otherwise apt to be overspread.

"*Manure.* In the following spring the land thus prepared will be fertilized by the frost and easily converted, by harrowing into mould, or what Dr. Anderson calls *moss earth.* If any clods are to be found in a rough state they ought to be burnt, and if the season is dry, fire may be spread over the surface, the ashes immediately harrowed in and the ground sown. Dung, lime, clay, sand, or small gravel may also be employed as manures as circumstances will admit of it.

"*Crops.* Bear seems to thrive in land thus prepared, oats also would answer well. Rye would probably succeed. Rape would certainly be productive. Red clover has not yet answered but will most probably succeed when the lands have been longer under cultivation. Rye-grass and the grass called *Yorkshire fog* seem to answer particularly well.

"*Succession of crops.* It has not yet been ascertained by experience, what is the best succession of crops on such lands, but the great object certainly is to get them laid down into grass as quickly as possible. They can then be broken up with the fen plough, the surface burnt, and the quantity of rich ashes which the roots of the grass will produce, will ensure a succession of abundant crops for at least three years, of which two may be of grain, and with the last crop of grain, the land may be again laid down to grass.

It is on the whole concluded that by this management "the extensive bogs in this country, Scotland, and Ireland may be rendered fertile, and a great addition made to the wealth of the country, and the subsistence of its inhabitants.

In some observations on this system it is suggested that frost has much effect in reducing moss into the state of vegetable earth, and that of course it must be advantageous to have it exposed as much as possible to its influence.

WATER, a well known fluid much used as an article of drink both for man and cattle.

It is a clear insipid and colourless liquid, capable of being coagulated into a transparent solid substance termed ice when placed in a temperature of 32° of Farenheit's thermometer, or lower, but volatile and fluid in every degree of heat above that, and when pure and freed from heterogeneous particles was formerly considered as one of the four elements.

From the experiments of some modern chemical philosophers, as Lavoisier, Watt, Cavendish, Priestly, Kirwan, &c. it would seem to consist of pure air or oxygen and hydrogen, or inflammable air intimately united, or according to Mr. Watt of those two principles deprived of part of their caloric or latent heat. The former entering into the composition of water in the proportion of about 85 hundredth parts, and the latter in that of about 15. In some instances it would seem that air and water are mutually convertible into each other. And Cavendish recites several experiments in which he changed common air into pure water by decomposing it in conjunction with hydrogen or inflammable air. Dr. Priestly likewise having decomposed pure air or oxygen, and hydrogen, or inflammable air, by firing them together by the electric explosion, found a manifest decomposition of water, which as nearly as he could judge was equal in weight to that of the decomposed air. He also made a number of other curious experiments which seemed to favour the idea of a conversion of water into air, without absolutely proving it. And the difficulty which M. De Luc and others have found in expelling all air from water is best accounted for on the supposition of the generation of air from water; and admitting that the conversion of water into air is effected by the intimate union of what is called the principle of heat with the water, it appears sufficiently analogous to other changes or rather combinations of substances.

On the whole there seems to be water in all bodies and particles of almost all kinds of matter in water,

o that it is hardly ever sufficiently pure to be considered as in an elementary state.

It has been long since observed by Boerhaave that water, if it could have all the requisites of an elementary substance would be as simple as fire; but there is no expedient hitherto discovered for procuring it so pure. Rain water which seems the purest of all those we know of, is replete with infinite exhalations of all kinds which it imbibes from the air, so that if filtered and distilled a thousand times there still remains fæces. Besides this, and the numberless impurities it acquires after it is raised by mixing with all sorts of effluvia in the atmosphere, and by falling upon and running over the earth, houses and other places others are blended with it. There is also fire contained in all water, as appears from its fluidity, which is owing to fire alone. Nor can any kinds of filtering through sand, stone, &c. free it entirely from saline matter, &c. Nor have all the experiments that have been invented by philosophers ever been able to derive water perfectly pure. Hence he is convinced nobody ever saw a drop of pure water, that the utmost of its purity known, only amounts to its being free from this or that sort of matter; and that it can never, for instance be quite deprived of salt since air will always accompany water and air always contains salt.

Dr. Hutton states that "water seems every where to be diffused and to be present in all space wherever there is matter. There are hardly any bodies in nature but what will yield water; it is even asserted that fire itself is not without it. A single grain of the fiery salt, which will in a moment's time penetrate through a man's hand, readily imbibes half its weight of water, and melts even in the driest air imaginable. Among innumerable instances, harts-horn, kept forty years and turned as hard and dry as any metal, so that it will yield sparks of fire when struck against a flint, yet being put into a glass vessel and distilled will afford $\frac{1}{8}$th part of its quantity of water. Bones dead and dried twenty-five years and thus become almost as hard as iron, yet by distillation have yielded half their weight of water. And the hardest stones, ground and distilled always discover a portion of it. But hitherto no experiment shews, that water enters as a principle into the combination of metallic matters, or even into that of vitrescible stones. From such considerations philosophers have been led to hold the opinion that all things were made of water. But Dr. Woodward has endeavoured to shew that the whole is a mistake, water containing extraneous corpuscles, some of which, according to him, are the proper matter of nutrition; the water being still found to afford so much the less nourishment, the more it is purified by distillation. So that water as such does not seem to be the proper nutriment of vegetables but only the vehicle which contains the nutritious particles and carries them along with it, through all the parts of the plant.

There seems to be no standard by which the weight and purity of water can be ascertained, as it scarce ever continues two moments exactly of the same weight, by reason of the air and caloric contained in it. The expansion of water in boiling shews what effect the different degrees of caloric have on the gravity of water. This makes it difficult to fix the specific gravity of water, in order to settle its degree of purity. However the purest water we can obtain according to the experiments of Mr. Hawksbee is 850 times heavier than air; or according to the experiments of Mr. Cavendish, the thermometer being at 50° and the barometer at 29,3, about 800 times as heavy as air; and according to the experiments of Sir George Shuckburgh, when the barometer is at 29,4, 27 and the thermometer at 53°, water is 836 times heavier than air, whence also may be deduced this general proportion which may be accounted a standard, viz. that when the barometer is at 30° and the thermometer at 55°, then water is 820 times heavier than air; also that in such a state the cubic foot of water weighs 1000 oz. averdupois, and that of air 1,222 or $\frac{2}{19}$ nearly, also that of mercury 13,600 oz. and for other states of the thermometer and barometer the allowance is after this rate, viz. that the column of mercury in the barometer varies its length by the $\frac{10}{1000}$th part of itself for a change of each single degree of temperature, and water changes by $\frac{3}{2000}$ parts of its height or magnitude by each degree of the same. However, we have not any very exact standard in air, the more water there is contained in the air the heavier of course must the air be; as indeed a considerable part of the weight of the atmosphere seems to arise from the water that is contained in it.

With respect to the properties and effects of the fluid, it is well known to be extremely volatile, being capable of being entirely reduced into vapour and dissipated when exposed to heat and unconfined.

It is however found that water heated in an open vessel acquires no more than a certain determinate degree of heat, whatsoever be the intensity of the fire to which it is exposed; which greatest degree of heat is when it boils violently. But that the degree of heat necessary to make water boil is variable, according to the purity of the water and the weight of the atmosphere.

Dr. Hutton gives the following table as shewing "the degree of heat at which water boils, at various heights of the barometer being a medium between those resulting from the experiments of Sir George Shuckburgh and M. De Luc."

Height of the Barometer.	Heat of boiling Water.
Inches	°
26	205
26½	206
27	206·9
27½	207·7
28	208·5
28½	209·4
29	210·3
29½	211·2
30	212·0
30½	212·8
31	213·6

"Water is found the most penetrative of all bodies after fire and the most difficult to confine; passing through leather, bladders, &c. which will confine air, making its way gradually through woods, and is only retainable in glass and metals, nay it was found by experiment at Florence that when shut up in a spherical vessel of gold which was pressed with a great force it made its way through the pores even of the gold itself. And by this penetrative quality alone it may be inferred to enter the composition of all bodies both *vegetable*, *animal*, *fossil*, and even *mineral*, with this particular circumstance, that it is easily and with a gentle heat, separable again from bodies it had united with. But yet the same water, as little cohesive as it is, and as easily separated from most bodies will cohere firmly with some others and bind them together in the most solid masses; as in tempering of earth or ashes, clay, or powdered bones, &c. with water, and then dried and burnt when the masses become hard as stones, though without the water they would be mere dust or powder. Indeed it appears wonderful that water which is otherwise an almost universal dissolvent should nevertheless be a great coagulator."

And "some have imagined that water is incompressible and therefore nonelastic; founding their opinion on the celebrated Florentine experiment above mentioned with the globe of gold, when the water being as they say incapable of condensation, rather than yield, transuded through the pores of the vessel, so that the ball was found wet all over the outside, till at length making a cleft in the gold, it spun out with great vehemence. But the truth of the conclusions drawn from this Florentine experiment has been very justly questioned; Mr. Canton having proved by accurate experiments that water is actually compressed even by the weight of the atmosphere.

"Besides, the dimunition of size which water suffers when it passes to to a less degree of heat, sufficiently shews that the particles of this fluid are, like those of all other known substances, capable of approaching nearer together."

Water is in common language distinguished into several different kinds, according to the circumstances under which it appears or is found, as;

Fresh-water, that which is insipid or without any saline taste or inodorous, being the natural and pure state of water.

Hard-water, that in which soap does not dissolve completely or uniformly but appears in a curdled state. It is observed that the dissolving power of hard water is less than that of soft, hence it is less fit for washing, bleaching, dyeing, boiling kitchen vegetables, and many other purposes.

It is mostly found that the hardness of water may arise either from salts or from gas. That which arises from salts may be discovered and remedied by adding some drops of a solution of fixed alkali; but the latter by boiling, or exposure to the open air.

And that spring waters are hard; but river water soft. Hard waters are remarkably indisposed to corrupt, they even preserve putrescible substances for a considerable length of time, hence they seem to be best fitted for keeping at sea, especially as they are so easily softened by a very little alkaline salt added to them.

Putrid-water, that which has acquired an offensive smell and taste by the putrescence of animal or vegetable substances contained in it. This kind of water is in the highest degree pernicious to the human frame and capable of bringing on mortal diseases even by its smell. Quick-lime put into water is useful to preserve it longer sweet; or even exposure to the air in broad shallow vessels. And putrid water may be in a great measure sweetened by passing a current of fresh air through it from the bottom to the top.

Rain-water is a sort of water that may be considered as the purest distilled water, but impregnated during its passage through the air with a considerable quantity of putrescent matter, whence it is superior to any other in fertilizing the earth. Hence also it is inferior for domestic purposes to spring or river water, even if it could be readily procured: but such as is gotten from spouts placed below the roofs of houses, the common way of procuring it in this country, is evidently very impure, and becomes putrid in a short time.

River-water, this is a sort of water which is next in purity to snow or distilled water; and for domestic purposes superior to both, in having less putrescent matter and more fixed air. That however is much the purest that runs over a clean rocky or stony bottom. But river waters generally putrify sooner than those of springs. During the putrefaction they throw off a part of their heterogeneous matter, and at length become sweet again, and purer than at first; after which they commonly preserve a long time; this is remarkably the case with the Thames water taken up about London, which is commonly used by seamen in their voyages.

Salt-water, is such as has much salt in it so as to be sensible to the taste.

Sea-water, this is an assemblage of bodies in which water can scarce be said to have the principal part: it is an universal collection of all the bodies in nature sustained and kept swimming in water as a vehicle: being a solution of common salt, bitter cathartic salt, a saliuitic substance, and a compound of muriatic acid with magnesia, mixed together in various proportions. It may be freshened by simple distillation without any addition, and thus it has sometimes been useful in long voyages at sea. Sea-water by itself has a purgative quality, owing to the salts it contains, and has been greatly recommended in scrophulous disorders. And it is about three parts in one hundred heavier than common water; and its temperature at great depths is from thirty to forty degrees; but near the surface it follows more nearly the temperature of the air. It is probable that sea-water may be made use of with much advantage in agriculture.

Snow-water, this is the purest of all the common waters when the snow has been collected pure, kept in a warm place, in clean glass vessels, not closely

stopped, but covered from dust, &c. snow-water becomes in time putrid; though in well stopped bottles it remains unaltered for several years. But distilled water suffers no alteration in either circumstance.

Spring-water, this is commonly impregnated with a small portion of imperfect neutral salt extracted from the different strata through which it percolates. Some contain a vast quantity of stony matter which they deposit as they run along and thus form masses of stone, sometimes incrustating various animal and vegetable matters which they are said to petrify. Spring-water is much used for domestic purposes, and on account of its coolness is an agreeable drink, but on account of its being usually somewhat hard is inferior to that which has run a considerable way in an open channel.

Spring-water arises from the rain and from mists and moisture in the atmosphere. These falling upon hills and other parts of the earth, soak into the ground and pass along between the different strata till they find a vent out again in the form of a spring. See *Spring* and *Well*.

The author of Phytologia remarks, "that the necessity of much water in the progress of vegetation is shown by the great quantity which exists naturally in all parts of plants; insomuch that many roots, as squill and rhubarb, are known to lose about six parts out of seven of their original weight simply by drying them before the fire, which quantity of moisture nevertheless does not exhale in the common heat of the atmosphere during the life of the root; as is seen in the growth of squills in the shop of the druggists, and of onions on the floors of our store rooms." And that "a second necessity of much water in the economy of vegetation may be deduced from the great perspiration of plants, which appears from the experiments of Hales and others; who like Sanctorius have estimated the quantity of perspiration from their daily loss of weight; which however, is not an accurate conclusion either in respect to plants or animals, as they both absorb moisture from the atmosphere, as well as perspire it. But this great perspiration of vegetables, like that from the skin and lungs of animals, does not appear to consist of excrementitious matter because it has in general no putrescent smell or taste; but seems to be secreted first for the purpose of keeping the external surface of the leaves from becoming dry, which would prevent the oxygen of the atmosphere from entering into the vegetable blood through them; since according to the experiments of Dr. Priestly on animal membranes the oxygen will only pass through them when they are moist. A second use of this great perspiration is to keep the bark supple by its moisture, and thus to prevent its being cracked by the motion of the branches in the wind. And though a great part of this perspirable matter is probably absorbed as on the skins of animals; yet as it it exists on so large a surface of leaves and twigs, much of it must necessarily evaporate on dry and windy days.

And the discovery of the decomposition of water has led to a third great use of water in the vegetable economy, which is probably owing to its ready decomposition by their organs of digestion, sanguifraction and secretion. This is evinced first by the great quantity of hydrogen, which exists in the composition of many of their inflammable parts. And secondly from the curious circumstance which was first discovered by the ingenious Dr. Priestly that the water which they perspire is hyperoxygenated; and in consequence always ready to part with its superabundance of oxygen when exposed to the sun's light, whence it may be concluded that part of the hydrogen which was previously an ingredient of this water, has been separated from it, and used in the vegetable economy. And that, from the decomposition of water, when confined in contact with air beneath the soil, the nitrous acid seems to be produced and ammonia, both which are believed useful to vegetation."

But "besides these peculiar uses of a great quantity of water the more common uses of it both to vegetable and animal life, along with the matter of heat are to produce or preserve a due suppleness or lubricity of the solids and a due degree of fluidity of the liquids, which they contain or circulate. And lastly for the purpose of dissolving or diffusing in it other solid or fluid substances, and thus rendering them capable of absorption, circulation and secretion."

It is also beneficial in the view of irrigation by the "occasional suffusion of water over the land by which it not only supplies simple moisture for the purposes above mentioned, in the drier parts of the seasons, but brings along with it calcareous earth and azotic air from the neighbouring springs or other manures from the rivers."

And another beneficial consequence "is to give a due penetrability to the soil which otherwise in most situations becomes so hard as to stop the elongation of the tender roots of plants; but the cohesion of the soil may nevertheless be too much diminished by great and perpetual moisture, so as not to give sufficient firmness to the roots of trees."

It may also be injurious in some cases, as in very hasty showers by washing off "much of the decomposing animal and vegetable recrements, which are soluble or diffusible in water, and carry them down the rivers into the sea." And from the sides of hills this damage is accomplished by small showers.

"And the evaporation of moisture from the surface of the earth may produce so much cold as to injure such terrestrial plants as are too long covered with it." Water as constituting the chief drink of domestic animals is of great importance to the farmer, and should be had in a full supply and of a good quality wherever it can be possible to provide it. See *Drinking Ponds*.

Application of water to the purposes of fisheries.

Besides the above uses of water, there is still a profitable application of it to be noticed, which is that of fisheries, which where the situation and circumstances are favourable should not be neglected, especially where salmon are abundant. These Mr. Marshall remarks "as copious and constant sources of human food, rank next to agriculture. They have, indeed, one advantage over every other internal produce;—their increase does not lessen other articles

of human sustenance. The salmon does not prey on the produce of the soil; nor does it owe its size, and nutritive qualities, to the destruction of its compatriot tribes. It leaves its native river, at an early state of growth; and, going even naturalists know not where, returns of ample size, and rich in human nourishment; exposing itself in the narrowest streams; as if nature intended it as a special boon to the species. In every stage of savageness, and civilization, the salmon must have been considered as a valuable benefaction to this country."

At present, says he, "the salmon fisheries of this island, as private property, are of high value;—particularly in the northern parts of it. And those of the southern provinces, he apprehends, are capable of great improvement." In speaking of which he observes, "admitting that the individuals which are bred in any river, instinctively return to the same, from the sea,—the most obvious mean of improvement, in any particular river, is that of suffering a sufficient number of grown salmon to go up to the spawning grounds; protecting them, while there; and guarding the infant shoals, in their passage from thence to the ocean. Even admitting that those which are bred within the British islands, and escape the perils that await them, return to these islands, it is surely," he says, "a matter of some importance, viewed in a public light, to increase and protect the breed as much as possible."

He remarks that "it is a well ascertained fact, that salmon pass up toward the spawning grounds of different rivers, at different seasons, or times of the year: consequently, no one day in the year can be properly fixed, by law, to give them free passage up rivers in general. Each river of the island should" he thinks, "have its particular day of liberation; which ought to be some weeks before the known close of the spawning season, in a given river, the ascertaining of which would require considerable time and trouble."

And "the better to assure the ascent of salmon, after the day of liberation," he suggests that "all mills, weirs, and other obstructions, whose proprietors have, by ancient custom, the right of taking salmon, ought to be under regulations; and to be liable to the free inspection not only of other proprietors of the same river, but of the public in general; to see that a free, obvious, and easy passage be made, for the fish to ascend: the law making it equal felony to destroy, or wilfully to obstruct, after the days specified, salmon passing up to a spawning ground. And the more effectually to protect the spawning grounds, the same penalty should be there perpetual. Each branch of every river should have a fixed point, above which it shall be felony to destroy salmon, wilfully, at any season of the year. This regulation would, he conceives, be of essential use. For, in times of floods, it is not all the vigilance of man, nor scarcely any obstacle he can raise, which is able to prevent salmon, that are near their time of spawning, from ascending the upper branches of rivers; namely, the brooks and rivulets, here proposed to be strictly guarded by law. But they rarely enter these, he believes, before they are in that state; and, in course, until they may be said to be out of season, and unfit for human food. Hence, the proprietors of spawning streams would have little reason, he supposes, to complain of such a regulation or restriction."

It is stated further as true that "salmon, in a dry season, and for want of flood water to assist them in their extraordinary efforts to gain the higher branchlets of a river, will spawn in its lower deeper parts. But, here, it is probable, few of their progeny escape the voracity of fish of prey, which inhabit deep waters. While, in the shallow pebbly streams, at the heads of which they delight to lay their spawn, the infant shoal is free from danger. And it is for this security, no doubt, he observes, that the instinct of the parents leads them to the greatest attainable height,—at the peril of their own lives!" as they are liable to be destroyed in a thousand ways in such situations.

Having in this way considered the methods suited "to the protection of the parents, and their infant spawnlings, it now remains to guard these from their native streamlets, to the sea." In order to which it may be observed, that "the enemies to young salmon are fish of prey; as the pike, and trouts of size: both of which, he says, ought to be considered as vermin, in rivers down which samlets are wont to pass." And "the hern is another destructive enemy of young salmon: especially in the higher branches of rivers. Yet continues he, we see these common destroyers nursed up in herneries! But more wisely might the cormorant be propagated and protected. The hern is tenfold more destructive of fresh-water fish, than is the cormorant. The otter is likewise a well known enemy of fish. But he is a greater enemy, he believes, to grown salmon, than to their young." But that "a species of vermin which is much more injurious than the otter, to young salmon, is the angler; who, during minor floods, when the young "fry" are attempting to make their escape downward to the sea, counts his victims by the score; and might boast of carrying home, in his wicker basket, a boat load of salmon. The net fisher is still more mischievous. But most of all the miller; who takes them in his mill traps, by the bushel, or the sack at once, and thus destroys a whole fishery in a season."

Here Mr. Marshall observes, that "if it were asked what punishment is due to the crimes of such men, the answer would be apt. If a miller, a net fisher, or an angler of young salmon were detected in digging up the seedling plants of a field of corn, or destroying the young lambs of his neighbour's flock, what punishment would be due to him? This the law would readily determine. And let the punishment for destroying young salmon, says he, be neither more nor less." For, says he, "if it is a fact that salmon return to their native rivers, and if the whole of a salmon river belongs to one propreitor, the crime of destroying young salmon becomes perfectly analogous to that of destroying the young of agricultural animals. And it behoves the proprietors of

salmon fisheries, no matter whether they are entire or joint properties, to protect the one with the same zeal and assiduity as the other." But "even supposing this commonly received opinion to be ill founded, yet admitting that the whole, or the principal part, of the salmon which are annually brought to market, are bred in the rivers of these islands, it necessarily follows, that the greater number there are bred, and protected to the sea, the greater prospect there will be of the markets being plentifully supplied, in future. If by wise regulations, formed into a law, the present supply could be doubled, the advantage to the community would be of some importance." And "when we see the great disparity of the supply, between the rivers of the north, and those of the south, of this island, it might not be extragavant, he thinks, to imagine, that the supply from the rivers of England might be made five or ten times what it is at present." And that "one of the first steps towards regulations of this nature is, he conceives, to endeavour to ascertain the causes of this disparity; and to profit by such as can be subjected to human foresight and control. Accurate examinations of the Tay, the Tweed, the Trent, and the Thames, would perhaps, he says, be found adequate to this purpose," if made by persons properly qualified for the undertaking.

After this brief account of the nature of breeding salmon, and of the manner of affording the young shoals a safe passage to the sea; it may be necessary to point out in a cursory way the methods most employed in taking them in their return. But on this subject a few particulars may be sufficient, as there are mostly persons who can readily contrive to take them under ordinary circumstances.

It is stated by the above writer that "the situations in which salmon first attracts the particular attention of fishermen, are *narrow seas*, *estuaries*, or *mouths of rivers*;—in which they remain some time,—more or less, probably, according to their state of forwardness with respect to spawning; and in which various devices are practised to take them." It is suggested that "in the wide estuary of Solway firth, which separates Cumberland and Dumfriesshire, there are two of the several ingenious methods there practised, which are entitled to particular notice" in this place.

It is found that "beside the open channels which are worn by the Esk, the Eden, and other rivers and brooks that empty themselves into this common estuary, the sands of which its base is composed, and which are left dry at low water, are formed into ridges and vallies, by the tides and tempestuous weather. The lower ends of these vallies, or false channels, are wide and deep; opening downward, towards the sea: their upper ends growing narrower, and shallower, until they close in points, at the tops of the sand banks. As the tide flows upward, the salmon, either in search of food, or the channel of the river to which they are destined, enter these vallies or "lakes." But finding, on the turn of the tide, that their passage further upward is stopped, they naturally return with it into deep water; where they remain until the next tide." And "the manorial proprietors of these sand banks having discovered this fact, have, from time immemorial, he understands run lines of nets, during the fishing season, across the lower ends of these lakes or vallies;—half a mile or more, perhaps, in width: the nets being suspended in such a manner, that they are lifted from the ground, by the current of the tide, in flowing upward; so that the fish find no difficulty in passing beneath them, into the lake. But, on the tide's turning, their lower edges fall down close to the sand, and effectually prevent the salmon from retreating. They are, in consequence, left dry, or in shallow water, easily to be taken,—by hundreds, perhaps, at once."

And the other remarkable method, is founded on a well known habit of salmon, when they first make the land, and enter into narrow seas and estuaries, to keep much along the shore: no matter, whether to hit, with greater certainty, their native rivers,—or to rub off the vermin, with which, in general, they are more or less infested, when they return from the ocean,—or in search of food." And "this method of taking salmon, if not a modern invention, has recently been raised to its present degree of perfection, by an enterprising salmon fisher and farmer, in the neighbourhood of Annan; who has turned it to great profit. At a short distance below the mouth of the river Annan, he has run out a long line of tall net fence, several hundred yards in length, and somewhat obliquely from the line of the shore; with which it makes an acute angle, and closes in with it, at the upper end: thus forming, in effect, an artificial lake; one side of which is the beach, the other the net fence. The lower end is ingeniously guarded, with nets of a more trap-like construction, than those which are in use for natural lakes; in which fish are found to lie more quietly, until the turn of the tide. In this immense trap, great quantities, not of salmon only, but of cod, ling, soals, and other white fish are taken." And in short Mr. Marshall says, "he knows no place, in the island, where sea-fishing, for salmon, can be studied with so much profit, as on the shores of Annandale."

In respect to river-fishing, for salmon, it is chiefly done, the same writer says, with the seine, or long draft net, whose construction and use are universally known. And he "has only to remark upon it, that in rivers which are liable to frequent and great changes of depth, and strength of current, by reason of tides and floods, it is desirable to have nets of different textures, as well as of different depths. As one of the constructions best adapted to the ordinary state of the water, and to the size of the fish that frequent it (salmon peels, trouts, mullets, and other small sized fish, are, in some rivers, commonly taken with salmon); and another with more depth, and wider meshes; to be used during high water and strong currents, when the larger salmon do not fail to hasten upward. And the same strength of hands which is able to draw a close shallow net, can work a deeper one with wider meshes. In wide rivers, with flat shores, a variety of nets are required of different lengths as well as depths, to suit every

heighth and width of the water" that may be met with.

It is likewise a practice in rivers to set traps for salmon. "The most common device of this kind is the *weir*, or salmon leap; namely, a tall dam run across the river, with a sluice at one end of it, through which the principal part, or the whole, of the river at low water is suffered to pass with a strong current and in this sluice the trap is set. But the writer has not entered into the minutiæ of the construction of salmon weirs; as he conceives them to be, in all cases, dangerous, and in many, he apprehends, highly injurious to the propagation of salmon. And although it would be altogether improper to demolish those which long custom has sanctioned, he is of opinion that it would be equally improper to suffer more to be erected; at least, until some judicious regulations are made respecting them: regulations which cannot be delayed, without injury to the public," in so far as these fisheries are concerned.

In concluding this interesting subject some remarks are introduced "on poaching, or the illegal taking of grown salmon. There are already, the able writer observes, severe penalties inflicted for this crime; which, compared with that of destroying young salmon, might, in a public light, be deemed venial; the latter deserving tenfold punishment. For the grown salmon that are taken in season, by poachers, becomes so much wholesome food. There is no waste of human sustenance by the practice. Nevertheless, as a theft, the crime is great, and ought to be punishable as such. What he has to propose, as an improvement of the present law, is to make the receiver, in this, as in other cases of theft, equally punishable with the thief. If poachers were not encouraged by purchasers of stolen salmon, the practice would not be followed" it is supposed.

But there is "another and more destructive and pernicious race of salmon poachers," which require notice, "on the sea coasts, in narrow seas and estuaries, and at the mouths of rivers, especially in the northern parts of the island, immense numbers of salmon (and doubtless other fish) are said to be devoured by porpoises, the most audacious fish of prey, in northern latitudes." And it "is asserted by those who have had opportunities of ascertaining the fact, that they not only destroy salmon in the narrow seas, and open estuaries, but that they have been seen guarding the mouth of a river, in the salmon season, and destroying them, in numbers, as they attempted to enter. If, therefore says the writer, on due investigation, these facts be ascertained, how much must it behove government to [illegible] estuary fishings, and thereby bring to market those which might otherwise be lost to the community."

These observations, regulations, and remarks demand much attention and regard as there are a great number of rivers and waters, in the country which might be turned to great profit by establishing fisheries upon them.

With respect to pool or pond fish, we have already offered some observations and statements. See *Fish Ponds*.

Water *Braxy*, in *Farriery*, a disease in sheep which has been much disputed by some; but Mr. Hogg, in his Shepherd's Guide, is confident of its existence, having seen and dissected several cases of it, and is likewise assured that it does considerable damage on some particular farms; but whether it is a species of the common braxy, will he thinks admit of a doubt, though it is always viewed by the shepherd as such. He adds, that in two external symptoms it has a resemblance to it. The first is, he says, that the animal when living appears affected much the same way, lying frequently down and loitering behind, and likewise appears somewhat swelled. And the next is, that, like all others affected by the braxy of any kind it will not bleed to any extent on opening a vein. The cutting of a vein in the tail, spauld, or below the eye will make other sheep bleed plentifully; but from these scarcely a drop will issue; and even on cutting the principal vein in the throat, only a very small quantity proceeds.

But "in the interior symptoms it differs very widely. On opening the sheep the whole entrails are swimming in bloody water, none of which is within the guts, but only within the rim of the belly. The gall bladder is very small, appearing as having been mostly spilled previous to its death, and the urinal bladder is contracted and shrunk up to a size scarcely noticeable. The small fibres connecting it with the other parts are inflamed, and on bringing it near the nose smells somewhat like the other braxy. The bladder seems entirely without urine, but on blowing it up it is always quite sound and never bursts; "the guts and flesh are a little discoloured, and have a smell peculiar to that disorder. The smaller apartment of the stomach or *reid* hath some purple spots on it; and, on being felt with the hand these are thicker in the texture than the other parts of it. They seem to have bled a part inwardly; this some supposes issues from the liver." This disease has been noticed by the Rev. Mr. Findlater. No remedy it for has yet been pointed out; the common braxy is by the above writer distinguished into three kinds, or what he terms species, besides the above.

It is a disease that makes its attack about "the middle of October when it begins to make its appearance on some farms. This universal ravager of the young flocks, through all hardy districts and farms in the nation, sets in early or late or continues until a later period of the season. This is now perfectly well ascertained and generally acknowledged, and likewise that all kinds of food which preserve a continual vegetation are effectual preventatives; such as clover, turnips, sea-marsh, and the dark coloured tath that grows in abundance on drained ground that has formerly been marsh."

It is added that "in two of the species the difference is only discernible on opening the carcase, when it appears differently infected in the one from the other. But they have both the same symptoms; both the same effluvia when dead, and both proceed from the same cause; namely, indigestion. But, in one, the stomach and intestines only are principally infected, while a small part of the inflammation only is commu-

nicated to the flesh. In the other the fleshy parts are all swollen and corrupted, while a small proportion only of the inflammation is communicated to the stomach and bowels. Such of the sheep as fall of this disorder in the spring die generally of this latter description." It is supposed "probable that the one originates in a stoppage in some of the blood vessels, and the other in a stoppage in some parts of the bowels, but however that is, they are certainly both consequences of indigestion."

The first is supposed to originate from over repletion or being too much gorged with vegetable food, the disease coming on as the frosts set in.

The second sort differs only in the appearance of the carcase on dissection. In this case the inflammation instead of commencing about the stomach takes its rise about some of the most fleshy parts of the body, and seems to be the consequence of some air getting into the veins, having resemblance to the *black spauld* in cattle. It sets in at the same season when the grasses fail, and the cattle are begun to feed on fodder and dry herbage."

The third or dry braxy can "hardly be said to proceed from indigestion. It makes its attacks during storms of snow when the walk of the hogs is much circumscribed, and when they are confined too much to the tops of heather, bent, and other dry sapless food; but it only seizes on such as have plenty of grass when the weather is soft.

"On dissection, the bodies of the animals dying of this species are considerably different from either of the other two; the carcase is much less swelled and not nearly so blue and putrid; the stomach is scarcely infected in the least, but the small therms are mortified, black soft, and almost rotten. The inflammation visibly beginning in one of the latter folds of the intestines."

The loss of "the cud is, he says, the first token. As the distemper advances, the agony which the animal is suffering become more and more visible. When it stands it bring all its four feet into the compass of a foot, and sometimes it continues to rise and lie down alternately every two or three minutes. The eyes are heavy and dull, and deeply expressive of its distress. The ears hang down; and when more narrowly inspected, the mouth and tongue are dry and parched, and the white of the eye inflamed. The pulse beats strong and thick, the breathing is not very short, but attended with panting and seeming difficulty. The urine is high coloured and the blood dark and thick.

"In all these cases the kidneys are terribly infected and are reduced to a flat jelly resembling putrid gore, and the natural consistency of the liver is also much spoiled. In the first case the belly is prodigiously swelled even so much that it sometimes bursts. All the stomachs or rather all the different apartments of the stomach, are inflamed in some degree, and all in the same proportion; but the first always the least, and the latter or that next the intestines, most, which is often quite putrid. In the second, the whole body is hoved and swelled like a loaf. The liver in this case is extremely putrid, and the ventricles of the heart full of congealed blood, and a livid redness pervades the whole body and bowels, and the fore thighs are commonly worst.

"In the third case the belly is only a little swelled, the chewed grass in the maw is very stiff and almost quite solid to feel upon, and the flesh is not greatly tainted."

The only method of cure is he thinks, "first when the animal is found in time, to give it a severe heat by running; if this do not cure it, nothing that he is acquainted with will, however unfavourable this may appear, let him hunt it well and follow after it; that it lie not immediately down on leaving it, or if it will lie down let it be in a house."

The next remedy "is bathing amongst warm water the space of eight or ten minutes at least, when a quantity of water gruel, mixed with butter or some softening ingredient may be given as an injection, or otherwise. But care must be taken that none of these is administered for the water braxy, because either of them occasions instant death."

As a preventative, he advises the farmer first to take particular notice what number of sheep his ground is adequate to feed properly, to stock it accordingly, *and pasture the young and old of his flocks all together*. By this plan the sickness, or braxy is almost totally eradicated wherever it has been introduced; for the young of the flock, follow after and share the experience of those that are old, both with respect to what food is proper for every season of the year, and time of the day; and gain much by feeding along with them for every seasonable night, when they would otherwise have been lying fasting, and so hungry next morning that they are apt to wrong their stomachs by eating too freely of any thing that comes in their way. By thus rising in the night too, they are enticed both to pass urine and dung, by which the water braxy is totally prevented from attacking them and a stumbling block laid in the way of the others, besides it has various other advantages. Bleeding from the jugular vein to the extent of two ounces has been found of advantage in the common braxy." See *Sheep*.

Water *in the Head*, in *Farriery*, a disease in sheep which is often denominated the *sturdy*. According to Mr. Hogg, "a sheep affected by it becomes stupid: its eyes stare, and fix upon some different object from that which it is in fear of. It soon ceases from all intercourse with the rest of the flock, and is seen frequently turning round, or traversing a circle." And that it is occasioned by sheep being exposed too much to rough boisterous weather, without any shelter. He also asserts that a *bratted sheep* (one whose back is covered with a piece of cloth), will not take it; and of a well sheltered flock, very few ever will.

"There is in this disorder a collection of water in some part of the brain though it varies much in situation." And where it once begins to be formed "it continues to increase and gain upon the brain, until it is either extracted, or the animal so much wasted that it dies as lean as wood, at which period the brain is commonly half wasted away, and the skull full of these noxious fluids. Sometimes it concentrates

in the very middle of the brain, where it is very difficult to cure, and sometimes in the hinder parts, where it joins with the spinal marrow, when it is quite incurable. If this water is not extracted by some operation the disease invariably terminates in the death of the animal, and though the operation, whatever way performed, is extremely simple, yet thousands are suffered to perish, through mere carelessness or diffidence. In whatever corner of the brain the water settles, the skull immediately above it soon grows quite soft, and the shepherd by groping with his thumb, will easily discover where it is seated. If it is any where in the crown, the gentlest way is to tap it in the place where the skull is soft and let the water run out. This is commonly performed with an awl, or large corking pin, although an instrument with a small tube in it, might easily be made which would drain it off completely. And the writer has lately received a small silver trocar from Dr. Duncan, jun. Edinburgh, invented by him for the purpose of draining off the fluid, in whatever part of the skull situated, and has little doubt of its final success. By this operation, if the instrument is not pushed too far, the animal is nothing the worse whether it recovers at the first or not. But, what is very remarkable, this plan is not successful on all farms alike of which he has known many instances."

It is advised when the skull feels soft in the forehead that "the operation should be performed by thrusting a stiff sharpened wire up each nostril, until it stop against the upper part of the skull. If this cure were not well authenticated by daily observation, it might seem a very severe and dangerous operation, as the wire goes quite through the brain in two different places, yet a far greater number are cured by this way than any other. The operator must feel for the part of the skull that is soft, and lay his thumb flat and firm upon that, then taking the wire in his right hand push it up that nostril that points more directly for the place that is soft where the disease is seated, and if he feel the point of the wire below his thumb, he may rest assured that the bag is perforated, and that if the brain do not inflame, the creature will grow better; but if he does not feel the point of the wire press against the soft part of the skull, on which the thumb of his left hand must be placed it will be necessary to try the other nostril.

He supposes that the reason of this method being the most certain is "that the bladder being pierced on the lower side the liquid continues to drip through the hole as long as any remains, and even as fast as it gathers so that the perforation does not get leave to grow up, or close again, until the animal is quite better, while on the other hand although the water be ever so neatly extracted above by tapping, as soon as the sheep gets to its feet, no more of it can get out so that the operture made in the bag again closes, and the disease goes on. He has cured numbers both ways, and killed a part too; but those that he killed were generally with the wire; because if the other fails of the desired effect, the wire is always applied to as a last resource, and many has he seen cured by it which were to all appearance quite past redemption."

Where the sturdy cannot be felt by pressure with the thumbs nothing can be done for them save with the wire. The writer has always observed, "that a sheep on being wired is sick in proportion to the stiffness of the gristle below the brain, if the wire is hard to go up it is always very sick, but if it goes easily up, it puts it a little off its ordinary." When a sheep is wired it is proper to take hold of it with both hands behind the ears and shake its head loosely. This empties the bladder and the water must find its way by the nose afterwards, for they will grow quite better, though no water be seen to issue from the nostrils at that time; this makes them sicker for the present but they are more apt to amend afterwards. If it were really necessary to extract the sac, or small bladder, which generally contains the water, the operation of trepanning would be of all others the most feasible, but if the water can be extracted, the sac is of little consequence, else so many could never be cured by wiring. However, though he has never witnessed the success of trepanning he has been assured, that when carefully and gently performed and afterwards secured by warm cloths from suffering by the elements, a good many have been saved by it. In performing the operation, the best way is, he says, to raise up with a sharp knife about the breadth of a six-pence of the skin immediately over the part of the skull which is soft, then to raise about the half of that size of the soft skull, taking care not to separate them altogether, but let them keep hold on one side, folding, and keeping them back with the thumb until the water is extracted; then fold them neatly down again and seal them, and cover all with a wax-cloth. But some make two cross incisions each about an inch in length, then raising back the points of each angle extract the fluid and sometimes the bag, which holds it, in both cases the utmost gentleness must be used, and care taken afterwards to make them close above from outward cold or wet."

In these cases upon opening the head after death a bladder is found of a most delicate texture, thin and transparent, and full of a clear fluid, like water sometimes intermixed with a thin cruor. This bag is most commonly situated betwixt the brain and skull, and always increases in size as the disease advances; and the vacuum in the brain increases in proportion to the size of the bag or bladder. The hollow "is sometimes of one shape and sometimes of another," and the brain of a loose pulpy or watery nature.

WATER-*Crow-foot*, a plant of the weed kind, the (*ranunculus aquatilis*) of Linnæus, of which cows are said by some to be extremely fond. It is also stated by Dr. Pulteney in the fifth volume of the Transactions of the Linnœan Society, that it is not only relished by swine, but that they thrive remarkably upon it, requiring little other food till put up to fatten.

WATER-*Furrow*, a deep open furrow drawn by the common or double mould-boarded plough in a proper direction in arable lands, for the purpose of conveying off the superabundant water and prevent its stagnating to the injury of the crops. It is necessary as soon as possible after sowing all sorts of grain where

the soil is inclined to moisture to open as many water furrows as may be requisite to carry off the superabundant water and preserve the ground in a properly dry condition. It is observed by Mr. Young in his Calendar of Husbandry that water furrowing is a circumstance of much importance in the culture of wheat, but often-times strangely neglected. This work should be well and effectually performed on all lands except those that are perfectly dry all winter through. The water furrows should be ploughed as soon as the field is finished sowing, ploughing, &c. and then a spit should be dug from the bottom of them and laid on one side opposite the rise of the land and the loose mould shovelled out, the openings of all the furrows should likewise be cleansed so that the water may have an easy fall out of every furrow into the water ones. The number of these must ever depend on the variations of the surface: the only general rule being to make them so numerous that no water can stand on the land in the wettest weather. In bottoms of fields or other places where there is a double slope of land it is necessary to cut double water furrows about a yard or four feet from each other to take water from each descent."

He further advises that, "in all lands sown with clover or grasses among the corn, these furrows should be dug a spit deep, and the moulds thrown carefully out. Many farmers, he says, are not attentive enough to this point. They only scour the furrows, but they should consider how long the grass is on the ground, which may be two or three winters, consequently it must be very material to the crop, to lie dry all that time, which scouring alone will not effect. Particular attention should be paid to their spreading the earth they dig out of the furrows, if they be not cautioned, the men will lay it too thick and hurt the crop, the earth should be spread with great care and cut small, that the seed may rise freely."

On arable land, these furrows should be often examined during the winter season, to see that they are perfectly open and free, the clods, lumps, and other matters, that may have fallen into them being cleared out by the spade.

This is a practice too much neglected in many districts.

Water-*Furrowing*, a term signifying the operation of opening water-furrows.

Water-*Gage*, the name of a contrivance for measuring the depth or quantity of any water.

Water-*Gang*, a channel cut to drain a place, by carrying off a stream of water.

Water-*hair-grass*, a sort of aquatic grass. See *Aira Aquatica*.

Water-*Level*, the level which is formed by the surface of still water, and which is the truest of any. It also signifies the level used in draining, watering, &c. See *Level*.

Water-*Meadow*, a term signifying such meadow, or other inclosed low ground as is capable of being kept in a state of fertility by means of the water from some adjoining river or stream being conducted over it during the winter or other proper season. This beneficial practice has prevailed locally for such a very great length of time, especially in Wiltshire, Gloucestershire, and Devonshire, that it is extraordinary it has not been adopted in other districts where it is capable of being had recourse to without great difficulty. A late ingenious writer has ascribed this neglect to a deficiency of information among farmers, and particularly in what relates to the nature of levels. It is this circumstance, he supposes, that has confined it to the western districts of the kingdom.

These meadows should have such a form either by nature or art, that water may be capable of flowing over their surfaces in a rapid manner, in order to promote the early and rapid growth of the grass. And it is essentially necessary to their perfect success that the operator have at all seasons a full command of the water as well as of distributing it to every part, and of discharging it completely when it becomes requisite.

The advantages to be derived from meadows of this sort are very considerable, not only in the increased quantity of hay which they afford; but in the point of early spring food for ewes and lambs, as well as in many other respects. See *Watering of Land*.

From this sort of grass being so very forward in March and April, it is generally pastured in the spring with sheep; and to those farmers who keep them for breeding or fattening, becomes almost invaluable from the scarcity of green food at such periods: but after being flooded in the latter end of April, they are mostly shut in the summer for hay. And the after-grass is eaten off in autumn with cattle, it being considered as very pernicious for sheep to pasture on watered meadows at that season. A remarkable instance of its fatal effects is stated in the Agricultural Survey of Sussex: eighty ewes from Weyhill fair, were turned into some field adjoining a watered meadow; a score of them broke into the meadow for a night, and were taken out in the morning and kept till lambing; they produced twenty-two lambs, all which lived, but every one of the ewes died rotten before May-day. The remaining sixty made themselves fat, nor could a rotten sheep be discovered amongst them. It is an extraordinary fact, though not easily accounted for, that the grass of watered meadows should be so nourishing to sheep in the spring, and yet have so destructive an effect on them in the autumn. The fact seems however to be well established.

In the Treatise on Watering Meadows it is advised "that no sheep, except those that are just fat, should ever be suffered, even for *an hour*, in watered meadows, as they will infallibly rot them at any other season than the spring, especially if made from low, boggy, or swampy ground:" but that "it is not so when made from dry healthy land."

It cannot be doubted but that on such farms as it is convenient to have three or four meadows that can be watered, they will be found highly advantageous; as while neat stock, Mr. Boswell says, are eating the first, the second will be growing, the third draining, and the fourth under water.

Mr. Smith remarks that even a small piece of water meadow which will produce an early crop of spring feed at the very time of the greatest pressure of

scarcity, and when the turnips ought to be off the ground, must be much more valuable to a poor arable farm, than can easily be imagined by any one who has not witnessed the great utility derived from them in many parts of Wiltshire. What, says he, but for the water meadows could enable the Wiltshire farmers to bring to market a much greater number of sheep, and that at an earlier season than can be produced from any other county in the kingdom?

They afford here an early supply of grass for the forward or early breed of lambs, on which they begin to feed them about the middle of March, having previously withdrawn the water from them, and laid them perfectly dry. It has been observed that "on a good crop of grass of this kind five hundred couples may be fed for one day on an acre. The practice is to hurdle out, daily, such a portion of the ground as is necessary, leaving a few open spaces in the hurdles through which the lambs may feed forward on the fresh grass. The hours they are suffered to feed on this grass are from about ten o'clock in the morning till five in the afternoon, when they are generally folded on the contiguous barley fallows." This is a practice which is supposed to have a great advantage from its manuring a part of the farm without the dunghill. Mr. Middleton mentions a remarkable instance of the beneficial and fertilizing effects of watering, as occurring in the early part of the autumn of 1796, when such grass as had not had the advantages of water was nearly burnt up. "A close of about twenty acres, which had been irrigated, had a most luxuriant after-grass of from six inches to a foot deep. And a neighbouring inclosure of near forty acres afforded support for three months to forty-seven horses and bullocks, all which throve very well." And another case is recorded in which "forty acres employed in this way was found equal to the support of five hundred Wiltshire ewes from the middle of March to the 1st of May; or about six weeks; and the improvement of the stock in that time one shilling a week, or three pounds fifteen shillings per acre. In some parts of Middlesex, five pounds worth of hay might also be taken off the first week in May."

In speaking of the management of water meadows, Mr. Smith observes, that "in those great districts of water meads, which in Wiltshire are watered by the common consent of many different proprietors and occupiers of land, the operation of floating must begin and end at certain fixed periods which it is necessary for every one to know and regularly adhere to, not only to produce a crop of grass, but for the procreation of those animals that eat the grass: consequently as every farmer knows at what time he shall have grass for his sheep, he so manages his breeding flock that the lambs may be strong enough at the usual time of feeding to go with the ewes to take their food in the meadows and return to the fold for lodging.

"The time to commence feeding upon those large streams is generally about the 25th of March: therefore if the winter be very mild and favourable for the growth of grass, it sometimes gets to such height as many farmers, unaccustomed to the herbage, might think it to be much too coarse and luxuriant for sheep, and even too high to be fed off with cattle. So great was the luxuriance of grass in the water meads of Wiltshire two years since, occasioned by the mild growing weather immediately after the commencement of floating, that some farmers laid their meadows dry and fed it off in November and December, and by floating again obtained a crop of feed in the spring before the usual period. Many who did not adopt this method, lamented their grass was too high even in the month of February, and it was then not uncommon to see it in the water meads nine inches high laid on the ground and white at the bottom, before the lambs were strong enough to go into the meadows. Some apprehended that the long sour grass would be wasted, yet it was astonishing with what avidity the sheep devoured it, and even preferred the parts which were the longest, and rendered white at bottom from its extreme thickness; this they would gnaw down to the roots. It was remarked by Mr. Davis, that the grass then on Rickwood's mead was such a crop as at the usual time of cutting it, would have been estimated at 18 cwt. per acre. Many declared they never saw the crop of the water meads so very abundant and early; but on visiting the same meadow at the particular request of his friend Mr. Davis on the 10th March (when it had been feeding more than three weeks) and asking the floater if they ever began to feed it sooner, he replied "he had had the management of the meadows more than 30 years, and never knew it so early but once, when they began feeding it on the 11th of the first month in the year." He walked over the greatest part of this extraordinary piece of ground with some considerable difficulty from the thickness and height of the grass, and he could discover but one place (to the great credit of the floater) which was worse than another, and that not two rods square: the man soon saw him notice it, and before he could mention the circumstance told him he knew what he was looking at, and had contrived to do away even such a trifling defect: so this may be truly called, Mr. Smith says, a spotless meadow." See *Irrigation*.

WATER-*Mill*, a mill which is turned by the power or force of water. These mills often form great obstructions to the practice of watering land; of course should be diminished as much as possible, and tide mills be substituted in their place, as might be done with facility in many cases. See *Mill*.

WATER-*Poa*, a term sometimes applied to meadow grass. See *Poa Aquatica*.

Aidle-WATER, a term applied to the stagnant water in moss, in some districts, as Lancashire. It is highly prejudicial to the animals when they drink water that is mixed with it. It is removed by frequent tillage.

White-WATER, in *Farriery*, a disease in sheep of a dangerous kind. According to Mr. Rudge, it is a very destructive disorder on the Cotswolds, which usually comes on with rapidity and sometimes terminates with death in three hours. It is supposed, he says, "to be owing to their licking up the white frost on their green food in spring and autumn. Folding at night on bare ground, giving them dry meat in the morning, and keeping them from the turnips till the frost is gone

is the obvious mode, he says, of prevention if the foregoing cause, is well founded. If however, the disorder is owing to gorging themselves with watery food, such as turnips, it is probable that to keep them moving about, without suffering them to rest long, or swell with what they have eaten, will carry off the beginning complaint, and even if the frost has been the occasion, this is the best remedy that reasoning suggests, and it is said to be the practice of the shepherds in Northumberland."

Watering *of Land*, the practice of overflowing it with water in order to improve it, from a neighbouring brook, river, or stream which has a higher level than the ground to be flooded. In some districts it is termed irrigating, and in others floating, &c. It is a method of improvement which appears to have been had recourse to on lands at an early period, as in Herefordshire, it seems to have been practised nearly two hundred years ago, from a work on the subject written by Rowland Vaughan, and published in the year 1610, entitled "Most Improved and Long Experienced Water Works: containing the manner of summer and winter drowning of meadow and pasture, by the advantage of the least river, brook, fount, or water mill adjacent; thereby to make those grounds (especially if they be dry) more fertile ten for one."

It is not improbable but that the fertility afforded by the annual overflowings of the Nile in Egypt might first suggest this means of improvement to other countries. But in whatever way the practice originated or was introduced, it is evidently a method that deserves the attention of the land proprietor and farmer in a high degree, as there are vast tracts of land in different parts of the kingdom that are capable of being benefited by it, to a very considerable extent with but little comparative expense. Wherever rivers, brooks, or streams of water pass through or near lands which are proper for this sort of improvement at a higher level than them, the business may in most cases be easily effected. But it will be accomplished with the least trouble, labour, and expense where the height of such streams above the grounds is the most considerable.

It has been stated by writers on irrigation, that the most proper soils for being watered are all those which are of a sandy or gravelly friable nature, as the improvement is not only immediate, but the effects more powerful than on other descriptions of land. There are also some strong adhesive sour wet lands, such as are common in the vicinity of large rivers which are also capable of being improved by watering, but the beneficial effects are not in such cases so soon produced as on those of the first sorts, nor is the process so advantageous to the farmer, on account of the very great expense to which he must, in many cases, be put to by previous draining. There are some other lands, as those which contain coarse vegetable productions, as heath, ling, rushes, &c. which may likewise be much improved by watering. It must be kept constantly in mind in attempting this sort of improvement, that the more tenacious the soil is the greater the command of water ought to be for effecting the purpose, as a stream capable of watering fifteen or twenty acres of light dry land, would be found to be beneficial in but a small degree when applied to watering half the same quantity of cold clayey ground such as in their natural state abound with coarse plants. On all soils of the last kind a considerable body of water is requisite for the purpose of floating them in order to produce much benefit, and where this cannot be procured this mode of improvement will seldom answer the farmer's intention or be advantageous in the result.

The lands that permit of this sort of improvement with the most success are such as lie in low situations on the border of brooks, streams or rivers, or in sloping directions on the sides of hills to which water can be conducted in an easy manner.

Mr. Smith indeed seems inclined to suppose that "there are only a few soils to which irrigation may not be advantageously applied; his experience, he says, has determined, that the wettest land may be greatly improved by it, and also that it is equally beneficial to that which is dry." But that as many persons unacquainted with the nature of irrigation may be more inclined to the latter supposition than the former, he explains the reason of wet land being as capable of improvement from flooding as that which is completely dry before. It is that in the construction of all water meadows, particular care must be taken to render them perfectly dry when the business of floating should terminate; and that the season for floating is in the winter and not the summer, which those who are unacquainted with the process have too generally supposed. All peat bogs is certainly of vegetable origin, and those vegetables are all aquatic. It follows that the same water which has produced the vegetables of the bog would under due management upon the surface, produce such grasses, or other vegetables as are usually grown by the farmer: and he has hitherto had reason to think, that this may be considered as a general rule for determining the situation of any experiments with water.

"It is not uncommon, says Mr. Smith in his useful tract on Water Meadows, "in Wiltshire to see lands where water has been diverted for the purpose of improvement divided by a hedge or drain only, the grass on one side of which is of the most luxuriant nature and abundant growth, but on the other so diminutive that its strongest blades have never reached the height of three inches. Having been much accustomed to make particular remarks on the appearance of the country in the course of numerous and extensive journies for the purposes of business and collecting information on the strata, it may not be amiss to point out some of the places which appear to be equally calculated for improvement by irrigation. He flatters himself, from the many successful experiments in the art of irrigation which he has established in different parts of the kingdom, even upon soils and with water which was formerly considered unfit for that purpose, that the prejudice against the quality of the water or soils to receive it will now be done away. He has no doubt but the failures in irrigation have arisen from bad management rather than from any fault in nature. These errors will be

clearly pointed out under the different heads to which they belong; he shall therefore go on to enumerate the places which are most sure to succeed. By the same system which he should recommend for draining the fens in the counties of Lincoln, Norfolk, Cambridge, and Northampton, large quantities of land upon the skirts of those fens might be converted into the most valuable water meadows; a considerable quantity of land on each side of the rivers where they pass through the adjoining counties of Bedford and Suffolk might also be made into water meadows by removing the inconveniences of floods. To such a tract of poor lands, as the western parts of Norfolk and Suffolk exhibit, water meads must be invaluable; and though a large proportion of these districts are well supplied with water, yet there is little or no water meadow in this country: but if the owners of these poor lands regard their own interest none of that description should be appropriated to any other purpose. The present occupiers of these as it were shifting sands, know that their soils cannot be managed without sheep, and the provision for the large flocks kept there is attended with great uncertainties, arising from the failure of turnips and artificial grasses, the farmer must consequently suffer great losses. Even the largest streams, in a situation like this, should be made to distribute their waste water over whatever land it can be made to cover, for all other uses of the water, except navigation and irrigation, ought to be dispensed with; and the land owners would in such cases better serve themselves and the public, by an application to parliament to float their lands instead of inclosing them. The expense of the latter is not repaid in many years, and upon the poorest lands the landlord is never reimbursed; whereas the expenses of irrigation would be amply repaid in the second or third year."

The benefit that would arise to individuals as well as the nation from the general adoption of this mode of improvement, must evidently be very considerable; though it cannot be easily reduced into the form of a calculation.

In the execution of this business it is supposed by some that the nature or quality of the water, like that of marle or other manures, is a matter of the first importance, and which should be particularly attended to before entering upon the undertaking. It has been remarked by Mr. Marshall in his Treatise on Landed Property, that "it is universally known, that water which flows out of a dungyard possesses a fertilizing quality. And it is generally admitted that the washings of sheep walks, freshly manured arable land, streets of towns, roads, &c. after a long drought, have the quality of fertilization. It is equally evident, he thinks, in different parts of the kingdom, that waters, issuing from chalk, limestone, marl, or other calcareous stratum, though they are perfectly limpid, possess the power of fertility; and those of some districts, as of Wiltshire, Dorsetshire, &c. to an astonishing degree. And a similar, though less powerful, effect is produced, by the limpid waters which issue from the slate rocks of Devonshire and Cornwall. On the other hand, waters that ooze out of peat bogs, and issue from particular mines, are well known to be injurious to the growth of agricultural vegetables."

And he adds, that "chemistry points out tests and processes whereby waters, as well as marles, and other gross manures, may be tried and analyzed. But the virtue of water, when considered as a manure, does not reside in a single principle, like that of limestone. Water is capable of suspending, not only calcareous earth, but various other matters, of animal vegetable and fossil origin, some of them friendly, others inimical to vegetation. It would therefore be imprudent in a practical man to commit himself to theoretic guidance alone; while the theory of manures, and especially that of irrigation, remains in much obscurity, and while experiments in the field, on the very land he is desirous to improve, may be made with facility and prompt decision."

But before entering upon the descriptions of the methods of performing the business of watering in different cases it may not be improper to give some account of the necessary tools, and an explanation of the terms more frequent employed in the work.

The principal tool in the execution of the work is the *level*, of which different sorts are made use of, but the best is probably, the spirit level. It is necessary to be employed to take the level of the land at a distance, compared with the part of the river, &c. whence it is intended to take the water, to know whether it can or cannot, be made to float the part intended to be watered. It has been already described, and is found very useful in undertakings of this nature, especially when on a large scale, though the workmen too frequently dispense with the use of it, bringing the water after them to work by. In drawing a main they begin at the head, and work deep enough to have the water to follow them. And in drawing a tail-drain they begin at the lower end of it, and work upwards to let the water come after them. The level should, however, be made use of as being more certain and correct. See *Level*.

A *line*, *reel*, and *breast-plough*, are likewise absolutely necessary. The use of the two former are well known; but as the line is mostly used in the wet, it should for this purpose be larger and stronger than those used in gardening.

The breast plough should be of the best description, being principally employed in cutting turfs for the sides of the chanels.

The spades made use of in this sort of work should have the stems considerably more crooked than those of any other sort; the bit being of iron, about a foot wide in the middle, terminating in a point; a thick ridge running perpendicularly down the middle, from the stem almost to the point; the edges on both sides should be drawn very thin, and as they are obliged to be kept very sharp, they should be often ground and whetted. This necessarily wears them away, and they soon become narrow; they are then used for the narrow trenches and drains, whilst new ones are used for the wider. From the stems being made crooked, the workmen, standing in the working position in the

bottom of the trench or drain, are enabled to make them quite smooth and even.

The crescent is another tool made like the gardener's edging iron, only much larger, having the form of a crescent, being very thin, and well steeled, with a stem about three feet long, and a cross handle to bear upon. It is used for tracing out the sides of the mains, trenches, drains, &c.

Wheelbarrows, also become necessary to remove the clods to the flat places; which may be made open, without sides or hinder parts.

Handbarrows are likewise sometimes made use of where the ground is too soft to admit of the wheelbarrows, and where clods require to be removed during the time the meadow is in water.

Three-wheel carts, &c. are, however necessary, when large quantities of earth want to be removed, particularly when it is carried some distance.

Scythes, both short and narrow, are required to mow the weeds and grass, when the water is running in the trenches, drains, &c.

Besides these, forks, and long four or five tined hooks, are requisite to pull out the roots of the sedge, rushes, reed, &c. which grow in the large mains and drains. The crooks should be made light, and have long stems, to reach wherever the water is so deep that the workmen cannot work in it.

And stout large water-proof boots, having tops so as to draw up half the length of the thigh, are indispensible; they must be large enough to admit a quantity of hay to be stuffed down all round the legs, and be kept well tallowed, to resist the running water for a length of time.

The terms made use of are very different.

A ware is an erection across a river, brook, rivulet, main, &c. made often of timber only, sometimes of bricks, or stones and timber, with from two to eight, or ten thoroughs (openings) to let the water through, according to the breadth of the stream. Its height is always equal to the depth of the stream compared with the adjacent land. Its use is, when the hatches are all in their proper places, to stop the whole current, that the water may rise high enough to overflow the banks, and spread over the adjoining land; or, by stopping the water in its natural course, turn it through mains, cut to convey it another way, to some distant lands, to water them. See *Ware*.

A sluice is made exactly as a ware, only it has but one thorough; for if there are more than one, it becomes a ware. See *Sluice*.

A trunk, is a covered sluice, being constructed in all cases where two streams of water are to cross each other at the proint of discharge, and to serve as a bridge.

A carriage, is a sort of smallwooden or brick aqueduct, built open, for the purpose of carrying one stream over another, and is the most expensive conveyance belonging to the business of watering.

A drain sluice, or drain trunk, signifies such as are placed in the lowest part of a main, as near to the head as a drain can be formed, and situated low enough to drain the main, &c. It is placed with the mouth at the bottom of the main, being let down into the bank; and from its other end a drain is cut to communicate with some trench-drain that is nearest. It is a contrivance used to carry off the leakage through the hatches when they are shut down, to convey the water to other grounds, or to repair the main, &c. And hatches are floodgates, being applied to the same purposes: they are, of course, variously constructed. A particular kind, which have about a foot, to take off, so as to permit the water to flow over that much of the hatch where it appears to be useful in irrigation has been in use, but is not found to answer. They are best when made whole, they may be made of any timber, but oak and elm are the best.

The term head main is used to signify a ditch drawn from the river, rivulet, &c. to convey the water out of its usual current to water the lands laid out for that purpose, through the means of lesser mains and trenches. The head main is drawn of various breadths and depths, according to the quantity of land to be watered; to the length, or to the fall or descent of the land it is cut through. And it often happens, that smaller mains are taken out of the head main; the only difference between them is, the one being much less than the other, and are mostly cut at, or nearly at, right angels with the other, though sometimes many degrees less. The use of both the large and small mains is to feed the various trenches with water, which branch out into all parts of the meadow, and convey the water to float the land. These smaller mains are by some called carriages, but improperly, for it is confounding them with the open trunk, called by that name as seen above.

The trench is a narrow shallow ditch, made to take the water out of the mains to float the land with. It ought always to be drawn in a straight line from angle to angle, with as few turnings as possible. It is never made deep, but the width is in proportion to the length it runs, and the breadth of the pane, between that and the drench drain. It is always cut gradually narrower and narrower to the lower end.

The trench drain is always cut parallel to the trench, and as deep as the tail drain water will admit when necessary. It ought always to be cut, if possible, so as to come down to a firm stratum of sand, gravel, or clay. If the latter, a spade's depth into it will be of great advantage; its use is to carry away the water immediately after it has run over the panes from the trench. It need not be drawn up to the head of the land, by five, six, or more yards, according to the nature of the soil. Its form is the reverse of the trench, being narrower at the head, or upper part, and gradually wider and wider, till it comes to the lower end, and empties itself into the tail drain, which is a receptacle for all the water that runs out of the other drains, that are so situated as not to empty themselves into the river; and therefore it should run nearly at right angles with the trenches, but in general, the preference is given to draw it in the lowest part of the ground, and to use it to convey the water out of the meadow where there is the greatest descent; this is generally found in one of the fence ditches: for which reason a fence ditch is mostly used for

that purpose, answering two purposes, fencing the meadow, and draining it at the same time.

A pane of ground is that part of the meadow which lies between the trench and the trench drain, and is the part on which the grass grows that is mown for hay; it is watered by the trenches, and drained by the trench drains, consequently there is one on each side of every trench. And a way pane is that part of the ground which lies in a properly watered meadow, on that side of a main where no trenches are taken out, but is watered the whole length of the main over its banks; a drain runs parallel with the main to drain the way pane. Its use is for a road to convey the hay upon out of the meadows, instead of the teams crossing all the trenches.

The term bend is applied to a stoppage made in various parts of those trenches which have a quick descent to obstruct the water. It is made by leaving a narrow slip of greensward across the trench, where the bend is intended to be left, cutting occasionally a piece, wedge fashion, out of the middle of it. Its use is to check the water, and force it over the trench into the panes; which, if it were not for those bends, would run rapidly on in the trench, and not flow over the land, as it passes along. The great art of watering meadows consists in giving to every part of each pane an equal quantity of water. And a gutter is a small groove cut out from the tails of those trenches, where the panes run longer at one corner than the other. Its use is to carry the water to the extreme point of the pane. Those panes which are intersected by the trench, and tail-drains, meeting in an obtuse angle, want the assistance of these gutters to convey the water to the longest side. Another use of them is, when the land has not been so well levelled but some parts of the panes lie higher than they ought; a gutter is then drawn from the trench over that high ground, which otherwise would not be overflowed. Without this precaution, unless the flats were filled up (which ought always to be done when materials can be had to do it), the water will not rise upon it: and after the watering season is past, those places would appear rusty and brown, whilst a rich verdure would overspread the others: and at hay-time the grass in those places would be scarce high enough for the scythe to touch it; whilst that around them, which has been properly watered, will from its luxuriency lie down. Though this method of treating those places is mentioned, it ought always to be opposed: for every inequality in water meadows should either be levelled down, or filled up. Here the waterman's skill is shown, in bringing the water over those places where it could not rise of itself, and in carrying it off from others where it would otherwise stagnate.

The term catch drain is sometimes applied to another method made use of to water the land when the water is scarce, and it is this: when a meadow is pretty long, and has a quick descent, the water runs slowly down those drains, one or more of them are, at a proper place, close stopped, till the water flowing thither rises higher and higher, either till it strikes back into the tail drains, so high as to pound upon the ends of the panes (in that case it will not succeed, and must be cut open again to let the water free), or till it flows over the banks of the drain, and waters the ground below; then the design succeeds, and (in proportion to the quantity of water thus collected) it is to be conveyed upon the land, either in a small main, out of which trenches are to be drawn with their proper drains, or by trenches taken immediately out of it. But a catch drain is by no means recommended; and it is proper to remark, that even when this method succeeds, the water having been so lately strained over the ground, it is supposed by the watermen to be not so enriching as it was before it was used, and therefore nothing but absolute necessity can support the adopting it.

The bed of a river, main, trench, &c. is the bottom of them.

"The term pond means water standing upon the land, or in the tail drain, trench drains, &c. so as to annoy the ground near them; and is occasioned sometimes by the flats not having been properly filled up: and at other times, when a ware being shut close, to water some high ground above it, the water is thrown back upon the ground contiguous. In this case the lesser evil, whichever it is, must be borne with.

"And a turn of water means so much land in a meadow as can be watered at one time. It is done by shutting down the hatches in all those wares where the water is intended to be kept out, and opening those that are to let the water through them. The quantity of land to be watered by one turn, must vary with the size of the river, main, &c. as well as with the plenty or scarcity of water.

The head of a meadow is that part into which the river, main, &c. first enter. And the tail of a meadow is that part out of which the river, &c. last passes.

The upper side of a main, or trench, is that side which (when the main or trench is drawn at, or nearly at, right angles with the river, &c.) fronts the part from whence the river entered. Consequently the lower side is the reverse.

"And the upper pane in a meadow is that pane which lies upon the upper side of the main, or trench, that is drawn at right angles with the river: that is, when the river, &c. runs north and south, entering at the north, and the mains and trenches are drawn east and west, all those panes, which lie on the north side of the main, &c. are called the upper panes, those on the south side are called the lower. But it may be noticed, that where the mains, trenches, &c. run parallel with the river, the panes on either side are not distinguished from each other."

It is well remarked by Mr. Smith, that "artificial irrigation is produced by diverting the water of a brook out of its accustomed channel (where there is a fall) in such a manner that the new water course being kept nearly level, the space between the old and new channel may be floated. The water being brought upon the land by the new channel and taken away to the old one. Thus a constant discharge and succession of water is retained without such an accumulation as would make it appear bright upon the land, or without such a deficiency as would leave any part of it

not perfectly floating, for the art of irrigation may be most properly called floating, not soaking nor drowning. Soaking the soil similar to the effects produced from a shower of rain is not sufficient for the general purposes of irrigation, nor will damming up water or keeping it stagnant upon the surface like that in a pond or on the fens produce the desired effect.

"The latter may properly be called drowning, because it drowns or covers all the grass, thereby rendering the plants beneath it certainly aquatic, or the herbage disposed to make such a change; whereas the herbage of a water meadow should by its very construction and good management, enjoy the full benefits of both the elements of air and water. Practice has proved that there is no better method of doing this, than by keeping water passing over the surface of the land with a brisk current, but not so brisk as to wash away the soil, and yet in sufficient quantity to cover and nourish the roots, but not too much to hide the shoots of the grasses: hence appears the nicety of adjusting the quantity of water: and hence it also appears, that one main drain, to bring the water on the upper side of the mead, and another on the lower side to take it away, will not be adequate to all the purposes of such an accurate regulation. If the space between the upper channel (which may be called the *main feeder*) and the lower one (which may be termed the *main drain*), should therefore be wider than is proper for the good adjustment of the water, that is, so that every part of the space, shall have enough water passing over it and no part too much, then that space must be divided into smaller spaces by intermediate drains, which shall catch and re-distribute the water. These drains are called *catch drains*, and the ground which can be floated in this way, is called *catch work* meadows, because the water is caught or collected, and re-distributed by these drains, which in a well formed meadow should never be more than for ten yards apart. As the water is brought by the main feeder upon the higher side of a piece of ground which slopes towards the *main drain*, and down which sloping surface the water will run very readily, it does not to persons unacquainted with irrigation, at first sight appear necessary to make such a number of intermediate *catch drains;* but it is proved by experience, that however regular the slope of ground may appear to the eye, that the water will find a number of irregularities, forcing itself into gutters or channels, and defeat the purposes of irrigation; in the hollow places by excess, and in high ones by the want of water. Hence the water, which was scattered over the surface of the first space, being all collected in the catch drain, may by the skill of the floater be let out upon those parts of the bed below which appear to need the most assistance."

As it is highly requisite to possess full command of the water in all cases of improvements of this nature, the work should always be well formed at first. Temporary means of making dams and hatches to divert the water out of its usual channel may, says Mr. Smith, "suffice to try an experiment, or for a tenant who has but a short term in the grounds to be irrigated; but every land owner who enters upon such work in this temporary manner, sadly mistakes his own interest; indeed it is frequently more difficult to repair than to renew upon large streams when the foundations are often destroyed by the force of the water. The same principle holds good upon small streams, and even in the drains and feeders of a water meadow. Wherever the channels are so constructed as to make a fall, or much increase the rapidity of the stream it is constantly disposed to wear away the sides of its channel or undermine a dam. To repair these defects, land must be dug away and wasted each time it is replaced with the loss of labour. The consequent ill management of the water renders it more advisable and perhaps cheaper to make all such works of masonry. When works are well done at first the owner ever finds much pleasure in viewing them; and even the labourers feel much more interested in their good management."

"It will, he thinks, be impossible to form any exact estimate of the probable expenses of making a water meadow. Much depends on the original state of the ground, the size and fall of the streams to be used, the cost of hatches and length of the main feeders, which may be necessary for diverting the water out of its original channel, and even upon the charge for levelling land, which differs materially. Some soils are much harder and more difficult to move than others, and in certain situations, building materials are very scarce and dear. This last circumstance must make a considerable variation in the price of the hatches; where the stream is large. It is also impossible to tell with any degree of certainty, what proportion these expenses should bear to the quantity of land irrigated, for some situations will require much more masonry than others."

In business of this kind, it is necessary, before entering upon its execution, to fully consider, whether the stream of water to be made use of will admit of a temporary wear or dam to be formed across it, so as to keep the water up to a proper level for covering the land without flooding or injuring other adjoining grounds; or if the water be in its natural state sufficiently high without a wear or dam, or to be made so by taking it from the stream higher up more towards its source, and by the conductor keeping it up nearly to its level till it comes upon the meadow or other ground. And still further whether the water can be drawn off the meadow or other ground in as rapid a manner as it is brought on. And having in addition to these an attention to all such other difficulties and obstructions as may present themselves, from the lands being in lease through which it may be necessary to cut or form the mains or grand carriers, from the water being necessary for turning mills, from the rivers or brooks not being wholly at the command of the irrigator, and from small necks of land intervening, so as to prevent the work from being performed to the greatest advantage, the operator may be in a situation to commence his operations.

After inculcating the necessity of having the water under full regulation by proper management of the

works, in order to have an equal distribution and prevent waste, Mr. Smith states, that "no part of a meadow, either in catch work or beds, should be so formed as to be floated directly from the main feeder; but all the main feeders should be kept high enough to discharge the water into the small feeders with considerable velocity and through a narrow opening. The motion of water is truly mechanical; it requires a great deal of ingenuity, and a perfect knowledge of lines and levels to make it move over the ground in a proper manner. No two pieces of land being exactly alike renders it still more difficult to set out a water meadow; but even if the figure of two pieces be alike, the inequalities of surface will probably vary. Each meadow therefore requires a different design, unless the land owner makes up his mind to the heavy expense of paring off banks, and filling up such hollows as may be necessary to reduce it to some regular method. The construction to be varied according to the nature of the ground. This constitutes the difference between the water meadows of Berkshire and Devonshire. Those of the latter are upon small streams carried round the sides of the hills, and are chiefly catch work, those of the former being near large rivers and boggy ground are thrown up into ridges to create a brisk motion in the water, and also for the essential purpose of draining off all superfluous moisture, which might be injurious to the grasses when shut up for feeding or mowing. Where there is much floating to be done with a little water, or rather where the great fall of a small stream will admit of its being carried over a vast quantity of ground and used several times, it is desirable to employ it in such a way that the meadows so irrigated must not be exhibited as perfect models. If it should answer the purpose of a coat of manure upon such an extent of ground, it is all that can be expected, and will amply repay the expense. Losing fall is wasting water."

And it is further added, that "all the drains of a water meadow require no greater declivity than is necessary to carry the water from the surface, therefore the water ought to be collected and used again at every three feet of the fall, if it be not catch work. It is sometimes difficult to do this in bed-work meads, but where the upper part of the meadow is catch-work or in level beds, and the lower part not too much elevated it may be done. By collecting and using the water again in the same piece of ground before it falls into the brook, a set of hatches is saved, and it is not necessary to be very particular about getting the upper part into high ridges, since that part of a meadow which is near the hatches generally becomes the best, and the lower end of the field being often the wettest or most boggy in its original state, requires to be thrown up the highest. If the land is of a dry absorbent nature before floating, it is not necessary that it should be thrown up into high beds. There are many good meadows in Wiltshire that have little work in them and some that have neither drain or feeder: but these are extraordinary situations which do not occur in any other county, or they must have suggested the ideas before stated to have been the origin of floating, he has some reason to think, from the natural warmth of peat ground, which keeps it from freezing, that such land will produce an earlier crop of spring feed than any other. At all events it will first show the advantages of irrigation, and gravel or sand may be next to this."

Mr. Smith likewise further suggests, "that if grass ground could be ploughed in such a manner as to set the two furrow slices in a leaning direction against each other with the grass outwards, the roots would be kept dry all winter, and the shoots would have the full advantage of the sun, and much benefit from shelter.

"If, says he, ground ploughed into this form before winter, could be watered toward the spring so as to give it a good soaking, it might be pressed down again to a level surface with a heavy roller. If these narrow ridges were crossed with level trenches at every 40, 50, or one hundred yards distance, according to the fall of the ground, and those trenches which should run up and down the slope, and supply or discharge the contents of those which are horizontal, such ground might be laid dry or wet at pleasure. And he is inclined to believe, that land so shaped might be floated all winter with stagnant water to its great benefit, and perhaps in the spring also, if the water be changed at frequent and proper periods; for the water would remain only in the furrows, where there would be little or no vegetation, and the newly loosened soil of the ridges could not fail to absorb moisture, such as will promote the growth of the grass without any danger of putrefaction. The levels must be taken before a piece of ground be ploughed into this shape, and the earth taken out in cutting the cross drains must be used in stopping furrows on the lower side of them. Perhaps upon wet ground it would be necessary to re-plough it every autumn, or the strong lands might become *too* solid to receive the same benefit by it; and it will be necessary to level the ridges every spring, if the ground is mowed, but if summer fed it might as well remain in this form as any other. This easy method of getting land up into ridges, which are very narrow, gives to the surface all that inclination which is necessary for drawing off water, and is certainly so far likely to answer the purpose of irrigation. The water is thus under the same command as in any of the best formed meadows, and a much less quantity will be sufficient than under any other system of irrigation. It might, perhaps, answer the purpose to float young wheat, or any other sort of grain by a similar method. He is inclined to think that flat peaty ground, such as the level fens in Norfolk, which are subject to be covered a few inches deep every winter with stagnant water, would be much benefited by ploughing in this way before the floods commence. Some parts of it would thereby be raised above the water and vegetate quicker in the spring, and the sedgy matter growing up in the furrows, would in a few years raise them to the same level. The cross drains where on a declivity would serve to catch and re-distribute the water, and the fall from one to the other must be very little. If this method will not do for irrigation, he expects that four furrow ridges of turf with a small feeder

upon each, would answer all the purposes of a more expensive system, There is always good grass by the side of the feeder, whether the water runs over it or not; and a meadow of this sort would be nothing but feeders. It requires so little elevation of ridge and fall in the feeders, that the water might be soon used again, therefore a very small quantity would suffice, and if there was a scarcity in the winter, the whole discharge might be stopped and gradually lowered in the spring. This method would answer all the purposes of complete saturation, which seems to be one of the most essential parts of irrigation, and might be applied more or less, according to the time of the year. When the water is put on, he apprehends no grasses would sustain any injury by exclusion from the air for a day or two at the first application. If these ridges could be elevated but four or six inches above the furrows it would give the surface nearly the same slope as the wider ridges of common meadows; perhaps it would be better to begin ploughing the furrows wide at the ridge, and very narrow at the furrow, which would leave but narrow spaces for drains. If a piece of ground were ploughed in such ridges, according to the common way of turning over the furrow, if it were set pretty much on edge, he is induced to believe that the grass between would soon cover the whole surface."

He even observes in addition, that "perhaps ridges might be made by beginning the two first furrows more apart than the usual width, thus leaving the width of one furrow between the two first, to constitute the channel of the feeder. These ridges must be ploughed up and down, with only three or four inches fall between the cross feeders, and the water may be brought into use again at every other set of beds. If the ground requires to be loosened every year, or once in two or three years, it will not be attended with much expence, and there will be no very great inconvenience in mowing ground in this shape, if the sides of the ridges be about a swath wide. He should think that meadows of this sort might be made for twenty-five or thirty shillings per acre, floated with less water than catch work, and have many advantages over it; viz. the water would lie more above the surface, would be more at command, and therefore changed more easily, and it may be pent up better to get a good soaking when scarce. This may be done more effectually in turns, and will run drier when the water should be taken off. It does not require much skill in the making or management. All the water will be let through nicks, instead of running over a nice level edge, which in the first place is seldom made well, and in the next is difficult to keep in repair. This sort of work would, he thinks, have all the advantages of drains and feeders, whereas the same channels are obliged to serve for both in the common catch-work; it would require but very few or no stops, and consequently want but little attendance. It might be practised where there is six or eight inches of fall between the cross feeder and cross catch, as the water of each ridge which should be short, may be let out by a sod with less trouble in the regulation than catch-work. Much of the expences of a water meadow must depend on the number of hatches, and the cheapest and best method of executing them; he has many times turned his thoughts to the improvement of this part of the business. Masonry is always very troublesome and expensive, and more especially in meadows where the materials must be brought from a great distance, and is often to be laid upon a bad foundation under water: wood-work is also subject to much leakage, and liable to decay where it is alternately wet and dry. A good *penstock* sluice or dam, to stop up a stream of water, for the purpose of floating the land, should be so constructed that no water shall escape with a proper place to discharge the surplus. If this be done by letting it fall over the top, it becomes necessary to sheet the bottom of the hatches with timber or stone, and even a small stream which has to fall a considerable height, will soon undermine the foundation of the hatches, unless much pains be taken to secure them. He should therefore prefer damming the stream with a pipe laid underneath, to be plugged up with another pipe, which should reach to the top of the water, and serve as a wear to discharge the surplus through the same pipe, which will carry away the whole when this hollow plug is drawn. The top of the hollow plug should be hooped, and the bottom fastened by three or four chains of equal length, which will admit of its being drawn, and replaced without difficulty, and prevent its being taken away."

And it is conceived, that "if the trunk through the bank or dam, is laid sloping, it will carry all the water of a small stream, save a great expence in the hatches, and make the stoppage of the water much more complete and manageable. If a meadow can be floated from the water, which comes from an underground drain, and it be at all desirable to return that water back into the drain again, it will be best to cut open the drain, and lay a pipe into it four feet long, with another pipe affixed to the upper side of it, long enough to reach to the surface of the ground intended to be floated. A tube of this sort may be easily fixed in the drain and well stopped round, so that no water shall escape, with an opening on the upper side for the water to rise in the tube which the plug goes through. The plug must be cut off level with the top of the tube, and the whole may be covered with a flat stone."

It is readily conceived, that a pipe of this kind must have the effect of raising the water to the surface, when the plug is in, or of letting it pass along the drain in its usual course when out. And that "where the main feeders of a water mead, are not more than three or three and a half feet wide, and are subject to no great inundations or hasty floods, which descend with considerable force, it may not be necessary to make any contraction in the stream, in order to regulate the height of the water, nor to have any expensive rollers or racks attached to the hatches. While the head of water can never exceed three feet, nor the width of the feeders; there can be no difficulty of drawing them if made in the following manner: If the width of the main feeder, be not.

contracted, the water, which will rush through on drawing the hatch, will have less power to fret away the sides, and bottom of the channel, than when it falls with much more rapidity on a sill, or *through* a narrow opening. If the sill is laid in something deeper, he should think it better, as the sediment would then lodge on the upper side, which would tend to make it more water tight at bottom."

And he further states, that "all drains or channels for carrying the water on or off the land, in that constant course and regular quantity which practice proves to be necessary, have two very different uses, and they have been called by two different names. It will be recollected that those which bring the water into the meadow, and distribute it along the ridges, have been denominated *feeders*, and those which collect it in the furrows or bottom of the slopes, and carry it into the larger ones, which lead into the old channel, are called *drains*. The first sort continually bring a supply of water to make the slopes wet, and the other sort carrying the water away, prevent the meadow from getting *too* wet, during the time of floating, serve to drain it till dry, when that operation is over, and to remove any superfluous moisture, which may leak from the soil or fall from the clouds. It is common in some counties to call the *feeders* by different names, as *carriages*, *gutters*, &c. &c. which rather confound than explain their uses, and these names being merely provincial, there can be no harm in deviating from terms of such limited sense. Drains or channels for the water, whether great or small have but two distinct uses, he shall therefore for the sake of perspicuity, call all that bring the water on, by the accustomed name of *feeders*, and all those that take it off by the appropriate name of *drains*, denominating those large ones which convey the water to the meadow, and along the main ridge to supply the other by the name of *main feeders*, and the ramifications which run along each ridge and distribute the water down the sides by the name of *floating feeders*. The first operation of floating begins, or ought to begin, at the edges of these feeders; the *main feeders* being nothing but channels or roads, along which the water must pass, from the places where it can be found to the places where it is to have its effect. The place of its use lies between the floating feeder and the foot of the slope drains, which are made in every furrow for the purpose of catching the water, he shall therefore call these by the name of *catch drains*, and those which collect the contents of each of these drains being larger, and conveying more water, by the name of *main drains*. Thus every drain which is made use of in a water meadow may be easily explained by the name of *main feeder*, *floating feeder*, *main drain*, and *catch drain*."

It is the opinion of the same writer, therefore, that "all floating may be done without building hatches in great rivers, which are often attended with heavy expenses, and many inconveniences. If the proprietor has the land far enough up the river, nothing more is necessary, than to go thither, and cut a channel out of it, which shall be deeper than the bottom of the stream. The water, which will be taken out in this new channel, may be dammed up by hatches in it at any place most convenient for getting it out upon the surface. To turn it into its old course down the river, nothing more is necessary than a hatch at the upper end of the feeder. Feeders constructed in this way, will be extremely serviceable in time of floods, for by drawing both the hatches, an entire new channel will be opened, which is generally much straighter than the old one. To contrive the shortest possible way to get the water upon the ground, it is evident, that an obtuse angle is best calculated for that purpose; it shortens the length of the feeders, facilitates the motion of the water, increases the velocity, and consequently preserves that natural warmth or motion which keeps it from freezing in the winter or stagnating in the summer. It also prevents the accumulation of scum, or whatever floats upon the surface, and enables the floater to distribute the water much more equally on every part of the work, than if it went in a more circuitous course. The wind has less power to retard the motion of the surface, and the sediment which should go out upon the beds is less liable to lodge in the bottom of the feeders, and consequently the feeders will be cleared out at much less trouble and expence, especially if there be proper plugs or small hatches to draw up for the purpose of sending a stream through them."

It is observed from this that "it may appear to many that these hatches are too expensive or unnecessary, but practice proves, the writer says, that the first expense is the least, and that once well done is done for ever. Inclined planes are absolutely necessary for the purpose of irrigation. To form these between straight and parallel lines, it is necessary to dig away land where it is too high and move it to those places where it is too low, to make such an uniformity of surface. The new made ground will of course settle in hollows proportioned to the depth of loose matter which has been recently put together, but this settlement will not take place until the new soil has been completely soaked and dried again; therefore these defects cannot be remedied before the second or third year of watering: it will then require more skill to manage a water meadow for the three or four first years, than it can afterwards."

And he concludes by remarking that "however simple the construction of a water meadow may appear to be on a superficial view; those who enter minutely into the concern will find it much more difficult than is commonly imagined. It is no easy task to give an irregular surface that regular yet various figure which shall be fit for the overflowing of water. It is very necessary for the operator to have just ideas of levels, lines, and angles; a knowledge of superficial forms will not be sufficient; accurate notions of solid geometry (obtained from theory or practice) are absolutely necessary to put such a surface into the form proper for the reception of water without the trouble and expense of doing much of the work twice over."

The following directions have been laid down by

Mr. Young, for watering land in the horizontal or slanting method. The operator is to commence his work by having recourse to the use of a *spirit level*, beginning from the highest part of the land that the stream can be commanded from, where the grounds on the different sides are the property of the same person, and wears or other works, as just noticed can be carried across the streams for the purpose of forcing the water, either wholly or in a partial manner, into a different course. When it has been raised as high as possible in this manner the level is to be formed from the surface of the water, carrying it on what is called the dead level, and marking it out, at certain distances by two rows of pegs or stakes driven well down, one on the line of the dead level and the other opposite to it, at such distance below as may be sufficient to allow for the proper flowing of the water: a few inches in the mile will be sufficient to draw it: but from a foot to a foot and a half or two feet in that length may be necessary to afford a proper fall; and where interruptions present themselves, from buildings or other causes, a still greater fall will be requisite in order that the passing of them may be provided for in a gradual, not a sudden, manner. In this way the work may proceed to the extent of the land that is capable of being watered. The level on the land upon the other side of the stream may be set out in a similar manner where it may be necessary.

When this has been well performed, the land on the different sides of the stream, below the lines set out by the level should be minutely examined and inspected, as the whole may be irrigated if the command of water be sufficient. The extent that can be properly performed must, however, depend much on the degree of fall or descent from the entrance of the water and its out-fall, as well as on the declination of the more elevated parts of the ground. It, however, generally happens that a much greater space of land can be covered with water than was at first supposed to admit of it.

The circumstance next in importance is that of deciding where to commence the business. But this depends on various points, which can only be settled by the judgment of the operator on the spot. If there be a full supply of water, the whole should be covered; but in the contrary case, the expense of cutting the mains or carriers on such levels in a sufficient manner should be considered; and where one side of the stream is better adapted to the purpose than the other, that on such side should be the first executed. And that if the land most adapted to the purpose be at much distance from the place whence the water is first taken, and there be not a supply for the whole of the land below the line of level on one of the sides, the expense of forming the carrier should be put in comparison with the greater advantage of irrigating the most suitable grounds, in preference to others that are nearer, without possessing equal advantages. It mostly happens that the beneficial consequences of irrigating at command are such as to overbalance that of forming the mains or carriers. And besides, though the supply of water may be found insufficient in such seasons as are very dry, it may be abundant in the winter time; the simply covering the land at that period being more than adequate to the expense of the business; which is a circumstance that may render it more beneficial to lengthen the carriers, than by having them shorter to be confined to the watering of such lands as are less proper for the purpose. In particular cases it is not improbable but that the winter irrigation may extend through the whole of the level that has been marked out.

And it has been suggested that "where it may happen that there are a great variety of different sorts of land below the line of level, such as low, flat, wet meadows, extended on the borders of the river, having pastures with dry, gravelly, or sandy tillage lands higher up, and moory or heathy grounds, so that the operator has it in his power to perform the business, at his option, on different sorts of land, it is too frequently the case to begin with the low grounds that admit of improvement in other ways, as by draining and proper manures of the fossil kind, and that are not only the most difficult and expensive in the execution, but often the least advantageous in the produce afterwards, except when the business is performed with uncommon correctness." Of course in examining such grounds as are situated below the mains or carriers, the irrigator should fix upon such lands as are, from the nature and condition of the soils and the smallness of their value, capable of affording the greatest and most speedy improvement and advantage. In most cases these will be found to be the more dry declining parts in the state of tillage, and the old worn out dry pastures." And in some instances the heathy and moory lands may be selected for this purpose with great chance of beneficial improvement being produced.

And in such cases where "it can be done, it is best to begin with such parts as are contiguous to or approach the nearest, the mains or carriers; and, after having passed the water over them, to mark the lowest places, where it can be carried off to the best advantage; and from such parts it should then be seen to which other lands the water can be conducted with the greatest facility and benefit. Where the natural shelving of the ground is considerable, less care is necessary; but where this is not much, it may often be requisite to convey the water in a slanting direction for a considerable way, before lands sufficiently low for being covered by it are met with; as in this sort of work it is invariably necessary, in order to prevent the waste of water, to proceed with that which is first made use of to its final outlet into the river before the works on other divisions are commenced." And where the "sloping tracts of land managed in this way are extensive, it of course mostly becomes necessary to convey the water in a slanting direction across them. By this means an opportunity is afforded of throwing it over the lands in the intermediate space between the bed of the river and the master drains or carriers, and in this way one

space or division of ground may be supplied after another, and the water conducted at pleasure to any given point, thereby enabling the operator to supply or omit any space or field that he may think proper, but still by this means preserving the regularity of the plan, which at any future period may be perfected. The most material circumstance to be regarded are the abundant supply of water and the quickness of its being conveyed off, as by its sluggishness or stagnation much mischief may be produced." And it is a point of advantage in this oblique or slanting method of watering, that it may be beneficially performed with a smaller supply of water than in others; as where that is the case it may be directed to such spaces only as it will be equal to, but when more abundant, it may be suffered to overflow the whole at the same moment, care being taken to have it spread equally by proper formed trenches.

In cases where the "ground to be floated is so much upon the level that the descent cannot easily be determined by the eye, it will be necessary to take an accurate level, and compare the highest part with the stream intended to be employed by which the degree of fall from the surface of the water to the highest point of the land may be ascertained: and in order to convey the water to this point, should it be distant from the stream, the sides of the ditch or canal should be sufficiently raised for the purpose so as not to keep the water in a dead level, but with such a degree of descent as the two points will admit of. In the operation of cutting this canal or main feeder, it will be easy to preserve the proper degree of fall, having previously ascertained the length; for instance, in cutting fifty yards with a fall of five inches, it will be obvious that in every ten yards a descent of one inch should take place, this is necessary to keep the water in a constant lively motion. In some cases it may be necessary to have two main feeders, in order to effect a more equal distribution of the water: the depth and width of which feeders must be regulated by the supply requisite for the smaller gutters." Near to the mouth of the canal or feeder it will be proper to have a flood-hatch or clow fixed, by which the water may be admitted or excluded as there may be occasion.

And in the constructing of the floating gutters, it is probably the best method to cut them at right angles to the feeders; but where the surface is uneven, in order to preserve a regular descent, a different direction should be given to them, the distance from each other being about ten yards, the gutters becoming gradually narrower as they recede from the main canal or feeder. The principal object being to throw the water as evenly over the surface as possible, these gutters should be so formed that the water which has been introduced may overflow their little banks rather than run rapidly along the bed. Where obstructions occur, as low parts, or deep ditches, a pipe or spout may easily be laid to continue the progress of the water; and where there are bridges, roads, or small eminences, by trunks or other contrivances made so as to convey the water underneath them.

When proper preparation has been made for introducing and spreading the water, it will be necessary to form drains to receive and carry it off in nearly the same proportion that it has been introduced; which is to be effected by making them parallel to the gutters at even distances from each, or, as the irregularity of the land may require, but narrowest at the highest part, increasing in width as they approach the lowest (which is the reverse of the preceding works), until they arrive at the main channel which is to take off the water that has been collected on the land.

As when the water is first turned upon the land, it may, perhaps, be found that it will not spread itself evenly: this may be regulated as noticed above, by stops across the feeders or floating gutters, at such places or distances as the operator may find necessary, which may be made by putting down a stake at each side of the water and placing a board before them.

There is another circumstance to be particularly regarded in attempting to improve lands by the application of water, which is to ascertain that both the soil and subsoil are naturally dry, or have been made so by proper drains, otherwise they cannot be benefited by watering, as has been found from much practice and experience. Consequently the previous operation of draining is indispensably necessary, before lands in which there is much moisture can be flooded with any probability of success. The perfection of watered meadows consisting as already noticed, in the operator's having it in his power to let on or take off the water at pleasure; it follows, of course, that a complete power of draining is as requisite as that of the command of water.

Mr. Marshall has given practical directions for four methods of applying water, artificially, to the surfaces of grass lands in his able work on Landed Property:

1. *Covering low flat lands with stagnant or slowly moving water.*

2. *Raising flat lands into ridges, and overflowing them with running water.*

3. *Spreading running water over naturally uneven surfaces; and*

4. *Watering sloping grounds that have been raised into ridges, by cultivation.*

In the first case, which he supposes, "was formerly the one in use, for enriching the bases of vallies, by the means of water in this country. In the midland counties, tradition, he says, speaks of it with familiarity: and the remains of works that have been used in practising it, are still evident. Even in the western districts of the southern range of chalk hills, which have long profited more by irrigation than all the other districts of the island, this, it is more than probable, he thinks, has been heretofore the only method in use. It is, indeed, an interesting fact, that the far-famed long grass-mead of Orcheston (in Wiltshire) is still watered in this manner." But he conceives that there are few situations, however, in which this method can be now practised with the best effect. The one to which it is most applicable is, he supposes, a drained morass, or other flat

moory ground, through which a stream naturally passes, or to which a sufficient supply of enriched waters can be led. A body of water, lodging on a light spungy surface, tends to compress and consolidate it: while the sediment of foul waters, let fall in passing from an agitated to a stagnant state, further promotes this tendency. The rich moory meadows and pasture grounds, which are seen in various parts of the kingdom, were doubtlessly, he thinks, brought to their present profitable state, by being flooded with stagnant or slowly moving waters."

But "another, and perhaps the only other, class of lands, to which this method can now be properly applied, are dry valley lands, which are composed of a sufficient depth of soil for the pasture of herbage, with a subsoil of flints, pebbles, or rough gravel, to draw off quickly, the superfluous moisture which may be left in the soil, after its surface has been freed from water; and, thereby, to give vegetation the immediate freedom of action." But lands of this sort with a sufficient command of water, are much less frequently met with than those of the former class, though highly desirable.

The manner of flooding flat or dishing lands with water in this state "is, he says, simply that of raising a dam across the lower end of the site of improvement, of a sufficient height to overflow the land, and of sufficient strength to sustain the weight of the water; with a channel at each end, to convey away the overflow; and with a valve in the middle (or in the lowest part) to draw off the water, at pleasure." And when "the subsoil is not sufficiently absorbent and open to free the soil from superfluous moisture, presently after the body of the water has been drawn off, a main drain should be run up into the area of the site, and lateral drains be branched off, from this, to wherever the water is found to hang; whether on the surface, or in the subsoil." But that where this is throughout retentive, though but in a small degree, the land may be deemed improper for this mode of watering.

In the second case which he conceives to be a modern practice, comparatively with that of "flooding —"drowning"—or covering the entire surface with standing water, being still confined, as a general practice, to one quarter of the kingdom. Among the chalk hills of Wiltshire and Dorsetshire, (more particularly the former) there are large tracts of waterformed valley lands, which have long been irrigated with scientific accuracy. These lands, it is probable, were first brought to a firm sward, by flooding them with standing water; and have since been moulded into their present form."

In explaining the theory on which it proceeds, and on which it may be beneficially had recourse to when a sufficient supply of proper water can be had, it is remarked that "plants, as animals, have their natural elements. Water plants—aquatics which root beneath the water live but in this element; where they are secluded, in a certain degree, from air and heat. On the contrary, the agricultural vegetables of this country, among which are to be ranked the more nutritious meadow plants, require a free communication of atmospheric air and heat, to every part of them: they cannot live with their roots immersed in water, nor flourish while water is lodged immediately beneath them. And between these two opposite tribes of plants is found an intermediate class, a sort of amphibious tribe, which delight in water, yet can live, though not flourish, on dry land, provided it is of a cool nature.

Where, says he, the soil of the low flat meadow lands, rests on a retentive base, the palustrean tribe seldom fail to intermix with the meadow herbage, in a season which is favourable to dry land plants, the superaquatics are kept in a dwarfish underling state. On the contrary, in a wet season, they flourish, while the better herbage becomes weak and unproductive. If, through neglect, the soil be suffered to remain saturated for some length of time with water, the meadow plants dwindle, or die, and the ranker marshland weeds take possession. Hence, continues he, in the practice of irrigation, the propriety of quickly relieving the soil from superfluous moisture, in order that the better herbage may gain the ascendancy: especially in the spring, when a few days of warm weather, at the critical juncture, may give the one or the other an ascendancy, during the early summer months. Even in meadows, where the superaquatics do not abound, the same principle of practice holds good. For it is well known, to common observation, that flat retentive meadows, which do not readily shoot off surface waters, are materially injured by a cold wet spring, by which the finer more nutritious herbage is cut off, or effectually checked; so that the hay crop proves thin, is of small bulk, and an inferior quality."

It is further added that, "it is evident, that water, even standing water, may remain, for a short time upon dryland plants, with impunity (especially perhaps in a cold season); but that, wherever it is suffered to lie long on the surface (more especially perhaps during warm weather) there, dryland plants, in general, are destroyed,—are probably suffocated, for want of that supply of air which standing water is incapable of affording them. Hence, he thinks, appears to arise an advantage of irrigating with running water. And hence also the propriety of irrigating, by intervals; in order to enable the plants to recover their strength, and exert their natural powers, imbibe the nourishment which the water may have provided for them; and thereby to encrease their strength. And, moreover, the warmth which moving bodies, even agitated liquids, naturally generate, may be suggested as another advantage of irrigating land with running water."

These remarks, he supposes, has been "sufficient to explain, the reason for laying up cool flat lands into ridges, for the purpose of irrigation. Experience has well ascertained, that where calcareous water, at least, is spread over a sufficiently sloping surface of grass land, the superaquatic plants disappear: while the more nutritious grasses luxuriate. On the contrary, where the same water is suffered to loiter on a flat soil, lying on a retentive base, the grosser wet land plants prevail. And, further, that

the same or similar water, thrown over the same or similar soil, with the same turn of surface, but with a dry absorbent base, produces luxuriant crops of valuable herbage. And from long continued observations, on facts of this kind, has doubtlessly arisen the present practice of Wiltshire and its environs."

The operation is directed to be performed in a suitable situation for receiving the stream: "mark out a plot of green-sward, two perches in length, and one perch wide. Roll back the turf, and form the soil into a ridge, as below, being careful in forming it, to keep the best of the mould still toward the surface; and leaving the open on the ridge, eight or nine inches deep, and nearly level;—the end toward the stream being made somewhat higher, and rather wider, than the other; that the water may flow evenly over every part of the ridge. Return the turf, being careful to lay it evenly and firmly along the sides of the trench; and cut a drain on either side of the ridge thus formed; with proper outlets, to carry away the waste water. Lastly, raise a channel, between the ground and the source of the water; to conduct it into the watering trench: and continue to adjust the ground, until the water will flow, evenly, over every part of it." The following form of a ridge has been found to answer perfectly in Mr. Marshall's practice.

It is remarked that, "this operation may be performed, either with the spade, or with the plough. The former is the more expensive method; but it is more accurate, and sooner brings the improvement to profit. By the spade, the natural soil is distributed again at the surface. By the plough much of it is buried under the ridges; while the furrows are left destitute." Where there is a great depth of fertile soil, the plough may be used with better effect than where the soil is shallow.

In respect to the *elevation* of meadow ridges, it may be observed, he says, to be evident, that "on the principle offered, the steeper the sides are formed, the more beneficial will be the effect of the operation. But it is not less obvious that the expense of it will be proportionally great. Something may depend on the nature of the materials of which the ridges are to be formed, and the method of forming them. If, in moving the materials, a regular stratum of flints or gravel could be buried, at a proper depth, as an open subsoil, a small degree of elevation would be sufficient. In ordinary cases, one foot of rise, to a statute pole ($16\frac{1}{2}$ feet) of base will suffice; provided the drains between the beds be sunk to a sufficient depth. One foot of rise to five feet and a half of slope, or eleven of base, may be considered as the maximum of elevation. On these premises, he thinks, we may conclude, that a ridge set out one statute perch in width, at the base, requires an elevation of nine to eighteen inches at the ridge; onn of two perches in width, an elevation of eighteen inches to three feet; according to the nature of the materials with which it may be formed." And that with respect to "the *turn of surface*, or form of the slope, there are sufficient reasons why it should be convex, not a regularly inclined plane, nor of a concave or hollow cast. A regular sheet of water spread over a sloping surface has a natural tendency to break into streamlets, and collect into partial currents. In the process of watering, this effect is produced, in part, by the unevenness of the surface it is spread over, and the obstructions it meets with, in its descent; as well as by the natural propensity of falling waters to collect into a body; and the steeper the descent, the greater freedom of action this propensity acquires. Hence, the propriety of giving the water a gentle descent, on the upper part of the slope, in order to preserve the entirety of the sheet as far down the side of it as may be; and this is effected by the convex form: which, also, gives firmness to the sides of the trench. Further, a convex surface, while it lessens the descent at the ridge, encreases it, at the foot of the slope, and thereby hastens the drying in that part; to which the superfluous moisture of the entire slope tends; and where noxious plants are most liable to gain a footing;" the soil being, there, kept the longest in a state of saturation.

The next consideration is, "the width of these convex beds. In what has been said of their elevation, it plainly appears, he says, that the expense of forming them is in proportion to their width. An acre of ground may be raised into beds of a rod wide, with the mentioned slope, at half the expense, perhaps, that another acre can be formed into those of two rods in width, and the same slope: the latter requiring to be raised, at the ridge, twice the height of the former: beside the work, in this case, lying within a smaller compass. And from what has been said of the form of the slope, it is equally evident that water may be more evenly spread, over a narrow, than over a wide or deep slope; and that a narrow bed will dry more quickly, than a wide one, of the same soil and substrata. Nevertheless, there is an advantage of wide ridges, which, in some situations, may more than overbalance all their inconveniences. A given quantity of water will irrigate twice the quantity of ground (though not perhaps with twice the profit) raised into beds of two poles wide, that it will in those of one perch in width: beside the current expenses of management being less." But, that where "the quantity of water is great in proportion to the quantity of ground, or if it can be collected again, and spread over other lands, belonging to the same proprietor, which lie below those that have been irrigated, narrow ridges may claim a superiority."

It is hence concluded, that "the proper width of water-meadow ridges depends much on soil and situation, and on the quantity of water, proportionate to the quantity of ground. In the environs of Salisbury, the prevailing width is ten yards, nearly two perches. In the neighbourhood of Amesbury, there are some of three times that width. But they are

nearly flat." From one to three poles may, he thinks, be fairly set down as the ordinary limits of width, that is proper. In regard to "the arrangement of meadow beds, and the general economy of a watered meadow, almost every thing may be said to depend on the particular circumstances of the given site."

But "suppose a copious stream of good water, to pass through a flat of water-formed land, in a dilation of the base of a valley. And further, suppose this site to be nearly level, from side to side of the valley, or to have a gentle descent from the banks of the stream towards the outer margins: a case which frequently occurs, where flat lands have long been liable to the overflow of foul waters. In this case, says he, the beds require to be run across the valley (directly, or obliquely, as the descent may dictate); and the water to be conducted to them, by an artificial channel widening on each side of the natural stream, with a main drain, near each outer margin, leaving room for a carriage way between it and the foot of the bank of the valley: and, where the grounds to be watered are wide, other roadways may be left between the conducting trenches, and the bed of the brook or rivulet" from which the water is taken.

It is remarked, that "these dry slips of land are useful, not only in conveying away the crop, but in furnishing comfortable lodging grounds for pasturing stock, when the area of the meadow is moist. It follows that these road slips ought to be watered with caution, late in the spring, and during the summer months.

With respect to "the most eligible method of raising the water, high enough to fill the trenches, it is that of placing folding gates (like those in use for navigable canals) across the stream; at the upper end of the site of improvement. In summer, or when the water is not wanted for use, the gates are thrown open, and fastened back, to give free passage to floods. But, during the time of irrigation, they are kept shut; to throw a constant supply of water into the main trenches." But where "the descent, downward of the valley, is considerable, the main trenches or conducting channels require to have *stops*, or rather *checks*, placed across them, at distances proportioned to the descent;—in order to fill, with due effect, the *working trenches*, whose mouths open into the conducting channels. And, in order to gain more perfect command of the water, the mouth of each operative trench ought to be furnished with a regulating valve, to admit just water enough to supply the given ridge, while under irrigation, and to close the entrance, effectually, when it is laid dry. A lifting board,—in the form of a shovel with a short handle,—and sliding in upright grooves formed in the faces of two slender posts (joined together within the ground)—becomes a simple and eligible regulator for this purpose." And "where a meadow ridge happens to be long and much declining (circumstances that ought as much as possible to be avoided) checks are likewise requisite to be placed in the working trench; to assist in distributing the water evenly over its surface. These checks are formed in different ways. Two thick tough sods placed in the trench, so as to leave an opening between them, narrow enough to force a sufficient quantity of water over the sides of the trench, above them, and wide enough to let the remainder pass down freely into the lower part of the trench,—form a simple and not ineligible check, for this purpose; as the opening may be readily widened or narrowed" as there may be occasion.

When the descent straight across the valley is not sufficient, where the descent down it is considerable, it is advised to direct the beds obliquely across it; and by this easy mean gain the required fall. But when "the base of the valley is wide, so that the length of the beds, if run out from the natural stream to the outer bank, will be too great (as fifty to a hundred yards) wind a conducting trench along the foot of the bank, as well as by the side of the brook or rivulet, and sink a deep drain in the midway between them."

In respect to "the dimensions of working trenches, they ought to vary, according to the breadths and lengths of the beds to be watered. The wider and deeper they are formed, the more freely a large body of water will pass along them. Hence it is evident that the upper end of a long trench ought to have the larger dimensions; in order that a sufficient supply of water may pass freely to the further end; where the dimensions are required to be less; as the uniform contraction serves as a continual check to the water, and thus tends to force it, in its passage, over the sides of the trench. From six to fifteen inches wide, and from four to ten inches deep, may serve to give a general idea of their dimensions."

It is, however, advised in *complex cases* where the sites of improvement are extensive with plenty of water, the surfaces irregular and the lands belong to different proprietors, to study the business on the spot where such practises are established, and procure an experienced workman or superintendant to assist in setting out and executing the plan.

In the third case the practice which prevails in the more western counties, particularly Devonshire, where it has been established immemorially. "The spring waters which issue from the slate rocks that are the prevalent substructure of that part of the island, are of a fertilizing nature; and the steepsided vallies, which there abound, are mostly covered with a rich deep soil, fit for hay ground. These circumstances may well serve to account for the prevalence and the antiquity of the practice, in that quarter of the kingdom. Something of this practice, on a small scale, has also been long in use, in different parts of England, for spreading the wash of dung yards and homestalls, over grass lands lying beneath them. Of later years, it has been employed, in different districts, to distribute more copious streams."

Where the quantity of water is small,—"whether it flow from a farmstead, or a spring of superior quality,—it ought to be collected, in a reservoir, wherever it is not employed on the ground; more especially in the spring months, while the hay crop is growing;

in order to be able to liberate it, should its growth be arrested by a dry season; and to meliorate the soil, as soon as the crop is off the ground, for the benefit of the aftergrowth. The ground, or site of improvement, is mostly given, in the source of the water, or the point at which it can be commanded. Where this is a matter of choice, it is generally advisable to run the channel of supply along the brink, or brow of a slope, in the manner recommended above: thus giving the flatter lands above it, to the plough, to which, in level situations, they are best adapted,—and the steeper to the scithe, as watered hay grounds, for which they are most eligible:—extending the ground, downward to the foot of the slope,—and to the flatter lands beneath it:—provided their subsoil is absorbent and open; and provided the given quantity of water is sufficient for the whole extent."

It is obvious, that "the canal, or artificial water course, from the natural stream, the fountain or the reservoir, to the ground of improvement, requires a certain fall to give a due degree of current to the water that it conveys." Where "the motion of water, in a made channel, is sluggish, part of the water is liable to sink, and be wasted by the way. Slowly moving waters does not tend to make the bottom of the channel firm and watertight, like a living stream. Nor will a channel of the same size convey an equal quantity of water in the same time, nor will it clear itself so well from obstructions, as a quicker current. —On the contrary, dead water gives the suspended matter, which ought to be conveyed as nutriment to the plants, an opportunity (for the want of due agitation) of dropping, by the way, in the form of mud: and thereby foul[illegible] the channel." or course.

But on the other hand, when the current is "made too rapid, it is liable to wear the channel, and to cause unnecessary repairs. Beside, where all the height, which can be properly got, is required, every foot of superfluous fall contracts, unnecessarily, the field of improvement. From much attention, practically bestowed on this subject, Mr. Marshall is of opinion that one per cent, (namely one inch, foot, or yard of fall, in every hundred inches, feet, or yards of distance) is, in ordinary cases, the proper fall as giving an active, but an inoffensive current. Under the circumstances above mentioned, and where the length of channel required is great, one half per cent, may be made to suffice. Two thirds of the ordinary fall gives a degree of life to the stream, and may, in many cases, be eligible" and proper.

In marking out water courses of this nature, the use of the level becomes necessary as shown above. The best forms of them whatever the size may be, are those of inverted arches as clearing themselves better when low in water, and giving firmer banks on the lower sides, than is the case with square flat bottomed [illegible] troughed method.

The modes of performing the business, must be directed by the particular turn of the surface of the lands.

In low *valley* lands, whose natural surfaces are sufficiently uneven, to admit of running water being spread over them, without the assistance of art; and whose substrata are sufficiently absorbent and open, to permit them to dry quickly, after the water be taken off; where they lie pretty regularly shelving, the method of watering is to lead the water along the higher side of the site,—and to draw it off by a main drain on the lower side: straight working trenches, and correspondent drains, being cut, downward of the area; so as to spread the water over the whole, without suffering it to lodge on any part of the surface. This, for the sake of distinction, is often termed the Dorsetshire practice.

But "where the surface is more irregular, lying in natural swells and ridges, with dips and hollows between them, the water is to be led along the tops of such higher parts, without regard to the straightness or regularity of the trenches; and the drains to wind up the hollows and lowest ground, with the same irregular directions."

It is observed, that "there are two ways of ascertaining the true lines of the trenches and drains, in cases of this nature. The one is by flooding the entire area (where this can be done) and driving down "leveling pegs," over every part of it, so as to leave their heads uniformly level with the surface of the water: which being let off, the shortest pegs show the proper lines for the trenches, the longest those of the drains," a practice which was adopted by Mr. Bakewell in Leicestershire.

But "the other method which has occurred in his own experience is attended with less trouble and inconveniency. The higher parts are readily ascertained, and the lines of the trenches accurately traced, with the levelling instrument artificial mounds being raised between the detached knolls when wanted. After the fresh-made ground has properly settled, and the trenches have been duly formed, the water is turned on: and, by this ready mean, the proper lines of the drains are accurately given. This is, he says, an easy way of watering valley lands: and, where the irregularities of surface are sufficiently great, and the subsoil absorbent, it is very eligible; especially, if in making the trenches and drains, the turf and the soil, so raised, be applied in adjusting the natural defects of the surface of the ground."

But in the watering more steeply sloping grounds; as the sides of hills, and the lower banks of vallies: in what is called the "Devonshire Practice," where the sides of the vallies lie in, or nearly in, their natural states. Many of them appearing as if they had never been subjected to tillage; and those which have been under the plough have been laid down again to grass, with nearly their natural surface. The practice of laying up soils into high arable ridges has never, perhaps, there gained a footing.

In these cases "the conducting channel being led along the brink, or across the upper part of the slope, in the manner recommended, the working trenches are to be supplied from it, by the means of checks and valves, as already described. And "the distance between the working trenches is to be regulated by the steepness and evenness of the surface. Wherever the sheet of water is seen to break, and divide into

numerous streamlets, there a trench is required, to catch and respread it: the working trenches, in this manner of watering, operating in the twofold capacity of trenches and drains: fresh supplies of water being let down, from above, to the lower trenches," as there may be occasion.

In cases where the depth, or downward length, of the slope is great, or where an additional supply of water offers itself, or where reservoirs are formed at different heights, an additional main channel is required, to lead a fresh supply, across the midway of the slope. This main trench likewise receives the waste water, from above; and, like the working trenches, acts, at once, as a supplying channel and as a receptacle of waste water. Hence a given quantity of water will irrigate a much larger extent of ground, in this manner of watering, than in irrigating ridges, raised on level ground; though it may be presumed, not with equal benefit.

In the business of forming the trenches, of which ever description, the turf and loose earth that are raised out of them, and which are not wanted to make their lower sides firm and level, are to be used in filling up the channels and dimples in the face of the slope; in order that the water may spread more evenly over it; and thereby to lessen the otherwise requisite number of trenches." And in the same intention "where hillocks or small protuberances occur, as they generally do on natural surfaces, they are to be lowered, by turning back the turf, using their contents as above, and returning the sods to smooth surfaces. But where the knoll is large, water may be led, by a narrow branching trench, to its top, and be thus spread evenly over its sides."

With regard to "the proper descent, or declination, of the working trenches, it depends, in some measure, on the press of water which enters them. One quarter per cent, may serve as a guide in setting them out: first making them of inferior dimensions; and then turning on the water: afterward, enlarging them; and, in doing this, adjusting them in such a manner, that the water will flow evenly out of them, from end to end. And it may be just noticed, that the shorter the operative trenches are made, the more easily they may be regulated, without the encumbrance of checks," which should be avoided as much as possible.

At *fig.* 1. A, A, *plate* XLI, is shown the river running through lands. B,B, two main drains at right angles to the river, one running north the other south, across the meadow to within about six yards of the fences. C,C, fence-ditches at the head of the meadow, used for tail drains to convey the water that runs over the way-panes, I,I, watered from the upper side of the mains, B, B; by means of these lower fence-ditches the water is conveyed into the side-fence ditches, H, H, to the tail-drains, or lower fence-ditches, G, G, and discharged by them into the river A again at K. D, a wear erected across the river to force the water into either of the mains, B, B, which is done by shutting the wear D close. L, L, two wears erected at the mouth of each of the mains, B, B; the uses of which are, when the wear D is shut close, and there is not water enough, or it is not convenient to water both parts of the meadow at once, by shutting close one of these the current is forced into that main whose wear is open, thence to be conveyed through the trenches over the panes, to water that side of the meadow; then by shutting that, and opening the other, the opposite main, B, is filled, and by means of the trenches that side of the meadow is watered in the same manner; and lastly, by shutting them both, and opening the wear D, the water flows in its usual course, and the land on both sides is laid dry. E, E, E, E, are trenches taken out of the mains B, B, to convey the water over. M, M, M, M, M, M, M, M, are the panes or parts of the meadow that produce the grass. F, F, trench-drains to draw off the water from the panes, and convey it into the tail-drains. G, G, the west fences of the meadow, here used for tail drains to convey the water into the river. K, the place where they discharge themselves into the river. N, N, two drain sluices, one at the lower end of each main, used when the wears L, L, are either or both of them shut close; these drain sluices are opened to convey the leaking out of the mains into the fence drains, H,H, to keep the land dry and healthy. I, I, are the way- (or road-) panes, watered from the banks of the mains B, B, the whole length of the mains.

At *fig.* 2. A is the river. B, a wear erected across the river. C, the head main taken out of the river above the wear B. S, a wear erected across the main C, to be kept close when the meadow is not watered. D, a smaller main, taken out of the head main C. F, another small main, taken out of across the head main C. E, E, E, E, bends made in small mains, and trenches just below the places where the branch-trenches are taken out of them, to check the water at those places, and force a proper quantity into branch-trenches. G, G, G, G, G, G, bends made in those branch-trenches which have so much descent that, were it not for these bends, the water would run down almost to the end of the trenches before it would flow over the panes. H, H, H, H, H, H, H, H, H, trench-drains to convey the water off from the panes. There should be on each side of every trench, unless a fence-ditch, or the river, can be used instead. P, P, sluice-drains, to convey the leakage of the water out of the mains D and F. L, L, L, L, trenches taken out of the small mains, to convey the water into the various parts of the meadow, which at the lower part increases in width. T, T, T, T, T, branch-trenches, taken out of the other trenches. N, N, N, N N, N, N, N, N, various gutters taken out of the ends of some of the trenches, to carry the water to the longest corner of the panes, and sometimes taken out of different parts of the trenches, to water some little irregularities in the panes, which without such assistance would not have any water upon them. I, a master or considerable drain, into which several others empty themselves, and thence run into the tail drain. K, a sluice, erected at the end of the small main D, to force the water into the branch-trench T, that being the highest ground. M, the tail-drain, which receives

all the water from the other drains, and conveys it into the river at O, the point where the water from the tail drain runs into the river. R, a fence ditch, being the bound of the meadow on that side, and used also as a drain to convey the water into the tail-drain.

And at *fig.* 3, A is the head main, taken out of the river, forming an angle of about 60 degrees. The descent of the land permits the main to overflow it at B, the point where the meadow can be watered; consequently the place for the main B B to be drawn, at right angles with the stream, the whole breadth of the meadow intended to be watered, excepting about five yards at each end. C, D, two wears erected to turn the water either way; or, when both are shut, to keep it in its proper current. E, another ware for the purpose of dividing the meadow into turns. F, G, H, I, K, L, AD, sluices to convey the water into, or stop it out of the trenches, as found necessary. M, N, two drain sluices. O, P, Q, R, S, T, V, W, bends to stop the water in those trenches which have the quickest descent. X, Y, Z, *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *k*, gutters to carry the water to the ends of the panes, and little irregular parts in the meadow. C C the lowest part of the meadow, where water is conveyed away. From the main B B to the principal drain A B, the meadow is watered regularly; but betwixt that drain A B and the small main A C, there is a great flat. To fill it up would be the regular method, so that the trenches taken out of the main B B should go down to the end of the meadow; to avoid that expense, the main B B is continued down on the east side of the meadow, till it has passed the flat grounds to F. Materials being had from the drains, &c. to raise the ground high enough to convey the water in the main on to F; which being the high ground, it is then carried east and west, the same as the main B B. Trenches are taken out of it, to water the lower part of the meadow. Trenches are also drawn out of the main that runs north and south, to water the flat part the opposite way; with drains between them to carry off the water into the west fence ditch: at E a ware is built to stop the water, and turn it into the trenches above it; at F a sluice is placed to turn the water into the main A C. For the same reason, the sluices A D and K are set at the mouths of these trenches to force the water down to the lower divisions of the meadow. The trench-drains A E and A F convey the water from the upper pane of the main A C, and also from one of the cross trenches A H. And A F and A B do the same from the other cross trench A G. To water this meadow it will be necessary to divide it into two, or perhaps three turns, if water should be scarce. One turn will be made by opening the wear C, and shutting that at D; the sluices G and H being also opened, the water will flow over the lower side of the main B B from D to M, down all those trenches that are taken out of it; and will be carried off from the trench-drains by the principal drain A B to C C. Thus will that part of the meadow be watered. Another turn is made by shutting the wear C, opening D, and shutting E. The sluice H being stopped, and the sluices I, A D and K opened, that division of meadow from the wear D to E will be watered, and the panes on each side of the main B B also, by the water flowing over its bank as it passes along; which is carried off on the side by the river, on the other by the principal drain A B; and also from the panes on each side of the trenches A G and A H, by the same drains A B, and the trench drains A F and A E, into the west fence drain to C C. The other turn is made by shutting the sluices I, A D and K, opening the wear E, and so much of the sluices F and L, as will let water enough through to supply the trenches below them; keeping that at F partly in, to turn the water into A C; and that at L the same also, partly to check the water, and force it over the sides of the small main A C, and into the trenches 1, 2, 3, 4. The reason for putting the sluice across the small main A C at L is, that part is supposed to be flat ground from L quite to C C; consequently the water would, if not prevented, run so fast down to the ends of the trenches 5, 6, as to draw all off from the high grounds, from L upwards. The small main A C is too wide to be checked by a bend at that place; besides, it would not answer so well to regulate the quantity of water necessary to water the panes from L to C C; and it is on the account of those trenches 5, 6, that a sluice is built. The water which runs out of this meadow at C C is, if the descent is quick, immediately made use of to water the next meadow below; or if there should be but little descent, it is oftentimes considered as a head main; and wherever below it will rise over the land, it is again made use of, in the same manner as it was at first in this plan of watering land. These are the methods advised and described by Mr. Boswell in his valuable Treatise on Watering Meadows.

In the fourth or last case, that of watering ridges on slopes in grass-lands, or "such shelving grounds as have formerly been in a state of aration; in which they have been raised into high wide convex beds, resembling those recommended above, for flat meadowy surfaces; and have been laid down to grass, in that form: a practice which Mr. Marshall, says, has been common to many parts of the kingdom, where the feudal or common-field system prevailed: the direction of the ridges being, mostly, straight down the slope. In this case it would be in vain to attempt to spread water over the surface in the manner usually practised on more even slopes. And if it be thrown into open trenches, cut along the tops of the ridges, agreeably to the practice in use for level grounds, and according to the ordinary practice of watering the lands now under notice, the operation becomes very imperfect. For, if the descent is considerable, the water will unavoidably flow out of the trenches, in streams immediately above the checks;" and the sides of the ridges will consequently be watered in a partial manner.

"These difficulties in spreading water, evenly, over ridges on such surfaces, have led some industrious managers to throw them down, and return the slopes to their natural states. But this, where the ridges are high and wide, is very expensive, if done by

hand: and, if performed with the plough, is greatly injurious to the land, for many years."

Mr. Marshall in this case adopted a better plan, "instead of leading the water down the ridges, he threw it into the furrows; and spread it over the sides of the beds, by the means of crooked trenches, winding, in the festoon manner, horizontally, or nearly so, across them,—and led it more effectually over their tops, by pointed trenchlets, depending from the festoons. These winding trenches, like those across plain sloping surfaces, act, he says, both as feeding trenches and as drains, or collecting trenches, to respread the water, evenly, over the ground, immediately below them: thus keeping the entire ridge covered with an even sheet of briskly moving water." He directs that "when the upper ends of the ridges are sufficiently irrigated, the water is to be let down the furrows to the parts below. Or, if the ridges are short, their whole length may be irrigated, at once; by letting down water to the lowest parts, through cuts of proper widths, made with a sharp instrument, through the lower sides of the trenches, where they cross the furrows: these simple regulators operating as checks, in common watering."

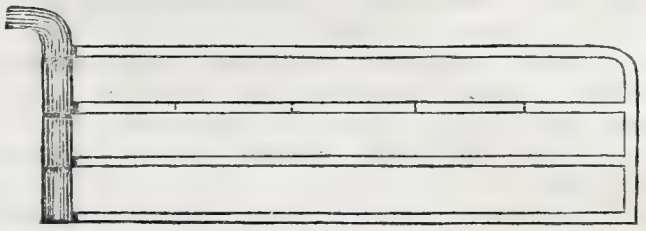
And the distances between the trenches, as well as their figure, must, he says, ever vary "with the steepness of the descent, and the form of the ridge."

In the annexed plate three meadows containing 23 acres, 1 rood and 19 perches are represented in a complete state of watering as practised on a farm at Eriveath near Denbigh, North Wales.

It has likewise been suggested by the same writer that the watering of the soil of arable lands is a practice that is highly deserving of attention; He is conscious that "wherever innoxious water can be conveyed to arable lands, lying with a sufficient descent there, it is more probable, the practice may be found profitable," at least in dry seasons.

The plan which he advises for performing the business is to form the soil into flat beds, with intervals, or trenches, directed somewhat obliquely across the slope, or general descent of the field; or so as to dip from one quarter to one half, per cent, beneath the *dead level*: this declination being equally calculated to communicate, and to carry off, water. "The width of the beds is, he says, to be regulated by the nature of the land. Absorbent soils may be laid into wider beds than those which are repellent, or less prone to receive water." And "the depth of the trenches ought to vary, according to the quality of the water, and the intention of using it. For merely moistening the land, in a dry season, with ordinary water, the trenches, he conceives ought to be deep; so as to lodge the water in the subsoil, rather than the soil. But when an enriched water is to be used, to fertilize the soil, and encourage the crop, during the early stages of its growth, it requires to be communicated, immediately, to the pasture of the plants. Consequently, in this case, the beds should be narrow, and the trenches no deeper than just to prevent the water from overflowing."

It requisite that "the water be conducted to the uppermost corner of the field, or open ground, to be continued down the slope, across the higher ends of the beds; being forced into the trenches, by means of regulated checks placed below their mouths; as occasion may require, the water being either suffered to run, with moderate streams, along the trenches; or, where the quantity is small in proportion to the quantity of ground, being checked at proper distances; so that the whole of it may be absorbed. In this manner going over the ground, and repeating the watering as the quantity of water, or a sufficiency of moisture, may render it necessary. This is shown in the figure below.



This sort of improvement has been lately objected to by some as producing coarse aquatic plants, and as affording hay which is inferior in its properties of supporting animals, but the former probably depends upon the business being improperly executed, and the latter is perhaps without a just foundation, at least it does not seem to rest on any experimental trials.

There cannot from what has been already done, be any doubt of its being very beneficial in all such situations as are proper for the business when well executed and managed.

WASTORELS, a term applied to outcasts of any sort of things.

WATER-*Farcy*, in *Farriery*, the name of a troublesome disease in horses. This disease has no resemblance to a true farcy, either in its cause, symptoms, or effects, and has only obtained this name through custom and ignorance.—The water-farcy, then, is nothing more than an *œdema* of the skin, which often happens in epidemical colds. In some cases it appears more generally dropsical, and the water is not confined to the belly and limbs, but shows itself in several parts of the body by soft swellings yielding to the pressure of the finger. The last kind generally proceeds from foul feeding, or from the latter grass. In the former case, we see the limbs and whole body enormously swell, and become very hard, the belly and sheath greatly distended: yet these may be reduced by slight scarifications withinside the leg and thigh with a sharp penknife, and three or four strokes on the skin of the belly on each side the sheath. A few purges afterwards will generally complete his recovery. In both cases the curative intentions are to discharge the water, and brace up the relaxed solids throughout the whole body. To this end purge once or twice in ten days; and give intermediately either of the following:

Take of Black hellebore, fresh gathered, two pounds.

Wash, bruise, and boil it in six quarts of water to four; and then strain out the liquor, and

put two quarts of white-wine on the remaining hellebore, and let it infuse, warm, forty-eight hours: then strain off, mix both together, and give the horse a pint night and morning.

Take of Nitre, two ounces;
Squills, powdered, three drachms to half an ounce;
Camphor, one drachm;
Honey enough to form them into a ball, to be given once a-day alone, or washed down with a horn or two of the above.

This is the course which Gibson has recommended.

WATER-*Poa*. See *Poa*.

WATER-*Workers*, a term applied to the former's of meadow drain and wet ditches, as in watering or otherwise.

WATH, provincially a name commonly applied to a ford.

WATTLE, a kind of hurdle formed with split wood, and used for making folds for sheep. It also signifies a fleshy excrescence growing from animals.

WATTLES, a term signifying rods laid upon a roof to thatch on.

WAVERS, a term applied to the young timberlings, that are left standing in falling a wood.

WAX, a substance formed by bees from the farina of flowers. See *Bee*.

WAY-BREAD, a name sometimes given to the herb plantain.

WAYED-HORSE, in *Horsemanship*, is one that is already backed and broken, and shews a disposition to be tractable.

WAY-GOING CROP, that which is taken from the land the year the farmer leaves a farm.

WEAKY, a work signifying juicy in contradistruction to hask.

WEANING, the means employed to reconcile a young animal to the loss of its mother's milk. In the weaning of a foal, some take it from its dam the over night, and put it into some empty place where it may rest, and out of the hearing of the mare. On the next morning they give him a little meat, as grass, hay, or chaff, with some clean water. In a few days he will have forgotten the dam, and may be put into a pasture with other colt-foals. See *Horse* and *Calf-weaning*.

WEANEL, a term applied to an animal newly weaned.

WATERING, in *Horsemanship*, the act of supplying horses and other cattle with water at stated times. It is a business that should be regularly attended to by the horse-keeper. See *Team* and *Horse*.

WEATHER, a term applied to denote the state or disposition of the atmosphere, with regard to heat and cold, drought and moisture, fog, fair, or foul, wind, rain, hail, frost, snow, &c.

A knowledge of this is of vast importance to the farmer, as the securing of his produce in a perfect manner greatly depends upon it, and it is in and by means of the atmosphere, that plants are nourished, and animals live and breathe: any alterations in its density, heat, purity, &c. must of course necessarily be attended with proportionable ones in the state of these.

The great but regular alterations a little change of weather makes in many parts of inanimate matter is fully shown in the common instances of barometers, thermometer, hygrometers, &c. and it is owing partly to our inattention, and partly to other causes that man like other animals does not feel as great and as regular ones in the tubes, chords, and fibres of his own body.

In order fully to establish a proper theory of the weather, it would be necessary to have registers carefully kept in divers parts of the globe for a long series of years, whence we might be enabled to determine the directions, breadth, and bounds of the winds, and of the weather they bring with them; with the correspondence between the weather of divers places and the difference between one sort and another at the same place, and thus in time learn to foretel many great emergencies; as extraordinary heats, rains, frosts, droughts, &c. But hitherto very few, and only partial registers, or accounts of the weather have been kept. The general conclusions that have been drawn from the experiments that have been made on this subject, are, that barometers generally rise and fall together, even at very distant places, and a consequent conformity and similarity of weather; but this is the more uniformly so, as the places are nearer together as might be expected. That the variations of the barometer are greater, as the places are nearer to the pole, thus, for instance, the mercury at London, has a greater range by two or three lines than at Paris, and at Paris a greater than at Zurich; and at some places near the equator, there is scarce any variation at all; that the rain in Switzerland and Italy is much greater in quantity, for the whole year than in Essex, and yet the rains are more frequent, or there are more rainy days in Essex, than at either of these places; that cold contributes greatly to rain, and this apparently by condensing the suspended vapours, and so making them descend: thus, very cold months, or seasons, are commonly followed immediately by very rainy ones, and cold summers are always wet ones; that high ridges or mountains as the Alps and the snows with which they are covered not only affect the neighbouring places but even distant countries as England, often partake of their effects.

And the prognostics of the weather formed from other observations are that a thick dark sky lasting for some time, without either sun or rain, always becomes fair first and then foul, that is it changes to a fair clear sky before it turns to rain. The reason is obvious: the atmosphere is replete with vapours which though sufficient to reflect and intercept the sun's ray from us, yet want density to descend, and while the vapours continue in the same state, the weather will do so too: accordingly such weather is commonly attended with moderate warmth, and with little or no wind to disturb the vapours, and a heavy atmosphere to sustain them; the barometer being commonly high: but when the cold approaches

and by condensing the vapours drives them into clouds or drops the way is made for the sunbeams; till the same vapour, by farther condension, be formed into rain and fall down in drops. And that a change in the warmth of the weather is often followed by a change in the wind. Thus the northerly and southerly winds, though commonly accounted the *causes* of cold and warm weather, are really the *effects* of the cold or warmth of the atmosphere: of which Dr. Derham assures us he had so many confirmations that he makes no doubt of the fact. Thus it is common to see a warm southerly wind suddenly changed to the north, by the fall of snow or hail; or to see the wind in a cold frosty morning, north, when the sun has well warmed the air wheel towards the south; and again turn northerly or easterly in the cold evening.

From the shepherd of Banbury's rules it may be observed that when the sun rises red and fiery, there will be wind and rain; but that when it rises cloudy and the clouds soon disappear or lessen, there will certainly be fair weather. And when the evening is red and the morning grey a fine day may mostly be predicted.

When there are small and round clouds, of a dapple grey colour, with a north wind, it may be concluded that there will be fair weather for two or three days, but that large clouds like rocks are a sign of great showers. And when small clouds increase it is a sign that there will be much rain, but if the large clouds are seen to lessen there will be fair weather.

It may also in summer or harvest when the wind has been south two or three days, and it grows very hot, and clouds are seen to rise with great white tops like towers, as if one were on the top of another, and joined together with black on the lower side be considered a sign that there will be thunder and rain suddenly.

And that when two such clouds rise, one on each hand it is time to make haste to shelter.

When a cloud is seen to rise against the wind or side wind it is a sure sign that when the cloud comes up near you the wind will blow the way that the cloud came. It is the same with the motion of a clear place, when all the sky is thick except one edge.

And "at all times, when the clouds look black in the west it is sure to rain, or if raining it is sure to continue; whatever quarter the wind may be in; and on the contrary, if it breaks in the west it is sure to be fair."

Fair weather for a week, with a south wind, is likely to produce a great drought.

The wind usually turns from north to south quietly, but comes back to north strong and with rain. Sudden rains never last long: but when the air grows thick by degrees, and the sun or moon and stars shine dimmer and dimmer, it it likely to rain some time.

When it begins to rain from the south with a high wind for two or three hours, and then the wind falls but the rain continues, it is likely to rain twelve hours or more; and it generally rains till a strong north wind clears the air. But when it begins to rain an hour or two before sun rising, it is likely to be fair before noon, and continues so that day; but if the rain begins an hour or two after sun rising it is likely to rain all that day unless the rainbow is seen before it rains.

When mists rise in low ground and soon disappear, it is a sign that there will be fair weather, but when they rise to the hill tops, there will be rain in a day or two.

And a general mist before the sun rises, near the time of full moon, is a sign of fair weather.

When there are mists in the new moon, there will be rain in the old; and if there are mists in the old moon, there will be rain in the new.

In regard to the seasons as spring and summer, when the last eighteen days of February and the first ten days of March are for the most part rainy, the spring and summer may be concluded likely to be so too.

The shepherd of Banbury says also, that he never knew a great drought but what began at that time.

And the winter, when the end of October and beginning of November are for the most part warm and rainy, January and February are likely to be frosty and cold, except after a very dry summer. But that when October and November are snowy and frosty, January and February may be likely to be open and mild.

It may be remarked that in summer when sheep rise early in the morning it is a sure sign of either rain or a very hot day; and that in all seasons when they jump and play about it is a sign of rain or wind (but generally both,) in the summer, and very stormy weather in the winter.

In winter when the sheep lie under a hedge, and seem loth to go off to pasture, and bleat, it is considered a sign of a storm.

When rabbits get out to feed early in the evening, it is a sign of rain in the night in summer, and of either rain or snow in winter, and when it is likely to be a bad night, they will be apt to get home before it is dark.

When owls screech, it is a certain sign of rain, and mostly in a very short time.

Also, when woodpeckers cry it is a sign of rain. For this reason in some places they are called rain fowl. Likewise, when peacocks cry much it is a sign of rain.

When the cocks begin to crow while it rains, it is a sign of fair weather.

And when sheep are fed with hay in the winter, and in frosty and snowy weather they leave the hay, it is a certain sign of the frost's breaking up.

Before a wet summer, the swans build their nests very high; but before a dry summer they build very low. The butter bump also does the same.

Where in the time of hay-making the black snails are to be seen stretched along on the swath of grass, it is a sign of rain.

And when frogs look black instead of a golden yellow, it is a sign of rain.

But when the raven is observed early in the morning soaring round and round at a great height in the air, it is a sure sign the day will be fine, and that the weather is likely to set in for fair.

And in summer, when the dor beetle is seen flying about in the evening, the next day is likely to be fine.

Also when the bat is observed flying about very late in the evening, the next day is likely to be fair.

Likewise when the swallow is observed to fly high, the weather will most likely be warm and fair. But when it is observed to fly low, and dip the tip of its wings in the water as it skims over the surface, the weather is likely to be rainy.

And the continual hoarse squalling of the Guinea fowl, the quacking of ducks and geese, and the loud croaking of frogs are sure signs of rain.

Also when bees do not go out as usual, but keep in their hives, it is a sign of rain.

Before great storms the missel thrush sings particularly loud and continues to do so till the rain begins. For this reason in some places it is called the storm fowl.

And pigs appear very uneasy before high winds, and run about squeaking as if they were in great pain.

Also in autumn, when flocks of wild geese are observed to fly over in a westerly direction, it is a sign there soon will be hard weather.

The early appearance of the woodcock and fieldfare likewise indicate cold hard winters. Much information of this kind may be found in Marshall's "Minutes of the Southern Counties."

Other conclusions may be drawn from plants, as most vegetables expand their flowers and down in sun shiny weather; and towards the evening and against rain close them, especially at the beginning of their flowering when the seeds are tender and sensible. This is visible enough in the down of dandelion and other downs, and eminently so in the flowers of pimpernel; the opening and shutting of which make what is called the countryman's *weather wiser*, by which he foretels the weather of the following day. The rule is when the flowers are close shut up, it betokens rain and foul weather, but when they are abroad fair weather. And the stalks of trefoil, lord Bacon observes, swell against rain and grow more upright, and the like may be observed, though less sensibly in the stalks of most other plants. He adds, that in the stubble fields there is found a small red flower called by the country people pimpernel, which opening in a morning is a sure indication of a fine day.

It is readily conceivable that vegetables should be affected by the same causes as the weather, as they may be considered as so many hygrometers and thermometers, consisting of an infinite number of trachæ or air vessels, by which they have an immediate communication with the air and partake of its moisture, heat, &c. And hence it is, that all wood, even the hardest and most solid, swells in moist weather; the vapours easily insinuating into the pores, especially of the lighter and drier kinds, from which they become applicable to many purposes of art.

Weather *Glass*, an instrument contrived to shew the state of the atmosphere as to heat, cold, moisture, weight, &c. and to measure the changes that take place in these respects, as to enable us to predict the alteration of weather as to rain, wind, frost, &c.

The weather glasses most useful to the farmer are barometers, thermometers, and hygrometers.

WEB, in *Farriery*, a sort of film on the eye. See *Eye*.

WEDDER, the name of a castrated male sheep.

Wedder-*Getter*, a term applied to such rams as are only proper for getting grazing stock.

WEDGE, a sort of lever employed in splitting wood. A mallet and proper wedges for tearing up wood, should always be kept about a farm house.

WEED, any sort of uncultivated plant growing in a field which requires to be extirpated.

In the language of husbandry all such plants as are spontaneously produced in the field without culture or affording profit to the farmer are denominated weeds. These are mostly of a more hardy nature than such plants as require the care of the cultivator, and of course frequently become injurious to such cultivated plants.

They may with propriety be distinguished in the manner of other plants, according to the period of their duration, into

1st. *Annual;*
2nd. *Biennial;* and
3d. *Perennial.*

The first comprehending all such as die after perfecting their seeds, continuing only one year as the term naturally implies. Weeds of this class are for the most part abundantly productive in seeds.

The second includes all such weeds as endure more than one year, and which after perfecting their seeds in the second year perish. This class is likewise in general abundant in the production of seeds.

The third comprises all those weeds which are capable of continuing many years. Some of these have the property of perfecting their seeds annually, without being thereby destroyed, while others less prolific in seeds, have the faculty of reproduction in their vivaceous roots, which are extremely tenacious of life, and there are still others capable of increase both by seeds and roots.

In the nature and vegetation of seeds of different sorts there is considerable diversity. Some are found to sprout forth as soon as they have a sufficient degree of moisture, sending down their roots though not in exact contact with the earth; others only germinate when inclosed in a suitable soil, and have the proper influence of the atmosphere; and there are many of these seeds even of the very small kind, which are capable of remaining in a dormant state for a very considerable length of time, and afterwards vegetate on being placed in a favourable situation, in regard to the influence of the air, &c.

There are other seeds which are provided with a soft feathery material which performs in some degree the office of wings, by which they are conveyed from their native situations and disseminated over lands at a considerable distance.

There is likewise a difference in the vivaceous roots of vegetable weeds, some being branched, others entire, some descending directly downwards, others inclining, some fibrous, others tuberous, some creeping, others knotted or jointed, and probably many

other variations that have not yet been fully noticed. They are in general capable of sending forth new plants from different parts. They likewise vary in the depths to which they send their roots in the soil, some penetrating deep while others ramify more upon the surface.

As different sorts of weeds are found to be prevalent in different situations, it is obviously a difficult matter to form such a list as may be applicable to every district. They have however been lately arranged as being injurious to cultivated grounds in somewhat the following manner, by Mr. Pitt in an ingenious paper in the fifth volume of "Communications to the Board of Agriculture."

1st. as affecting gardens.
2d. ——— corn fields and tillage lands.
3d. ——— meadows and pastures.
4th. ——— waste and uncultivated lands.
5th. ——— the hedges of inclosures.
6th. ——— woods and plantations.

Garden weeds: these are;

Couch-grass, or which in some places is termed twitch, squitch, &c. the roots of the hardy perennial grasses, which are particularly tenacious of growth, as dogs grass (*triticum repens*), white bent grass, (*agrostis alba*), and tall oat grass (*avenu elation*). The two first are readily distinguished by their flowering stalks as well as the ears, which contain the seeds: and the last, as it is observed, has a bulbous-jointed root, which affords shelter to various destructive grubs, worms, and insects; they should therefore be carefully rooted out and destroyed. "They are to be destroyed in gardens by carefully picking out the roots in digging, and as carefully rooting up whatever remaining fragments of the roots may send out a shoot above ground: the roots of the two former are so very vigorous and tenacious of growth, that they will even perforate a potatoe: if they are suffered to get a head they will form a perfect matting beneath the surface, and a green carpet above, to the almost total extermination of any other plant; they cannot, therefore, be suffered where any other plant is cultivated as a crop."

Suffolk-grass, dwarf meadow grass (Poa annua). This is, Mr. Pitt, remarks, "almost harmless in its roots, but increases so rapidly and abundantly by its seeds, as soon to occupy the whole extent of ground near it, if not timely prevented; it is common in gravel walks and pavements, or other spots where the surface is not repeatedly disturbed by the spade or hoe; it is so very prolific in its seeds, that it will produce and reproduce itself four times in one summer: it may be destroyed by taking care to root it out before its seeds are perfected and shed, otherwise the vegetation will be so abundant as almost to bid defiance to the weeders. Scalding it with boiling water, is advised by Mr. Curtis, as the most expeditious method of destroying it. But though a garden weed, it is a sweet and good grass in land of the pasture kind.

Catchweed, or what is called goosegrass, cleavers, hariff (galium aparine) in different situations: it is more common in hedges than amongst a crop, but if the seeds are permitted to shed it will become troublesome, as they are numerous and productive; the leaves are rough, so as to draw blood from the tongue by once or twice gently drawing along, and it may be easily destroyed in gardens by drawing it up before the seeds are perfected. "Young geese are very fond of the branches of this plant; and the seeds may be used instead of coffee."

Garden nightshade (Solanum nigrum), It is common in gardens about Brompton and Chelsea, but seldom found in the country; though sometimes on dunghills. As an annual plant it must be destroyed by being rooted up before its seeds have acquired perfection.

Goosefoot or wild orache (chenopodium album, viride, and hybridum). It is common and luxuriant in gardens, very prolific in seeds and in produce therefrom, if not rooted out before the seeds are scattered on cultivated land, they being very hardy and tenacious of growth. Like all other annual seedlings it is to be destroyed only by rooting up before the seeds are scattered.

Wild orache, or fat hen (Atriplex hastata). It is nearly allied to the chenopodiums, from which it is only distinguished by some of the flowers having only pointails, whilst others on the same plant have both chives and pointals, in common with the chenopodiums: the flowers are small, so that this distinction can only be ascertained by the microscope. It grows on rubbish, dunghills, and in kitchen gardens; is an hardy annual, very fertile in seeds: it is to be prevented or destroyed in the same way as the above.

Fools parsley, or lesser hemlock (Æthusa cynapium). It is common in gardens, and in its early growth resembles parsley, for which it is often mistaken, and when eaten occasions sickness: it should be rooted out when running to seed, when it is easily known.

Knot grass (Polygonum aviculare). It sometimes grows on gravel walks, trailing a considerable length in all directions, is very prolific in seeds; care should therefore be taken to root it up before they ripen: hogs are fond of eating it.

Ground ash (Ægopodium podragraria). It is said to be a very troublesome weed in gardens near London; but Mr. Pitt supposes, confined mostly to the shade of hedges. The plant is, he believes, perennial, and should be prevented gaining a footing in land intended for other crops.

Chickweed (Alsine media). It sometimes grows with great rapidity and luxuriance on land much pulverized by operose cultivation; it is an annual plant, very productive of seeds, and where it abounds it is improper perhaps to give the land a fine culture till it in some measure disappears: swine are extremely fond of this plant, and it is a grateful food, Withering says, to young chickens.

Blackbind weed, in some places called bearbind (polygonum convolvulus). It is a parasitical plant, often climbing up beans and other garden plants, hardy, and extremely prolific in seeds, of which one plant will sometimes produce many hundreds; if the ground be meant to be kept clean of this plant the seeds should never be suffered to shed: the seeds

contain a white flour, and are good for pigeons, poultry, and small birds of different kinds.

Spurge devil's milk (Euphorbia) chiefly, Mr. Pitt believes, the sun spurge (Euphorbia helioscopa). It is an annual plant, not very troublesome, nor difficult of eradication, yet not uncommon in gardens, where he believes it would soon become extinct, if attention were paid to root it out before its seeds were scattered.

Red dead nettle, or dee nettle (Lamium purpureum), which is called an annual plant by Linnæus, and a perennial by Hudson; it is common in our gardens, and flowering early, and a greater part of the year; the growth doubtless principally from seeds, which therefore should not be suffered to shed.

Henbit (Lamium amplexicaule). It is an annual garden weed, which should be weeded out before its seeds are perfected and scattered.

Nettle hemp (Galeopsis tetrahit). It is a luxuriant and disagreeable garden weed, which should be rooted out in time.

Garden sow thistle (Sonchus oleraceous). It is common, and of luxuriant growth. "The seeds of this plant," says Mr. Pitt, "should never be suffered to shed in any situation, for being furnished with feathers, they fly over a country with the wind, and vegetate on the first loose or cultivated ground they settle on. The plant will pay for drawing out of a garden, being a favourite food with rabbits and hogs."

Fumitory (Fumaria officinalis). It is common but not very injurious; and an annual plant, which may be destroyed by preventing its seeding.

Common thistle (Serratula arvensis): the seeds are numerous, and furnished with feathers to fly any distance before the wind, on which account they are liable to grow in gardens, though ever so much pains may have been used in their eradication, which when the case, they should be drawn up by the roots in moist weather with tongs, for they cannot be handled. The suffering of the seeds of this, and many other weeds to ripen and shed (particularly of the class syngenesia), is Mr. Pitt says, "not only a private neglect but a public nuisance, as they will propagate themselves to any distance by means of their feathers, which keep them afloat in the air, and they are wafted about by the various currents of wind till, by degrees, the feathers no longer supporting them, they are deposited in the crevices of loose or cultivated land, where they vegetate, and produce a plentiful crop, to the surprise of many, who wonder by what means they came there." He has "frequently observed a fresh bank of earth dug from the bottom of a canal, produce plentiful and vigorous crops of thistles and coltsfoot, and some people who have seen it have fancied that the seeds or fibres of these plants had been concealed in the earth, not knowing, or not considering that the seeds had been flying in the air, and that an elevated bank of earth was more liable to arrest their progress than the flat even land; as well as that the seeds were more likely there to vegetate, and produce a crop, than on a matting of turf."

Groundsel (Senecio vulgaris). It is another very common garden weed, with seeds feathered as before, and capable of spreading themselves far and near, with this farther chance of propagating themselves, that the plant is extremely quick of growth, insomuch that after clean weeding a garden, walk round it in a week or two, you may be surprised to find many plants of this kind, with the seeds ready to take flight. The eradication of this weed can only be effected by constant and unremitting attention.

Common nettle (Urtica dioica): it generally grows in hedges or shady places, but sometimes appears in other places, when it must be destroyed by rooting up: the leaves when cut may, according to Withering, be mixed with the food of turkies and other poultry."

Mistletoe (Viscum album): it is very common on fruit trees near the Severn, and in many other places, and when gotten to a head said to be very injurious in preventing their bearing; it should, therefore, be plucked off in time to prevent injury. It is sometimes pulled off as a sheep food in the winter season.

The cultivated potatoe (Solanum tuberosum), which, Mr. Pitt says, however "valuble as a crop, is very apt to remain in the ground, and intrude amongst other after crops to their injury, as well as having a slovenly appearance: this inconvenience is doubtless owing to want of clean getting up the crop; but it is very difficult to get up the crop perfectly clean, and every small root, or part of a root, having the eye or sprout in it, will vegetate if it escapes the winter's frost. As it is now found that the shoots of the potatoe will crop well after transplanting, it seems the better way to draw them from among other crops as they appear, taking the advantage of showery weather, and transplant them into a bed by themselves, where they may succeed some early crop, as winter greens, spinach, early cabbages, &c. by which means other crops may be cleaned, and potatoes raised without any expense of seed."

Injurious weeds in tillage lands. The principal weeds which decidedly infest lands under the plough are described below:

Ivy-leaved chickweed (Veronica hederifolia). It sometimes abounds very much, Mr. Pitt observes, "amongst wheat very early in the spring, but seeding and leaving the ground early, perhaps not much injuring the crop: the seed is said to ripen in 28 days from the first vegetation of the plant, which appears in March, and often gives a plentiful produce of seeds, which will lay in the ground many years, ready to vegetate next time the land is pulverised early in the spring; this should, therefore, be done in the fallow, which would occasion the seeds to vegetate, and the plant might be destroyed by ploughing under before its seeds ripen."

Lambs lettuce, corn salad (Valeriana locusta). This plant, Mr. Pitt says, "he never observed till last summer, when he certainly believes it was more plentiful than common in his neighbourhood, (Staffordshire.) He observed it on his farm, both in corn fields and arable pastures, but not in such quantity as to be

Injurious. In a hard tilled field near Litchfield, he found it in great abundance: it is an annual plant, not at all formidable as a weed; it is eaten by cattle. It is common in the county of Salop, according to the Report of that district, on the banks near hedges.

Dogs grass—Triticum repens.

Bent grasses—Agrostis, alba and stolonifera.

Tall oat grass—Avena elatior.

Creeping soft grass—Holcus mollis.

It is observed by the same writer that "the roots of these, and perhaps of some other of the hardy perennial grasses, compose what the farmers call *quick*, *couch*, or *squitch*, that plague and curse to arable cultivation; they are sometimes so interwoven together in the soil in land that has been under hard tillage and bad management, he says, as to form a perfect matting and to choke the plough: they abound, he observes, most in light and mixed soils, not equally infesting strong clays: the first of these, the dogs grass, has been generally referred to by writers, as alone producing couch or squitch, but this idea is now generally known to be erroneous; this grass principally abounding in hedges and gardens, though sometimes plentiful in arable fields, yet not one tenth part of the squitch of arable land is produced by this grass. The most general arable land squitch grass is of the Agrostis family, but to which particular species that most complained of by farmers belong, is not yet agreed amongst botanists. Dr. Stokes, he says, refers it to the fine bent (Agrostis capilaris); but Mr. Dickenson assures him it is a variety of the Agrostis alba; Mr. Curtis however informed him that this squitch grass has never yet been rightly specified, that ought it to termed Agrostis repens. He has frequently observed the ear or awn of this grass to have the general habit of the Agrostis, and it is very probable that more species than one of this genera have the habit of running in the roots, and producing couch or squitch."

And he adds that "the creeping red stalked bent grass (Agrostis stolonifera), and the creeping soft grass (Holcus mollis), are common squitch grasses on strong or cold wet lands; the tall oat grass (Avena elatior), is a very common squitch grass, on the light gravelly soils of his neighbourhood; its roots are composed of a bunch of bulbs, affording shelter to pernicious grubs, worms, insects; it is difficult of eradication, and very pernicious to a crop, particularly in wet seasons."

The first of the above four weeds, or (*triticum repens*) which in the county of Salop is termed *scutch*, is, the writer of the Report of that district says, very common every where as known to the cost of the farmers. According to Withering it can only be destroyed by fallowing in a dry summer. He states that at Naples the roots are collected in quantity, and disposed of in the market to feed horses. The taste is much similar to liquorice, dried and ground into meal that have been made into bread in years of scarcity. They have a detergent quality, and may be useful in the diseased livers of animals.

But, "these grasses, though so troublesome and injurious on arable land, are yet, probably, good meadow grasses, where their roots are not so liable to run as on arable land, loosened, broken, and pulverised by tillage.

It is observed, that "in regard to their destruction on arable land, it can only be effected by giving an early and complete spring and summer fallow, by repeated ploughings in hot weather, with sufficient harrowings between each ploughing to work out the squitch and bring it to the top; and unless the summer prove dry for some length of time, even this will be insufficient, in which case many active industrious farmers have it forked together by hand and burnt; others carry it in heaps to rot; and he has known it mixed with quick lime, which is to be commended: it should, however, be observed, that the great increase of the roots of these grasses is occasioned by hard tillage, or bad management, and often by both."

Mr. Rudge observes that, "it is a most troublesome and almost unconquerable weed on clay lands, on the light lands and loams it may be dragged out and finished by hand picking with tolerable ease; but on the stiff soils, and particularly in the wet furrows, nothing but repeated ploughings and exposure to the sun during the heat of summer, can check the increase of it, hence after a wet summer, the vale lands are generally foul. A crop of spring vetches is well adapted to smother and keep it down."

Wild oat haver (Avena fatua): it is common on hard tilled land, and when abundant, very unsightly and injurious to a crop. Dr. Anderson observes, he says, that this plant abounds so much in the cornfields in most parts of Aberdeenshire, as in many cases to constitute nearly one half of the bear crop (bear is the six rowed barley, Hordeum hexastichon, which is much grown in Scotland); it may be destroyed by the turnip culture, or by well managed early fallowing; and prevented by short tillages, and frequent seeding down to grass. It never occurs, he believes, in any considerable quantity, where there is a good systematic management, and due attention to clean seed: the awns are used for hygrometers, and the seeds instead of artificial flies, in fishing for trout, according to Withering, and the Flora Rustica. Mr. Rudge says, it is the growth of particular districts and cannot be destroyed; "in fields where the greatest care has been taken to hand-pull every stalk, it has appeared the following year in equal abundance. In new broken up leys, which have been in turf beyond the memory of man, they often spring up with as much luxuriance as if they were the natural produce of the soil. Hoeing, when the land is planted with beans or peas, will check them; but when they grow among wheat, it is not easy to distinguish the plants while young; and, in this case, they are left till they are nearly in ear, and are then drawn by hand."

White darnel (Lolium temulentum): it is often found in a wheat crop, but Mr. Pitt believes always produced from seed sown with the wheat, to prevent which, great attention should be paid to clean seed, and particularly that it contain none of this plant, it being extremely prolific, very injurious to a crop

when growing, and to its value at market: it is an annual plant, which he never recollects to have seen grow, except in a crop, and very rarely there without neglect in management."

Goose-grass, or catchweed, cleavers hariff (galium aparine and spurium) the seeds are roundish, rough, two from each flower, so large as not all to be easily separated from the grain in dressing. He has known this plant very troublesome in a wheat crop, twining and crawling up the straw or stem; it is not very common in well managed crops, but more generally confined to hedges. In the Gloucester Survey, it is observed to be a troublesome and frequent weed, on all soils among corn, and not easily to be destroyed.

Field scabious, (scabiosa arvensis); it is found in corn fields and pastures, but not abounding much.

Parsleypiert, (Aphanes arvensis); it is a diminutive weed of small account, but sometimes rather too much abounding; might, probably, be weakened by pulverising the land when in fallow, very early in the spring, and ploughing the plant under in due time.

Dodder (Cusuta Europæa): it is, Mr. Pitt observes, a parasitical weed, of which he has not much experience, but is informed by Mr. Dickenson, that it is not uncommon in his neighbourhood. "Some years ago, in travelling through Buckinghamshire, he observed this plant twining round the stems of a bean crop, and brought away a specimen, it climbs in a spiral direction round the stems, from which, by means of vessels, it draws its nourishment, and must, consequently, very much fret and injure any plant to which it is attached, it is called (as stated somewhere in Young's Annals), beggar weed, hell weed, and devil's guts, names which sufficiently shew in what estimation it is held by farmers. The plant is annual and produced from seed, which takes no root in the earth, but in its foster plant." In the Gloucester Survey on Agriculture it is remarked to be a great enemy to beans, vetches, and some other plants, but is never seen among wheat, barley, or oats. As soon as it has fixed on the plant, it separates from the root, and like other parasitical weeds, drows all its nourishment from the plant it has embraced. Large quantities of beans are often ruined completely by it, so as not to carry a single pod; and no method has yet been discovered to destroy it; for though the root cannot be found, yet it surely returns in some part of the field, where it has once begun to grow, whenever the plants on which it feeds, form the crop of the season.

Corn Bindweed (Convolvulus arvensis): it is Mr. Pitt says, another troublesome parasitical weed, often growing amongst wheat, and when abundant, twining round the corn, and very much injuring the crop; when wheat has been laid by heavy rain. Mr. Pitt has observed this plant increase in growth so as to hold it down fast; and prevent it rising again; it is not so common, here in Staffordshire, he says, as he has observed it in some of the counties nearer London, from whence we are in the habit of procuring seed wheat; on which account he has sometimes feared we should import it more abundantly by this means, but has since observed that the seed is small and easily dressed out; the plant is perennial, and much addicted to running in the root. Mr. Curtis has proved, he says, that cutting it off, even below the surface, only tends to spread it farther: it must be destroyed by fallowing, and using the same process as for squitch." The writer of the Report of Gloucestershire says, that the bindweed, "with wind," is most frequently found in clays and deep loams, in which the roots strike so down that even trenching, two spits and a half deep will not reach their extremities; and the smallest bit of a root left will spring and rise to the surface. It entwines round and entangles all plants in such a manner as either to bring them to the ground or check their vegetation by their structure on the surface of it.

Wild carrot (Daucus carota): it is common, and sometimes troublesome in dry land; a biennial plant, producing seed plentifully; this, in its cultivated state, is Withering says, the well known garden carrot; but Miller informs us, that he could never improve the wild carrot so as to render the roots in any degree comparable with the cultivated carrot.

Shepherd's needle, or beggar's needle (Scandix pecten): it sometimes abounding in hard tilled land, and its seed is not easily wholly separated from grain in dressing. It is a small annual plant, producing a plentiful crop of seeds; each seed is furnished with a spike or beak from one to two inches long, whence its name of needle; it seldom abounds in well managed land.

Chickweed (Alsine media): it is sometimes troublesome in a crop on land rendered fine by tillage, from which it should be rooted out. The Rev. Mr. Shaw, Mr. Pitt says, remarks, that "chickweed is an excellent out-of-door barometer: when the flower expands boldly and fully, no rain will happen for four hours or upwards; if it continues in that open state, no rain will disturb the summer's day; when it half conceals its miniature flower, the day is generally showery; but when it entirely shuts up, or veils the white flower with its green mantle, let the traveller put on his great coat, and the ploughman, with his beasts of draught, rest from their labour." Mr. Rudge states that it grows most plentifully on good and well cultivated lands. It mats so closely round the plants, and covers the surface so completely, as to keep out the influence of sun and air; and therefore requires to be removed, which is best done with the hoe.

Curled dock (Rumex crispus): this plant should never be suffered to shed its seed on any land, but should be rooted up and carried off in time: in arable land, the roots should be carefully picked off during the tillage, or they will produce vigorous luxuriant plants, drawing much nourishment from the soil to the injury of the intended crop. It is a hardy perennial, very tenacious of growth by its roots, and producing a wonderful increase of seeds; too much

caution cannot be used in avoiding sowing it, nor too much pains bestowed in its extirpation: it is the pest of clover fields in Norfolk, according to Withering.

Arsmarts, or lakeweeds (Polpyonums persicaria and pensylvanicum). They abound most in wet seasons on moist lands; and being hardy annuals, producing a plentiful crop of seeds, are apt to shew themselves in crops of grain: to be destroyed by fallowing, by draining, and by rooting out the plants.

Knott grass (Polygonum aviculare): it is a trailing plant; flourishes most by road sides and on gravel walks: out of the smothering crops, it is very prolific in seeds.

Black bindweed, or bearbind (Polygonum convolvulus): it is a parasitical plant, twining round any thing it can lay hold of; very productive of seeds, which being angular, are not easily separated from grain in dressing or winnowing. This plan is not much approved by the Staffordshire or Shropshire farmers, who are very cautious of sowing it. It is nearly allied to buckwheat (Polygonum fagopyrum), to which it is preferred by Dr. Withering, in the following words: "the seeds are quite as good for use as those of buckwheat; are produced in greater quantity and the plant bears cold better."

Knawell (Scleranthus annuus and perennis): it is a diminutive plant, but prolific in seeds, and of vigorous growth; it has been often found on a piece of poor thin soil on Mr. Pitt's farm when in tillage, but he does not think it very pernicious; it may, probably be weakened or destroyed by an early spring working of the land when in furrow.

Bladder campion (Cucubalus behen): common in wheat and barley crops, and growing in tufts many stalks from each root, which, when the case should be rooted out by hand: it is a perennial plant, and has the habit of increasing from its roots.

Cockle (Agrostemma githago): it is a luxuriant, vigorous, annual plant; perfecting many seeds, and drawing much from the soil: care should be taken not to sow this injurious weed. The seeds are so large that they cannot all be dressed from the grain, the plant should therefore be plucked out by hand before the seeds ripen.

Red and white campion (Lychnis dioica): these are perennial weeds, growing in hedges, corn fields, and pastures; to be weakened or destroyed by well managed fallows.

Mouse-ear (Cerastium arvense): it has somewhat the habit of chickweed, but of a duller complexion, frequent amongst corn and in pastures.

Corn spurry, or yarr, (Spergula arvensis): it is frequent, Mr. Pitt says, in corn fields, not very bulky or luxuriant, but quick and tenacious of growth, and producing seeds plentifully: as it is of humble growth, he has never observed it to be very injurious to a crop; but Dr. Anderson observes, he says, that in Aberdeenshire it is a pernicious weed, growing in such abundance among the crops as to choke the grain; he has often seen it so thick, that over a vast extent of surface you could not have put down a pin without touching a plant, and the farmers there think it indestructible; the doctor farther states that "he has remarked, that whenever any of the land had been poached, by being used as a road, especially in wet weather, no spurry appeared there; it was evident that this was occasioned by the clods thus produced not giving room for the small seeds to germinate freely; if, therefore, he could contrive to bring the ground into a cloddy state when sown, he should be free of it for this crop. He has lost a crop of bear, (six-rowed barley, Hordeum hexastichon), in one field by it entirely. The soil was in a loose, mealy, incoherent state; he resolved to delay ploughing it next season as long as possible, and to plough it when it was very wet. Fortunately it came a violent rain in the beginning of March; it was ploughed when nearly in the state of a puddle, it turned over more like mud than soil; dry weather succeeding, this mud bound a little on the surface, and produced a kind of clod; the corn was sown, it got a very slight harrowing, barely to cover the seeds, in an imperfect manner, and to leave the field as rough as possible: no yarr appeared, and the crop was one of the most luxuriant he had ever seen."

And Mr. Pitt suggests, that as "small birds are very fond of the seeds of this plant, it is probable that by the surface of the ground laying undisturbed through the winter, a large proportion of the seeds would be devoured by them; he believes in all cases of a stubble very full of small seeds, it is well to defer the ploughing as long as it conveniently can be on this account. Respecting land rendered over fine by tillage, it is well understood by Staffordshire farmers, he says, to be a fault, and that it is much better left only knappy, as they call it, that is, in small lumps; this is attained in fallows by working the land early in summer, and letting it lay to consolidate through the latter part of it; and in the turnip culture by the treading of sheep and cattle, and is one great reason why land should not have too many ploughings, but only a sufficient number, judiciously timed; but ploughing in general, particularly of broken land, is much best done when the land is dry."

Base rocket (Reseda lutea): Mr. Pitt observed this plant among some corn in Gloucestershire in the summer of 1795; it is an annual plant, not very much abounding.

Dwarf spurge (Euphorbia exigua): common in corn fields, but generally in single plants, and not to very injurious to the crop.

Corn poppy (Papaver rhæas,): it is, Mr. Pitt remarks, "an annual plant, producing numerous seeds, sometimes very abundant in corn-fields, and a pretty sure indication of a light crop. Query, is the lightness of the crop occasioned by the abundance of this plant, or the increase of this plant encouraged by the lightness of the crop? probably both: in a full crop it is scarcely to be found; its flowers appear in July. It might, doubtless, be weakened or destroyed in fallows, by encouraging an early vegetation in common with other seedlings." In the Gloucester Report it is stated to be common in all light and sandy soils, particularly in the neighbour-

hood of that town. But that since the practice of hoeing has become general, this weed has much diminished in quantity.

Corn crowfoot (Ranunculus arvensis) : it is, Mr. Pitt says, sometimes very abundant and injurious to a wheat crop on strong moist land: an annual plant of early growth, which can only be brought into vegetation in the fallow by an early tillage ; otherwise the growth of the seeds is deferred to the next spring, to the great injury of the crop. It is observed in the Flora Rustica, that " in some countries it has the name of hungerweed, whence it is supposed to indicate a barren soil." The orthography, however, is not derived from the nature of the soil, but from the hungry prospect it holds out to the farmer. In the Report for Gloucestershire it is said to grow most abundantly in strong loamy or clayey soils. And deep and frequent stirrings with the hoe, are advised as the most proper method for reducing it.

Dee nettle, dead nettle (Lamium album and purpureum) : it much abounds amongst crops on some lands, particularly in moist seasons ; the plants being perennial produced both from seeds and roots, great pains should be used in their extirpation.

Calves snout (Antirrhinum orontium) : Mr. Pitt observed this plant not uncommon amongst corn crops in Hampshire in the summer of 1795. It appears from Withering's Botany, he says, that other specie of this genus are also common in corn-fields, as the sharp-pointed fluellin (Antirrhinum elatine), the round-leaved snapdragon (Antirrhinum spurium), the corn snap dragon (Antirrhinum arvense), the least snap dragon (Antirrhinum minus) ; these he has not personally examined ; they are all annuals ; whilst the other species of this genus, common in hedges and on walls, as the Antirrhinum cymbalaria, ripens, linaria, and majus, are hardy, and strict perennials."

Shepherd's purse or shepherd's pouch (Thlaspi arvense, campestre, and bursa pastoris) : these are well known as sometimes troublesome weeds on arable land : are annual plants, of early appearance, and continuing great part of the year. To be destroyed by early and well managed fallowing, or by rooting up from the ground.

Whitlow grass (Draba verna).

Codded mouse-ear (Arabis thaliani). Both these are small diminutive weeds, appearing amongst corn early in the spring ; but being quick of growth and soon exhausted, are not of much consequence.

Smooth-leaved chadlock (Brassica napus).

Rough-leaved chadlock, or wild mustard (Sinapis arvensis).

Pale-flowered chadlock, or wild radish (raphanus raphanistrum).

It is stated by Mr. Pitt, that, " these three plants are confounded together by farmers, under the general name of chadlock, pronounced here kedlock, though they are as different and distinct, to the investigating botanist, as wheat, barley, and oats. They are all extremely common, and nearly equally so, if a large range of country be examined ; though the different sorts are more or less abounding in different places ; in his neighbourhood he can generally gather the three sorts in the same field, but the mustard is much more abundant ; in the neighbourhood of Litchfield, where chadlock is indeed very abundant, it is almost universally wild rape. Some years ago, he observed, in the common fields of Rutlandshire, the whole surface was tinged over with the flowers of the wild radish : they are all great nuisances, and, when suffered in abundance to ripen their seeds, must draw much from the soil, to the great injury of the crop ; and as they are very quick of growth, and perfect their seeds expeditiously, it is not uncommon for these plants to shed their seeds at the rate of several bushels per acre ; and as it is well known that the seeds will vegetate after laying many years in the ground, it is no wonder they should produce a plentiful crop ; yet, being simply annuals, they are not difficult of destruction, if due attention and proper means be used. To destroy these, as well as all other seedlings, the land in tillage should, he thinks, be pulverized early in the spring by ploughing and harrowing, after which rain and warm weather will soon cause all the seeds to vegetate that are near the surface ; they may be permitted to grow till they begin to flower, then plough them in, and again harrow the land, and the next rain will cause most of the remaining seeds to shoot ; which must in due time be ploughed under as before ; and if any should afterwards appear amongst the crop, they should be hoed or hand weed out ; by this means, in one or two tillages, these plants may be totally eradicated ; but if they are permitted to shed their seeds, their increase cannot be wondered at, when their prolific nature is considered, as well as the extreme hardiness of their seeds. The seeds, when dressed from grain, have, he understands, been frequently manufactured into oil."

Charlock, (sinapis). This is said by Mr. Rudge to be the most common weed in the vale of Gloucestershire. It is probably the same as the wild mustard, noticed above. He however remarks, that, " during the summer, both on the fallows and in the planted fields, its yellow blossoms predominate over every other plant, and unless destroyed in this state, leave an immense crop of seeds behind. To check the increase of this weed, the attentive farmer suffers it to come into blossom on the fallows, and then turns it in with a plough. This is not always effectual ; for frequently the plants being merely moved, but not from the roots, and leaving two or three inches above ground, soon recover the damage they have sustained, and go on to seed before the next ploughing. Women and children should go over the land with the hoe a few days after, and cut up the reviving plants ; or lambs should be kept on the fallows, which are said to eat off the tops with avidity. In the planted fields they are hoed up, and as some will unavoidably escape, women are sent in among the corn, after it is grown to a considerable height to pull out the weeds in blossom with the hand. Though the farmer will certainly diminish the quantity, and prevent any new accession by this attention, yet many years of good husbandry must elapse, before

the ill effects arising from the negligence of former cultivators, can be conquered; for this seed being strongly charged with essential oil will continue in the ground for an incalculable period of time uninjured, and as often as the soil is turned up, a quantity will be brought sufficiently within the influence of the atmosphere to vegetate. In 1804, he saw, in the parish of Brockthorpe, a considerable portion of the land in the common field completely covered with this weed, and the seeds perfectly ripe and shattering on the ground. The ploughing had been neglected till nearly the autumn; and as the land was not cropped, the charlock grew in great abundance, and left more seeds than the good husbandry of half a century will eradicate."

An agricultural writer has observed, that, "what is vulgarily called charlock in the vale of Gloucester is really the common mustard (*sinapis nigrea*), cultivated in the north for its flour. It is often here collected by the country people for the same purpose, and before the simple mode of living among the ancient farmers fell into disuse, few farm-houses were without a cannon ball and bowl, in which the mustard seeds were bruised, and the flour saved for the table with the black husks unseparated from it."

Wild rocket (Brassica muralis). It is observed, Mr. Pitt says, in some one of the county reports, which, for want of an index, he cannot now refer to, that this plant has made great progress in their corn-fields, and is considered as a very formidable weed. All the parts of this plant are considerably acrid, and have a rank disagreeable smell, whence it is called by the farmers who have it, *stinkweed*. It may doubtless, he thinks, be destroyed by the process above recommended for chadlock.

Fumitory (Fumaria officinalis): this is not uncommon in corn-fields, but not very pernicious: it is an annual plant.

Rest harrow (Ononis arvensis and spinosa): the former is not, Mr. Pitt says, uncommon in arable lands where there are no very desirable plants. The *arvensis* is common in this country amongst corn, and an hardy perennial plant; if the root can be destroyed in the fallow, there is little danger from the seeds: the roots are so strong as almost to stop the plough, unless the team be pretty strong. The *spinosa* he has often seen at a distance from hence, but it is unknown in this neighbourhood.

Tare (Ervum tetraspermum and hirsutum). Mr. Pitt says, "the tare is a terrible enemy to a wheat crop, where it abounds in considerable quantity; "in wet seasons whole fields of corn have been overpowered and wholly destroyed by it," according to Withering. Care should be taken that seed wheat be perfectly free from tares; and all land subject to it, should if possible be got so forward in the fallow, as to bring on the vegetation of this plant previous to sowing the wheat; the seeds are good food for pigeons and poultry."

Melilot (Trifolium *melilotus officinalis*): it is, Mr. Pitt says, a very injurious corn-weed in many parts of the kingdom. Mr. Miller marks Cambridgeshire, and Gerard, Essex, for abundance of it. Mr. Pitt has heard of it in Bedforshire, and seen it amongst corn in Gloucestershire, and Rutlandshire; in the latter county he was informed that five or six shillings per acre has sometimes been expended in weeding it out, without effecting the purpose. There cannot be a worse weed among bread corn, for a few of the seeds ground with it spoil the flour, by communicating their peculiarly strong taste: *Flora Rustica*. It flowers in June, and July, and the seeds ripen with the corn; it is probably capable of propagating itself, both by its roots and seeds, but might doubtless be much weakened by proper fallowing: horses are very fond of it; cows, sheep, and swine eat it, and bees are very fond of the flowers, it is therefore, though a corn weed, a good pasture plant." It is common, Mr. Rudge says, in the arable lands in the vale district of Gloucestershire. He suggests, that if the seeds did not afford an unpleasant taste to the flower of wheat with which it happens to be mixed, it might probably be cultivated with advantage, as all domestic animals are fond of it in some degree.

Sow thistle (Sonchus arvensis): this is a perennial weed, common amongst corn, which when it occurs ought to be drawn up by hand, before it ripens its seed; which being furnished with feathers, would otherwise fly over the whole country.

Common or *way thistle*, *cursed thistle*, or *saw wort*, (Serratula arvensis): it is, Mr. Pitt says, universally called thistle, but arranged by Linnæus, not as a *Carduus*, but a *Serratula*; growing every where; it may be weakened, he thinks, "by good tillage and weeding, but not totally destroyed otherwise, than by universal agreement to root it up, before its seeds ripen, or by a regulation of police enforcing the same; this weed one should almost conclude to be naturally produced by the soil, in consequence of the curse, "thorns also and thistles, shall it bring forth unto thee;" yet doubtless strictly speaking, produced only from its numerous fibrous roots, (which are hardy and strictly perennial, and which if separated in parts by ploughing, or digging, each part will, if left fresh in the soil, often vegetate, and produce a plant;) and from its more numerous seeds which are feathered, and will fly to a great distance with the wind, and when it becomes calm alighting upon cultivated land, they will there vegetate and grow luxuriantly, so that it is in vain for any person to attempt clearing his land of this weed, unless his neighbours also pursue the same plan: the roots of this plant may be pretty effectually destroyed, by a well managed summer fallow; as they will not survive repeated ploughings up in hot weather; and if due attention were bestowed to prevent it seeding, its numbers might be diminished; it is very injurious to all crops." It is easily, Mr. Rudge however says, conquered by proper attention on tillage lands, and may either be drawn by the thistle-drawer, or cut off deep with the hoe or spud-hook.

Mr. Pitt further adds, on the authority of the Flora Rustica, that "the goat and ass will eat it: horses, will sometimes crop the heads when young and tender, but no other cattle touch it growing. When burnt, it is said to yield a very pure vegetable alkali."

Thistles (Carduus's), called in Staffordshire, Mr. Pitt says, "boar thistles, to distinguish them from

the last, and from sow thistles, several sorts, principally the *Carduus lanceolatus*, *pratensis*, and *acaulis*; with other sorts less common; they abound in meadows, pastures, hedge sides, and borders of corn fields, where they should be rooted up after rain, before their seeds ripen, otherwise such seeds are liable to fly all over the country; these plants grow very luxuriantly, drawing much from the soil, and injuring or preventing the growth of grass near them, are very unsightly, and useless to cattle; some of the species, particularly the meadow thistles, are perennial, others are annual or biennial." The following uses of thistles are stated on the authority of Withering, who says of the Carduus lanceolatus, that if a heap of clay "be thrown up, nothing would grow upon it for several years, did not the seeds of this plant, wafted by the wind, fix and vegetate thereon; under the shelter of these other vegetables appear, and the whole soon becomes fertile."

Coltsfoot (Tussilago farfara): it is very apt to abound in hard tilled land. Lord Hawke, Mr. Pitt says, informed him "at the Board of Agriculture, "that the only time to destroy this weed, is by cutting it up in those months when it begins to throw out its flower, at which time, if so cut, it will bleed to death;" these months are February and March, at which time all land in fallow, subject to this weed, should certainly be ploughed and harrowed down, which would doubtless check the growth of, and very much weaken the plant; neglected at this time, it will soon after ripen its seed, which furnished by nature with feathers, flies all over the country, and establishes itself very quickly on cultivated land, and banks of earth newly thrown up. This weed may be considerably weakened by repeated summer ploughings, and may afterwards, for the greatest part, be weeded out by hand, as the ground is thus rendered light." In Gloucestershire, according to the Survey of that district, "it is not found except on soils which are poor in their nature, and subject to moisture. Fertilization by manure, and draining, are the obvious remedies."

Groundsel (Senecio vulgaris): it is, the first writer says, often found in fallows, on good soil rendered fine by cultivation, as its seeds ripen rapidly, and fly over the country with the wind: the plant should be destroyed in time, by weeding out, or ploughing under, and the seed by no means permitted to ripen."

Corn marigold, goulans, goul, buddle in Norfolk (Chrysanthemum segetum): it is, Mr. Pitt observes, "an extremely troublesome weed in some soils; and an annual plant, producing seeds plentifully, which vegetate, whenever the soil is cultivated, and very commonly in crops; would doubtless, he supposes, be destroyed, like other annual seedings, by early and complete fallowing, to bring the seeds in due time into vegetation, and afterwards ploughing the plant under; in Denmark there is a law to oblige the farmers to root it up according to Withering. It is stated, Mr. Pitt says, in the 'Statistical Account of Scotland, Vol. II. p. 4,' that the late Sir William Grierson, of Lag, held goul (Chrysanthemum) courts as long as he lived, for the purpose of fining such farmers on whose growing crop three heads, or upwards, of this weed were found; and it is observed by the President of the Board of Agriculture, that "some regulation of police for fining those who harbour weeds, the seeds of which may be blown into their neighbours' grounds, has no injustice in the principle." If this plant be cut when young in flower, and dried, horses will eat it, according to the Flora Rustica.

Corn mint (mentha arvensis): this is stated in the Gloucester Report to be a common weed on damp soils, and to increase fast by root, where, for want of frequent ploughing and dragging, it is neglected.

Stinking may weed (Anthemis cotula,) it is common in corn fields, Mr. Pitt says, "though often confounded with the corn chamomile (Anthemis arvensis, and Matricaria chamomilla), from which it is to be distinguished by its disagreeable smell; they are all injurious to corn crops, and should be prevented or destroyed by good fallowing or by weeding them out." It is observed in the Gloucester Report that "maithe or mathern often overruns a whole field, particularly when planted with peas, so that only the white blossoms of the weed is to be seen. The only chance of destroying this stinking weed is, it is supposed, by the drill husbandry, where room is left for the free use of the hoe. In the broadcast mode they must be pulled by the hand, which is not only tedious, but in some measure dangerous, as there is a noxious quality in the plant which injures the hands of the weeder, when they happen to have sores on them.

Blue bottle (Centaurea cyanus): it is "an annual weed, Mr. Pitt says, with a somewhat elegant blue flower: common in corn, where the tillage has been imperfect, or too long carried on without cleaning, by turnips or fallow." It is likewise common in corn fields in Shropshire and other counties. In the Gloucester Report it is stated, that 'blue bonnet, knapweed, corn flower, is a weed common in some fields, principally where the soil is loamy and mixed with pebbles. It should be extirpated by the hoe, and, when grown to blossom, by the hand.

Great knapweed (Centaurea scabiosa): a perennial corn weed, growing in tufts of many stems from the same root, should be destroyed in fallow, or by weeding out of the crop.

Pansy (Viola tricolor): this is an annual flower, often found amongst corn, where it is produced by seeds not destroyed in the preparation for the crop: the beauty of the flowers has gained them a place in gardens.

Corn horse-tail (Equisetum arvensis): it is often found in corn land, the fertile stem appearing early in the spring, with that of coltsfoot, and decaying before the other part of the plant appears. Mr. Pitt remarks that Loesel says, "if ewes in lamb eat it, abortion is the consequence; but it is believed sheep or cows will not eat it, unless compelled by hunger. It must be destroyed by the same tillage and weeding recommended for coltsfoot. It is stated by Rudge, to be found only on moist soils, and cannot easily be overcome only by draining.

Fern (Pteris aquilina): this is not uncommon in corn fields on dry sandy land; a hardy perennial, tenacious of growth, and striking a long tap root into the ground, beneath the reach of the plough, which

shoots up vigorously when the sun becomes powerful; the plant should be drawn up after soaking rain, but it will sometimes require a good deal of pains and attention to destroy this plant, particularly on land where it has been long established.

Injurious weeds in grass land. The principal injurious weeds of this kind are described below, most of them on the authority of Mr. Pitt.

Cotton grass, hares-tail, moss crops; (Eriophorum vaginatum and polystachion): it grows in bogs or meadows; poor people stuffing their pillows with the down, and making wicks of candles with it. This plant is a certain token that drainage has been neglected, and is of course necessary to be attended to.

Hog weed, low parsnip (Heracleum angustifolium): this is often found in meadows, but too coarse and weed-like to be suffered to abound on well managed land, though Mr. Pitt believes cattle will eat it either green or in hay: it may probably, he supposes, be weakened or destroyed, by annually cutting up.

Wild cisely, cow weed (Chærophyllum sylvestre): it is common in orchards, hedges, meadows, and pastures: cattle are fond of it in the spring, but he thinks is too coarse to be encouraged amongst grass. This plant and the last may probably be worthy of trial in cultivation by themselves, being of luxuriant growth, would yield a large produce, but their value has not yet been fully ascertained,

Garlick (albium ampeloprasum): it is frequently found in meadows and considered as a weed that injures cow pastures. It gives a disagreeable flavour to butter and cheese, but it does not seem that cows much dislike or refuse to eat it. It is suggested, however, that this may probably happen on account of its being so much blended and intermixed with the other grasses that they cannot avoid cropping it a little.

Ramson (Allium ursinum): it is found in some meadows, but commonly in hedges; other plants will not flourish near it, cows eat it, but it gives their milk and its produce a garlic flavour, and should therefore be weeded out as soon as discovered.

Rushes, of sorts (Juncus's): these are often found in meadows, and pastures, and are a sure indication that the land wants draining; which, when effected, they always give way to better herbage, though their extirpation after draining will be accelerated by top dressings of ashes. Mr. Rudge says, "the common rush is an inhabitant of soils that are moist and strong, that it abounds in the furrows of the pasture lands, and on the *meers* or strips of grass land between the lands in the vale of Gloucestershire, as the dividing mark of different properties, and that draining destroys it."

Docks (Rumex crispus, acutus, obtusifolius, &c.): they are found in strong sour land, and should be rooted up after rain, from meadows and pasture land, being refused by cattle; and eaten only by fallow-deer, who prevent their flourishing in parks and pleasure grounds. Mr. Rudge well remarks, that "docks are extremely injurious to the herbage of pasture lands, but if taken in time may be easily conquered. If, however, they are permitted to ripen, they leave an immense quantity of seed for future crops; and, being perennials, the evil is increasing in such a multiplied proportion, as almost to exclude the growth of all other plants. In a large meadow adjoining Gloucester, these weeds have matured and shed their seeds, he says, so many years, that, at the time of mowing the whole appears like a crop of docks. The "dock spit or spade" is the instrument with which they may be extirpated. This is a kind of crow or lever, with a claw at the end, a little curved, and divided into two prongs, similar to a hammer for drawing nails: an arm projects at about eight or ten inches from the lower end, for the foot to rest upon in forcing it into the ground, and a little above it, on the back side, a curve of iron, projecting three inches; in the upper end, a handle is fastened as in a spade: the claw seizes the root of the plant, and, by a gentle pressure of the handle downwards, easily draws it out of the ground: with this instrument, many hundreds may be eradicated in a day."

Bistort (Polygonum bistorta): in some places it occupies large patches in meadows, to the injury of better herbage; it is a perennial plant, but might doubtless be weakened by repeatedly rooting up; the root is one of the strongest vegetable astringents according to Withering.

Wild campion (Lychnis dioica): it is often found abundantly in arable pastures, where care should be taken to exterminate it, by well fallowing the land: there are two sorts, with white and red flowers.

Goose tansy, silverweed, or feathered cinquefoil (Potentilla anserina): common in many arable pastures, but generally untouched by cattle, should therefore be destroyed in the tillage, and by keeping the land free of stagnant water.

Tansey (tonacetum vulgare): Mr. Rudge remarks that it "is found in some pastures by the Severn side, and a few other places, but not abundant; it is an unpleasant weed, and should be eradicated with the spade."

Pilewort the (Ficaria verna) of Withering, and (Ranunculus ficaria), of the Flora rustica. It flowers very early in the spring, and abounds in shady, or moist ground; it occupies much room in some meadows, and chokes other plants, which grow near it, and not being eaten by cattle, should certainly be extirpated; nothing discourages its increase more than coal or wood ashes, according to the Flora Rustica.

Lousewort, red-rattle (Pedicularis sylvatica), it is found, Mr. Pitt says, "in moist meadows, and pastures, and he believes rarely, but where the land is in want of draining; it is said to be very disagreeable to cattle, and injurious to sheep; but he believes the injury is principally occasioned by the unwholesome nature of the land on which it grows: it may be destroyed, he supposes, by draining and top dressing."

Yellow rattle (rhinanthus cristagalli): this Mr. Rudge says, "generally grows in moist meadows, ripens its seeds, and sheds them before the time of mowing, when the dry husks make a rattling noise under the scythe: at this time, it contains no nutritious juice at all, though, when green, oxen and horses will sometimes eat it rather eagerly, and at other times refuse it. Having, however, no desirable quality to recommend its cultivation, and oftentimes overrunning large patches of ground, it ought to be destroyed; and being a biennial, this may easily be done, by grazing the

land for three or four years following, and taking care that the stalks, which are left by the cattle be skimmed off with a scythe before they are ripe enough to shed their seeds, or while they are in full blossom." It is added in respect to its removal, that "a farmer near the northern borders of Gloucestershire, shewed him a sloping piece of grass land which had been overrun with rattle; without any view to the destruction of that, he conducted the water of an adjoining stream, as well as he could, over the piece, which, however, was not wholly watered; but it proved, that on the watered part, the rattle was destroyed, while it continued to grow on that portion which had escaped."

Dyer's broom (Genista tinctoria.) Mr. Pitt has seen it very abundant in some pastures, on strong or moist land, from whence it ought to be grubbed up and destroyed.

Wood waxen, dyers weed, or base broom (genista tinctoria). This, Mr. Rudge says, grows abundantly in many parts of the vale of Gloucestershire, generally on dry pastures: it is refused by no cattle, but sheep; yet, being inferior to good grasses, should be rooted up, except in places, where, as in the neighbourhood of Bristol, it is collected and carried while in full blossom, to the manufacturers, who, by boiling, &c. extract a fine yellow colour from it."

Rest harrow, cammock, (Ononis spinosa, and arvensis): it is often found, the first of these writers says, "in pastures, where it is eaten by cattle, particularly the younger shoots: but it is too coarse and rubbishy to be suffered to increase, and should therefore be rooted out, or grubbed up as soon as possible." According to Rudge this "is a most troublesome weed, and a pretty sure proof of want of good cultivation and manure. By the former, the tillage lands may easily be cleared of it, and by well rotted horse-dung even pasture lands may be assisted; but rather than such a disagreeable plant should continue to grow, where its place might be supplied with good herbage, neither labour or expence should be spared. The little advantage it gives to sheep, which will eat the young shoots before the prickles are formed, is not a sufficient inducement in the calculation of a good farmer, to leave it undisturbed. In the parish of Elmore is, he says, a pasture ground almost covered with it; which lies too far from the farm-house to have manure easily conveyed to it. The occupier tried the experiment of drawing it out by the roots, but discontinued it from an idea that it came up with greater strength and abundance the next year. The truth is, that the business is but half done, if the roots are not entirely removed; as every broken piece will throw out shoots; and from long continuance of the plant on the spot, and the annual shedding of its seeds, it is probable that a new crop will arise in the following spring: but the farmer should not be discouraged on the failure of his first attempt; since, by continually watching the weeds in their early growth, and cutting them off with the hoe, they would gradually be destroyed; and the process would be much assisted by well dressing the places with rotten horse-dung, as before mentioned."

Common or *way thistle*, (Serratula arvensis): it should, Mr. Pitt observes, "be cut off within the ground, or rooted up."

Rough or *large thistles*, boar thistles, (Carduus's): these are generally mown or otherwise cut off, but are much better rooted up. It is remarked by Mr. Rudge in his able View of the Agriculture of the County of Gloucester, that "thistles of all kinds are very unpleasant weeds; either green or dried with the hay, they annoy the cattle in feeding, and therefore should never be permitted to grow long on any land; to prevent their growing at all, is perhaps impossible, but the increase of them may be checked by early attention: while, however, they are left to be mown with the grass, or to remain undisturbed in the highways during the summer, the seeds will be dispersed by the wind in various directions over the country: until a method, therefore is adopted to correct the evil in its infancy, the labour bestowed by good farmers for the extirpation of this weed, will not produce a complete effect, although it will prevent the thistle from being carried to the mow in a state of equal maturity with the hay, and its seeds afterwards from being dispersed with the dung in the fields. Was every farmer to do the same, the encouragement to persevere in the practice would be powerful; but it is not probable, that a farmer will expend much in doing what the negligence of a neighbour will render ineffectual. Some thistles are annual, others perennial; where the distinction is not known, the safe method is to cut the root with a paddle, deep in the ground, or draw up the root; and this should be done for the first time in spring, and again on the lattermath in autumn."

Cudweed, chafeweed, (Gnaphalium germanicum): it is not uncommon, Mr. Pitt says, "in arable pastures. He has seen it abundantly in an upland pasture, after barley, where the clover has failed of success; cattle refuse it, but it is said to be successful in the bloody flux of cattle, and of the human species; it seldom appears much in a crop, or when the artificial grasses succeed well."

Ox-eye, white marigold (Chrysanthemum lucanthemum): it is common in some pastures according to the same writer; and not grateful to cattle; but seldom abounding so as to be much injurious, and easily drawn out by hand."

Black knapweed, (Centaurea nigra): it is very common and abundant in some moist meadows and pastures; where it is a bad weed, being a harsh stubborn plant, seldom touched by cattle either green or dry, and not extirpated without much difficulty; it is a perennial plant, and increases much by the root according to the Flora Rustica. It might, however, very probably be much weakened, and extirpated by degrees, Mr. Pitt thinks, by drawing up after rain. Mr. Rudge states "that the common black knap or knob weed provincially 'hard-heads' is a vile and worthless weed, which cattle of no kind will touch, either green or dry; and yet is suffered on some pastures to grow and increase to such a degree, as to exclude the appearance of almost every other plant, and, though useless, are mowed with the other herbage, and preserved for winter fodder. This weed indicates poor land, though probably, by the use of soaper's ashes, it might be conquered; otherwise the land should be ploughed up, and converted to a better purpose.

Sedge grasses, various sorts (Carex's): it is often provincially termed hard grass, iron grass, carnation grass, most common in old sour moist land, undrained and unimproved; where in some places it occupies the whole surface; it is extremely hardy, and flourishes where scarcely any thing else will grow; seems produced by nature from this principle in her economy, that a bad plant is better than none, for this plant is not eaten by cattle who can get any thing better; yet, upon draining and top-dressing the land, it will generally give way to a finer and more valuable herbage.

Nettle (Urtica dioica): it sometimes grows in tufts on pasture land, where it should be rooted up as it will prevent the growth of better herbage; asses are said to be fond of it, and cows eat it in hay.

Mosses (Musci), various sorts: these Mr. Pitt says, sometimes spread on pasture land, and he believes indicate that the herbage is starving and torpid, and wants a stimulus to quicken its growth: top-dressing should be used, and draining, if necessary; and if the land be arable, a pulverization by tillage with liming, and the seeds of fresh herbage, after a crop or too, may be applied. On pastures treading with sheep and harrowing, or scarifying with a fine harrow has been found beneficial.

These plants are considered as proper to be extirpated from such grass lands; but besides these there are various others of less importance whose characters are doubtful, and their uses not well ascertained.

These the writer terms neutrals, and of which he has introduced an account in his valuable paper in the fifth volume of the Communications to the Board of Agriculture, and of which kind he considers the following:

Crowfoots, butter flower, butter cup, gold cup, (Ranunculus ficaria bulbosus, repens, and acris): the first or pile wort, Mr. Rudge observes, has knotty roots, rises little above the ground, blossoms early in the spring being chiefly found in meadows that are rather moist and eaten only by sheep. The others Mr. Pitt says, "are common in meadows and pastures in every part of the island that he is acquainted with, so much so, as to give a yellow tinge to the whole surface in the month of June; very abundant in the hay grounds near London, and indeed every where else; these plants are so prevalent in our meadows and pastures, and their good qualities have been so often questioned, that it seems highly proper their effects should be precisely ascertained. It is said in Withering's Botany of the bulbosus, "cows and horses have a great aversion to it;" and of the acris, "cows and horses leave this plant untouched, though their pasture be never so bare; it is very acrid, and easily blisters the skin." The Flora Rustica has given very elegant figures of these three plants, with remarks on the bulbosus, that "it inflames and blisters the skin, and beggars are said to use it for that purpose, to excite compassion by artificial sores: and on the acris, that "if cattle chance to eat it, their mouths become sore and blistered:" the three species are all occasionally found wild with double flowers; in this state we frequently see the first and third cultivated in our flower gardens, especially the third; but we should derive more satisfaction from informing the farmer how he might effectually root them out of his pastures than how he might cultivate them successfully in his garden, for they propagate themselves with great facility, and occupy a considerable space in good meadows." But, "notwithstanding these authorities, Mr. Pitt is inclined to think more favourably of these plants. He has never known a practical farmer name them as in the least degree injurious; and it is very certain of the Ranunculus repens, that cattle eat the foliage greedily with other herbage; and if they refuse the other species in bare pastures, it is probably because they have been deprived of most of their foliage with the adjoining herbage, and the remaining part of the plant is too acrid to be eaten alone; and indeed cattle refuse the flowering stems even of grasses, when deprived of their leaves: these plants may therefore, he thinks, be considered as seasoners and correctors, and adapted to uses in the animal economy, similar to that of salt, mustard, pepper, and vinegar at our tables, to correct the flatulent or putrid qualities of the more palatable, and luxuriant dishes on the great table of nature; and though not eaten alone, are an agreeable and useful stimulant with other more simple food. If these plants have any injurious qualities they have hitherto escaped the notice of farmers, all of whom cannot reasonably be supposed devoid of due attention."

Mr. Rudge, however, states that "the several species of crow-foot, provincially 'crazeys,' butter flowers, butter cups, and king cups, which in the spring throw a yellow veil over the meadows, are to be reckoned among the useless weeds, having little to recommend them to notice but their gaudy appearance." And that, "the three last are acrid and bitting to the taste, and are therefore rejected by cattle nearly alike." It is indeed said, that "the creeping crazey is more mild and palatable to some cattle; though it is to be suspected that cattle eat it, rather from necessity than liking, as, from its spreading along the surface, it becomes so matted with the herbage, that it must be taken up in some degree with it. The stalks of the two others are left standing, when the ground is quite bare around them, yet, when made with the hay, they are said to lose the pungent quality; and the brightness of the blossom in the rick, is always a sign of the whole having been well harvested."

Wild mint (Mentha arvensis): this is, found Mr. Pitt says, "in moist pastures, it prevents the coagulation of milk, and when cows have eaten it, as they will do largely at the end of summer when the pastures are bare, their milk can hardly be made to yield cheese; a circumstance which sometimes puzzles the dairy-maids. This plant may, he thinks, be weakened by effectually draining the land."

Yarrow (Achillea millefolium) and sneezewort (Achillea ptarmica); both common and indifferent to cattle, the former is recommended for cultivation on poor land, by Anderson. Mr. Rudge has found the common yarrow plentifully intermixed with the herbage in the vale district of Glocestershire, where much

fed with horses. Some agriculturists have, he says, supposed that cattle are not averse to it; but he has observed that this weed has remained uneaten till every blade of grass has been cropped close to the ground, and therefore that it should be extirpated by the spade or three pronged fork at the expence of manual labour."

Injurious weeds in waste lands. These Mr. Pitt considers as not very numerous; "for though many species of plants, useless for the food of domestic animals, grow there, yet, as there is no chance of introducing any thing better till such lands are appropriated and improved by cultivation, they can hardly be considered as noxious, so long as nothing better can be introduced in their stead." And that "as waste lands in their present state are useful only as sheep-walk, or for producing fuel, the improvement of them in the first respect, is an object deserving attention, particularly as such improvement would render them of greater value in case of inclosure, and would much shorten the business of bringing them into a state of cultivation."

He considers the weeds that encumber waste lands, and reduce their value as sheep-walk, to be of two kinds; "the common *upland rubbish*, and the *bog weeds*; the former smothers the land, so as to prevent the growth of better herbage, and the latter are generally injurious to animals that feed on them, either from their own nature, or because the land on which they grow is uncomfortable for, and unwholesome to, the health of animals, especially to sheep."

"*Heath* (Erica's), of sorts. The principal of the first class are,

Furze or *gorse* (Ulex europæus).

Petty whin, or *hen gorse* (Genista anglica).

Broom (Spartium scoparium): this is more commonly found in neglected dry arable land.

All these, when the land is of tolerable staple, should, he thinks, be burnt off, or grubbed up early in the spring; and if the land was afterwards sown with hay seeds in moist weather, it might much mend the herbage.

Fern (Pteris aquilina): it should be mown and carried off in summer, the value of it as litter being well worth the labour.

Those of the latter class, or which are occasioned by stagnant water, are principally:

Cotton grass (Eriophorum polystachion, *and* vaginatum).

Matt grass (Nardus stricta).

Rushes (Juncus's), several sorts.

Red rattle or *louse wort* (Pedicularis sylvatica).

Marsh St. Peter's wort (Hypericum elodes).

Kingspear (Narthecium ossifragum): these two last are of little consequence in themselves, but indicate boggy land; in their company is often found,

Purple flowered money-wort (Anagallis tenella).

Sedge grasses (Carex's), several sorts: these plants would give way to better herbage, upon draining their native bogs, which ought to be done by a rate, levied upon the inhabitants of the neighbourhood, having right of common.

It is here well remarked, that "if the country be not yet ripe for inclosing all the commons and waste lands, the improvement of their staple by measures of this kind, by destroying weeds and introducing better herbage; by draining the bogs and destroying the aquatic weeds growing therein, would mend their present state, and improve their value to the public; would render them capable of maintaining a greater number of sheep, and preserve such stock in better health, as well as render the land more susceptible of a rapid and easy improvement by cultivation, whenever the time shall arrive for their inclosure, and for such improvement."

Injurious weeds in hedges. It is remarked by Mr. Pitt in his excellent paper on weeding, that "all kinds of weeds are injurious to young hedges, which require to be well cleaned from them for three years after planting, otherwise the young quick would be choked and destroyed; and there are some kinds of plants which very much injure old full grown fences. Many kinds of weeds growing in hedges are a great nuisance if the seeds are suffered to ripen, because such seeds are liable to be carried into cultivated land by the wind; there are also some kinds of hedge weeds, which bear the character of being injurious to stock, these, if the observation be well founded, should be cleared from the hedges that such stock frequent; and, lastly, improper species of the vegetable kingdom, composing or growing in hedges, may be termed hedge weeds, because they prevent the main object of such hedges, that of dividing and fencing out the land."

Catch-weed, or *cleavers* (Galium aparine): this plant has a tendency to choke young hedges, by means of its numerous creeping rough branches; it should, therefore, be cleaned out in due time.

Great bind weed (Convolvulus sepium): this is, Mr. Pitt thinks, injurious to some hedges, by twining round the growing quick; the roots of this plant must be well worth gathering for medicinal uses, the inspissated juice of them composing scammony, a powerful drastic purge.

Great wild climber (Clematis vitalba): it is "common in hedges in the chalk counties, called there provincially old man's beard, from the hoary appearance of the plant after flowering, the seeds being furnished with numerous grey hoary tails. This plant is very injurious to fences, for the leafstalks twine about any thing they can lay hold of, and thus support the plant, which is large, luxuriant, and heavy, without any strength to support itself, and by its weight hauling down and deforming the fences." It is observed by Withering that "the fine hairs which give the cottony appearance are, I apprehend, too short to be employed in manufacture, though it is probable they may be used to advantage for the stuffing of chairs."

The hop (Humulus lupulus), the ladies seal, or black bryony (Tamus communis), and the wild vine or bryony (Bryonia diocia), are all, Mr. Pitt says, common in hedges, where he thinks them somewhat injurious to the fences.

And he says the sow thistles, the large rough thistles, knapweeds, and ragwort, as already described are great nuisances if their seeds be suffered to ripen in

hedges: in addition to which may, he thinks, be added the following, whose seeds are also furnished with feathers and capable of flying to a great distance.

" *Yellow devil's bit* (Leontodon autumnale).

Wild lettuce (Lactuca virosa).

Yellow hawkweed (Hieracium murorum).

Bushy hawkweed (Hieracium umbellatum):

Smooth hawksbeard (Crepis tectorum).

Burdock (Aretium lappa): this is a well known plant, which should not be suffered to perfect its seed in hedges, being very luxuriant of growth; " before the flowers appear, the stems, stripped of their rind, according to Withering, may be boiled and eat like asparagus; and when raw, they are good with oil and vinegar."

Dog's mercury (Mercurialis perennis): it is said, Mr. Pitt observes, " to be noxious to sheep; it is very common and abundant in some hedges, and appears very early in the spring, when sheep food is very scarce; on which account it is still more dangerous, if it be so at all."

These, and other plants of a similar nature, as well as all luxuriant weeds, and shoots of brambles, and whatever else grows beyond the bounds of the fence, ought, he says, to be brushed out of hedges about Midsummer, as is very often done in Staffordshire for the sake of their ashes, which are worth all the labour and expense.

Injurious weeds in woods and plantations. According to Mr. Pitt the list given below contains the chief herbs or plants peculiar to, or commonly found spontaneous in woods, so far as he has observed them as growing there without the aid of the owner or planter.

" *Enchanters nightshade* (Circæ lutetiana): this is found, he says, in woods in Bedfordshire and elsewhere.

Wood reed (Arundo arenaria):

Woodreoffe (Asperula odorata): it is, Mr. Pitt says, common in many woods; in Enfield pleasure grounds, Staffordshire, very plentiful.

Wild Angelica (Angelica sylvestris): this is common in woods and hedges, having the same properties in an inferior degree, with the garden angelica.

Solomon's seal, or wood lily (Convallaria): it is found in woods in various parts of the kingdom.

English hyacinth, harebell (Hyacinthus non scriptus):

Willow herbs (Epilobiums):

Bilberry (Vaccinium myrtillus): it is met with in moist woods.

Wintergreen (Pyrola): this is met with in woods in the moorlands of Staffordshire.

Wood sorrel (Oxalis acetosella: it is very common.

Wood spurge (Euphorbia amygdaloides): it is met with in woods, in a clayey soil frequently; Needwood forest, Staffordshire, plentifully.

Raspberry, dewberry, and common bramble (Rubus's): these are common in most woods, one or more of the species.

Strawberry (Fragaria vesca): it is common in woods.

Tormentill (Tormentilla reptans): this is very common.

Herb bennett (Geum urbanum): common.

Wood anemone (Anemone nemorosa);

Wood crowfoot (Ranunculus auricomus): this is common in woods on a clayey soil.

Stinking hellebore (Hellebore fætidus), in woods in many parts of the kingdom.

Wood sage (Teucium scorodonia):

Betony (Betonica officinalis):

Hedge nettle (Stachys sylvatica):

Bastard baum (Melithes mellissophyllum):

Cow grass, or cow wheat (Melampyrum pratense): very common in many woods, and said to be an excellent cow herbage, but not much found in pastures.

Fig wort (Scrophularia nodosa):

Coral wort (Dentaria bulbifera):

Pea everlasting (Lathyrus sylvestris): a luxuriant plant. He observed it in Lord Winchelsea's wood in Rutlandshire, stem 5 or 6 feet long.

Wood vetch (Vicia sylvatica):

Wood peasling (Orolus sylvatica):

St. John's wort (Hypericum perforatum):

Shrubby hawk weed (Hieracium sabaudam):

Saw wort (Serratula tinctoria):

Hoary groundsel (Senecio erucifolius):

Golden rod (Solidago Surgaurea):

Butterfly orchis (Orchis bifolia):

Friary blade (Ophrys ovata):

Sedge grasses (Carex's): several sorts.

Spurge olive, or spurge laurel (Daphnæ mezereum and laureola):

It is remarked that these are the most common spontaneous wood plants without noticing the timber or underwood species; but that many other sorts are to be found, which are less common or which the writer has not noticed.

It must be obvious that this is far from comprehending all the plants which have been considered as weeds by writers, as those which are known to be prejudicial to some sorts of cultivation or other are only introduced. In the new edition of Miller's Dictionary by Martyn a very large Catalogue of weed plants is given.

It is well remarked by Mr. Pitt that " the plants we term weeds, considered as respecting mankind, are not totally useless; many of them have valuable medicinal qualities, and some of them may be applied to uses so as to pay something towards the expence of clearing them from the ground: thus, sowthistles are good food for rabbits or hogs: the hog-weed, (Heracleum) is good for either hogs or cattle: horses are said to be fond of young thistles when partially dried, and the seed may be prevented from spreading by gathering the down, which makes good pillows; however there is some danger in trusting them to this stage of growth, as a high wind would, and frequently does, disperse them over a whole country. Chadlock, when drawn, may be given to cows, who are very fond of it, particularly of the smooth kind; and in the Oxford Report it is stated that it can be converted into good hay." And further that " nettles, fern, and the more bulky hedge-weeds, are, in Staffordshire, collected annually about Midsummer, and burnt; their ashes being afterwards formed into balls, which are of con-

siderable value, being used in composing a ley for scouring and cleaning linen and other clothes."

It is likewise stated that "it is said that pigeons are of use in picking up the seeds of many weeds that would otherwise vegetate; and he has no doubt but a prodigious quantity of the seeds of weeds are eaten by small birds, particularly of most of the lake-weeds (Polygonums), of the spurry (Spergula); and in severe weather of the different sorts of chadlocks (Sinapis, Brassica, and Rapphanus), and of many other kinds." And that in addition "it has been observed, that bees have not thriven so well in this island since the extirpation of weeds has been more attended to." Further that it is said that "in Japan, and in China, not a weed is to be seen; and that they only make use of night-soil as a manure, partly with a view of preventing any risk of weeds being produced that way."

WEED-HOOK, a term applied to the hook employed in extirpating weeds. The common weed-hook is a useful instrument for cutting weeds of a certain description, such as thistles, &c. being much in use in some districts; but, as the former of these when cut either at an early period of the season, or before much rain falls, are apt to spring up afresh and produce four or five stems in place of one, they ought, perhaps, in every instance, to be pulled, or, if they are cut, the operation should be done with a chisel, of a form resembling that in the figure below, which, if properly used will cut them below the surface.

WEEDING, the operation of cleaning crops of any kind from any sort of injurious weeds. It is evidently of little advantage for the farmer to have his lands prepared for the support of cultivated crops, provided plants of the weed kind are suffered to deprive them of the nourishing matters thus produced. It is likewise plain from the great diversity in the nature of those plants which are denominated weeds, that different ways must be had recourse to in order to extirpate them. Those of the annual and biennial kinds are often capable of being wholly destroyed by having them pulled up by the roots; by having the stem or stalk cut lower than the part where the first leaves are formed; and after they have formed flowers, by having them cut over any where below the lowest branches. But in these cases, as the plants have risen from the dissemination of the seeds of former years, many of which probably continue dormant in the soil, the destruction of the plants which rise in any one year, does not by any means clear the land. Annual attention must of course be requisite to keep them under.

It is found by experience that some particular soils and situations are favourable to the growth of some particular sorts of weeds, and others to others, and that such congenial weeds are constantly the most predominant. However it often happens that there are various kinds of weeds on the same land.

There are obviously two different methods to be employed in the destruction of weeds, one of which is in the preparation of the land, and the other during the growth of the crop. And in the former of which proper attention should be paid to the distinguishing such seeds as are of the root kind from those of the seedling description, as the destruction of them must be conducted in different ways.

It may be remarked in regard to the extirpation of garden weeds that many will constantly appear from the seeds being brought by the wind as well as by being introduced by using raw dung, particularly of hogs and horses, which often contain seeds possessing their vegetative power and the litter intermixed therewith often contains more. This shows that raw dung is very improper for a garden, but it is often used particularly for early or other potatoes.

Much labour in weeding will consequently be saved by particular attention in drawing up all seedlings in time, and before they have sown their seeds, for the increase of many weeds in this way is beyond calculation, and the precaution of preventing their seeding, should, therefore, never on any account be neglected.

The tools principally used in the gardens of Staffordshire, for destroying the weeds are, the spade, the three-fanged-fork for cleaning out root weeds, and the different kind of hoes, of which the Dutch hoe is used for scuffling over the surface, and the common hoes of a triangular or parallelogram form, for cutting up weeds, moulding up growing plants, and loosening the surface: these tools are, Mr. Pitt believes, very general, and known every where.

It has been well remarked by Mr. Naismith in his Elements of Agriculture in regard to destroying weeds in tillage lands, that "when the ground is greatly over run, a complete winter and summer fallow will, for the most part, be found unavoidable. Rib fallowing before the winter sets in as above recommended, will prepare the soil for parting freely with vivacious roots, the ploughing and harrowing requisite to tear them up, when the spring drought commences, will pulverize it, and provoke the dormant seeds to vegetate with the first moisture; by repeated turnings, during the summer the greatest part may be made to vegetate and be destroyed as they rise; and the vivacious roots which lie beyond the reach of the plough by being long prevented from exercising their vegetating powers, will be impaired in vigour. When wheat or any crop which is to stand through the winter is intended on such ground, it would be proper that the seed was sown in drills, that by stirring the intervals in the ensuing summer the tendency which most soils have to condense too much when greatly pulverised, may be counteracted. If spring seed is intended, the last ploughing should be given to the land, before the winter's rain commence, and the field accurately surface-drained. The influence of the atmosphere, during the winter, will thus communicate the happy medium of consistence on which he has repeatedly enlarged; and the soil, as soon as it is dry, will be in the best order for the reception of spring seed."

But when ground has been under any tolerable ma-

nagement, drill culture will, for the most part suit all the purposes of a clean fallow. In repeatedly turning the intervals, most of the annual weeds may be attacked in the groupe, and expeditiously destroyed as often as they spring; and the roots of the perennial turned up and exposed to the drought, if not altogether extirpated, would have their progress prevented, and their numbers and vigour diminished. But the rows should also be hand weeded, and the hand hoe will often be found an important instrument. Drill culture may thus be partially exercised every where with great advantage, adapting the application to any particular situation or circumstances. For example, where alternate courses of tillage and grass crops are adopted, in a course of three years tillage, the second might always be in drill; or if there were manure to spare, to keep a field in good condition in a tillage crop for four years, both second and third might be in drill. The first on account of the tough turf, and the last for the sake of sowing grass seeds would be more conveniently in broadcast. But the weeding of it should not be neglected. The larger weeds especially, and all those which are most prevalent, and most productive of seed should be taken out by hand labour when they begin to flower. By such strict attention to weeding tillage crops, and stocking the ground with proper perennial grasses when laid to rest, weeds would at length be so much subdued as to be seldom injurious."

It has been remarked by Dr. Anderson, Mr. Pitt says, that " there is only one mode of extirpating annual weeds whose seeds are indistructable; that is to put the ground into such a state as to induce them to germinate, and then to destroy the plants by harrowing up or ploughing under. This is strictly true, but he does not exactly agree with him in the process; the ground, for this purpose, should be ploughed before winter, but not harrowed, it being better to lay rough through that season, so as to have the greatest extent of surface possible exposed to the mellowing of frosts; as soon as it becomes dry in March, it should be cross-ploughed and harrowed down; many of the seeds and roots will then vegetate, which should in due time be ploughed under and harrowed again, and this process repeated as often as necessary: this is the true use of summer fallow, which, to have its proper effect, should always be attended to early in the season, when the powers of vegetation are greatest, and the heat of the sun is powerful."

He thinks, that " the great defect in the management of summer fallows, seems to be the neglect of working them early in the season, by which omission, the vigorous annual seedling weeds are not brought into vegetation in due time, after which they will not grow till the spring following, when they appear in such abundance amongst the wheat as sometimes to choak the crop; this is the reason why the poppy, the corn crowfoot, the tare, and many other annual weeds, make such havoc amongst wheat, when by a judicious early working the fallow, they might have been brought to exhaust themselves in the fallow summer: this appears very clear from the effect, for if no wheat were sown, the seeds of these plants would often fill the ground with a full crop; but seeds can vegetate but once, consequently, had this vegetation been brought on in the fallow, and the plants afterwards been ploughed under in due time, none could have appeared in the wheat crop."

And he supposes that " the turnip culture is peculiarly adapted to the destruction of weeds, as for this crop the ground must of necessity be in early preparation, by which weeds of early growth are brought into vegetation and destroyed, and those which remain alive in the soil may be exterminated by hoeing. He has observed that wet weather is as necessary as dry to give a summer fallow its whole effect; for without a soaking of rain after the land is prettywell pulverized, numbers of the seeds will not vegetate, but remain and grow amongst the crop; the root weeds are therefore to be destroyed in dry weather and the seedlings after rain; and though the land should after a dry season be apparently in excellent order for sowing, it is better to wait the effect of rain, and even give time for seedlings to vegetate before you actually sow for the crop."

A particular case is stated in which " some years ago, in a dry season, a ten-acre piece prepared for turnips, and apparently in excellent order for sowing; the one half of it was sown without waiting for rain, and the other half left; plentiful rain soon came, and on the sown part the turnips and chadlock started together, and the crop was very full of the latter, which required great trouble to clean out by hoeing and hand weeding; about a fortnight after the other part was again ploughed, and then sown with turnips; on this part scarce a single plant of chadlock appeared, the seed having vegetated in consequence of the rain, was destroyed by the after-tillage."

And that " the summer of 1795 was very dry and free from soaking rain in his neighbourhood; in that summer he had a wheat fallow of nine acres manured with lime; harvest being finished, and it appearing in excellent order for sowing early in September, it was sown with wheat accordingly; soon after plentiful rain came on. By some accident one butt or land, about four yards wide, the whole length of the piece, was left unsown, having been harrowed without sowing: the wheat appearing in due time elsewhere, the omission was discovered; it was now sown and ploughed in. The other part of the field, he says, abounded with chadlock, but that on this butt there was scarcely a single plant." And further that " the early sown wheat fallows of the summer of 1795 were very generally full of chadlock; whilst the later sown were not at all, or much less, infested with that plant."

It is therefore suggested, that " the destruction of root weeds and seedlings, on corn land, must be effected upon different principles; the former by working them out of the soil in dry weather only, the latter by pulverzing the soil, so as to induce the seed to germinate after rain, and afterwards ploughing under the young plants; also that frequent ploughings and harrowings are necessary to expose all the seedlings contained in the soil to the powers of vegetation. But it is conceived that the ploughings and harrowings of fallow ground should not, however, immedi-

diately succeed each other; time should be given for the consolidation of the soil, which, after well harrowing will undergo a slight fermentation, and settle, as it were, into a mass, after which it will turn up mellow, and the destruction of weeds will go on apace. The frequent ploughings, that have been recommended by some are not only, he thinks, unnecessary but injurious, insomuch that if any person would plough your fallow weekly for nothing, he believes it would be wrong to accept it. He has always observed that one ploughing of a fallow too soon succeeding another has no other effect than that of rooting about the clods, and prevents the general effect of consolidation and fermentation. The suffering of weeds to spread their leaves a little between the several ploughings of a fallow is not injurious; care, however, must be taken not to carry this idea too far, particularly in the case of squitch grasses, or so as to suffer any of the quick growing weeds to ripen their seed, or the luxuriant ones to become too large for burying with the plough." These remarks are practical and judicious, of course deserve the farmer's particular attention.

It is stated, that "if a fallow for turnips be cross ploughed and harrowed down in March, it will generally lie very well to the beginning of May; and in general no fallow will want ploughing oftener than once in six weeks, if sufficient harrowings be given between the ploughings; the particular time most proper for these operations must, however, be determined not by any general rule, but by local circumstances, experience and observation."

Where lands have not undergone proper improvement, or been under a bad system of management, it is evident, that much labour, trouble, and expence, will be necessary in order to fully extirpate the great variety of noxious weeds which infest them, to the great injury of the crops which are put upon them. But, that "where lands are already improved, and have been for some length of time under good systematic management, the business is in part, Mr. Pitt says, performed, and the evil much lessened," every rotation or course of cropping rendering the land cleaner and freer from weeds: the means to be made use of are, he says, "1. Complete and well managed fallows, when fallows are necessary or proper: 2. Manures free from the seeds or quick roots of weeds: 3. A careful choice of clean seed: 4. Short tillages, that is not taking too many crops in rotation: 5. Attentive weeding and a spirited use of the hoe, in which view the drill husbandry doubtless affords superior advantages to broad-cast, in keeping land clean from weeds; but land must be well cleaned before the drill husbandry is applicable: 6. A plentiful use of the clean seeds of the best grasses and trefoils at the end of the tillage: 7. Weeding the land when at grass, so as not to suffer the seeds of any injurious plants to spread themselves: 8. Upon again breaking up the land to pursue such a system of cropping as will not increase or encourage weeds."

Though much might be said on each of these points, he thinks it "unnecessary, as the intelligent farmer will easily supply himself with every precaution necessary from his own observations; he shall therefore only slightly touch upon the several particulars:" The subject of fallows has been already touched upon so that it is unnecessary to be further noticed here. In regard to fold-yard manure, "it should always, he supposes, undergo a fermentation before laying on the land, sufficient to prevent the future vegetation of any seeds that may be contained in it; but it should also be kept as free as possible from the seeds of weeds, and perhaps it is best laid on grass land, applying only lime, or other manures certain of being clean, to fallows; or if dung not certainly clean from seeds be laid on fallows, it should be laid on early enough to give time to the seeds to vegetate and spend themselves before sowing for the crop. Every one knows, says he, the necessity of clean seed to producing a clean crop, but sometimes neglect to apply such knowledge, and indeed clean seed is not always to be procured. Short tillages are universally approved in theory, but sometimes the idea of present advantage tempts a deviation in practice. Weeding of crops is generally imperfectly performed, and likely to continue so, he thinks, in many places, from the difficulty of procuring hands enough for work only temporary; thistles are generally only cut off, but they should always be drawn up by tongs, and other weeds by hand: the hoe has yet been only of general use in turnips, nor is it likely to extend farther, unless the drill husbandry should be more established, nor even in its present application can hands enough be always procured at reasonable rates. In the laying down of land to grass, the importance of clean seed is well understood, yet the seeds of docks are often sown with clover, and those of other pernicious plants with ray-grass: in the weeding of grass land, docks and thistles are often mown, or only cut off, but they should always be rooted up; for which purpose docking irons are formed upon a construction proper enough: they are, he supposes, every where understood, consisting of a forked or clefted spike of iron, jagged within the cleft, and fixed to the end of a wooden lever; this being forced down by the hand or foot, so as to inclose the root of a dock, or large thistle, will easily bring it up, particularly after rain; but mowing them off, being done with more expedition, is often practised, and they are sometimes left undisturbed, and suffered to scatter their seeds without any effort being made to prevent it."

It is further stated, that "upon breaking up a turf, it is understood in his neighbourhood, that unless a wheat fallow or a turnip crop compose a part of the tillage, the land will be injured and rendered fouler, and more addicted to produce weeds; this notion is, he believes, a just one, though often deviated from in practice for the sake of present profit, and under the idea of cleaning the land again next tillage; it is, however, well ascertained, that land well cleaned by former good management will best bear this deviation, for the fewer weeds it contains at breaking up, the less will be the increase of weeds during the tillage," or after management of the ground.

"But it is not enough, Mr. Naismeth says, to attend to weeding in the time of culture only. It is proper that grass fields also should be kept free of

all noxious and unprofitable herbage. The negligence which may be seen in this respect, in many places is shameful. Pastures are sometimes so close covered with large weeds that pasturing animals have scarcely room to pick up a mouthful, and thus the vegetable food which should nourish wholesome pasture is consumed by useless weeds." And speaking of the dock, ragweed, bur, corn and sow-thistles, he remarks that the two last are of the sort, which extend their vivaceous roots below the reach of the plough. It is not, says he, "uncommon with those who affect to pay a little more attention than ordinary to their pastures, to cut down these plants in the flower. If this is done in a rainy time, or if much rain falls soon after, the water descending into the fresh wound of the stem debilitates the roots and discourages the growth of the plants for a time. But if such critical rains do not occur, fresh leaves immediately arise to support the roots, and the cutting over has very little effect. They should be annually pulled up as soon as possible after the flower begins to form, taking advantage of the first shower which happens to fall, to soften the ground and make them draw freely. By pursuing this practice regularly for a number of years, the deep lying perennial roots are gradually weakened, and fall into decay. Nor is cutting down the ragweed of much avail. Some of the plants die, but many survive, and branch out more copiously the next year. But this plant not being deep-rooted is easily pulled up when in flower if the ground be soft at the time. The bur thistle being a biennial plant may be killed at any time by cutting it under the first leaves. The common dock is the most troublesome plant, especially in clayey soils, where it is always most frequent. Every bit of its long tap root left in the ground will continue to vegetate and at length form a new stem. It should be fully turned out with the dock iron as soon as the flowering stem is formed, and as the plants of this kind rise at two seasons, the fields should be weeded twice in the summer that no seeds may be allowed to ripen. The roots should be fully exposed to the drought; for if they be in a moist place they will continue to vegetate on the surface and strike out side roots into the ground. All other inesculent herbage on pasture grounds, and all weeds bearing seeds by the sides of roads, ditches, brooks, &c. should be cut down when they begin to flower, to prevent their increase by their seeds being dispersed over the fields."

Mr. Rudge, however, in reprobating the practice of confining the business of weeding almost solely to the tillage lands, while the meadows and pastures are almost wholly overrun with docks, nettles, hemlock, and thistles, remarks, that "it is supposed, that the scythe will be early enough to cut them off; the seeds, however, are generally ripened and dispersed before mowing time; and if not, they are carried with the hay to the stall, and mixed with the dung, or into the pasture for fodder during the winter; in either of which cases, they cannot fail of increasing greatly. Besides, the mere cutting off this kind of weeds, rather improves than diminishes their growth, by forcing them to throw out new shoots from the roots and that in greater abundance than before. Thus, a thistle which rises at first with a single stem, if cut off above the surface of the ground, spreads with several lateral branches, and covers a larger space of ground. The most likely method of destroying them, is to draw them up by the roots, which may easily be done when the ground is moist, and is done by those farmers who are anxious for their credit, nice in their herbage, and proud of seeing their pastures rivalling the neatness of a lawn. The negligence, indeed, of a neighbour often operates as a discouragement, and it is an evil not easily to be prevented: it is, however, surprising in another instance, to observe an almost unanimous encouragement given to the multiplication of noxious weeds. In the highways, they are left to grow to maturity, and their seeds are dispersed in immense quantities all over the country, by the wind, or carried by birds. Under these circumstances, it is certainly of little use for one, or even all the occupiers, to clear their lands, while this plentiful source remains unmolested. One should suppose, that the evident mischief resulting from this neglect, would excite a general combination against these destructive enemies to the interests of agriculture: that, however, not being the case, might it not be convenient to incorporate with the duty of the surveyors of the highways, the business of cutting up, and otherwise destroying, such kind of weeds within their district?

"Should the fact of the thousand fold increase of such self-sown seeds be doubted, let, says he, any one observe a patch on a common, from which the turf has been pared, how completely it will be covered with thistles in the following summer; and arable fields adjoining are not much better, where this negligence prevails."

And the intelligent writer of the paper on weeding further remarks that "there is another cause of the increase and propagation of weeds which may be termed a *public* cause, which it is not in the power of any individual to prevent; which a slovenly, neglectful, or ill-disposed individual may promote and increase, and which can only be prevented by a *political* regulation, and for which, he believes, no provision has yet been made in our political code; this is the numbers of vigorous and luxuriant weeds which are suffered to ripen their seeds in our hedges, pastures, woods, and other lands, and whose seeds being furnished with feathers, fly over the whole country, and propagate themselves far and near, growing wherever they alight and settle, and producing a plentiful crop; the most common and pernicious of which are, he thinks, the following: the various sorts of sowthistles, of saw-worts, of common thistles, coltsfoot, groundsels, and knapweeds."

For "as the seeding and scattering the seeds of these plants is clearly a public nuisance," and "as they are liable to be carried to a great distance by currents of air, and to injure the lands of all persons indiscriminately, he thinks, they ought to be within the reach of our political regulations. It is very justly observed, he says, by the president of the Board "that some regulation of police for fining those who harbour weeds, the seeds of which might be blown into their neighbours' ground, has no injustice in the principle." And he adds on the authority of Wither-

ing "that in Denmark there is a law to oblige the farmers to root up from their corn-fields the corn marigold (Chrysanthemum segetum); but this plant is not so publicly injurious as those above specified, the seeds having no feather, are much less liable to be blown elsewhere." The following regulation is suggested as practicable in the first instance.

It is for "the petty constable to be required, by precept from the high constable, to give, in their presentments to the quarter sessions, a list of all persons who suffered the above plants to run to seeds in their hedges or lands, such presentments to be particularly specified to the court; those referring to the coltsfoot to be given in at the Lady-day sessions; and those referring to thistles of all kinds, sowthistles, groundsel, including ragwort, and other senecio's, and knapweeds, to be given in at the Midsummer sessions; an order of court might be made for the removal of such nuisances within one month, and a view appointed at the expiration of that time by two of the neighbouring justices, who should be empowered to fine the offenders not complying with such order, in any sum not exceeding five pounds, to be applied to the relief of the poor of the parish where such offence existed."

It is supposed that "if the above proposed regulations were generally adopted and applied in practice they would render the British empire as free from noxious weeds as those of China and Japan; particularly if united with the several precautions before proposed for preventing or exterminating these intruders."

On the whole by an unremitting attention with these regulations, to exterminate all sorts of useless weeds from pasture and other grass as well as cultivated grounds, the growth of useless plants may be prevented and better herbage provided, and at the same time the arable crops be rendered more productive and abundant.

WEEKLY *Markets* and *Fairs*, such as are held within such short periods of time. It is common in most large towns through the kingdom to have one or more markets during the course of the week; but the fairs are generally at distant periods. They are too numerous to be introduced in this place, but may be seen in Owen's book of fairs.

WEEVIL, an insect of the beetle kind, resembling a small May bug, with a long sharp pointed head, to the hinder part of which are fixed two *antennæ*. It is an insect which often does much injury to grain that is laid up in store rooms. It is black, and therefore easily distinguished in any corn: but its principal and favourite food is wheat, of which, either old or new, it devours great quantities; without however communicating any bad smell to it, as the moth does. Some call it the corn-louse, because it bites animals more strongly than fleas do. This has made it to be looked upon as a carnivorous insect; and many have pretended that it devours both the worm and the chrysalis of the false moth: an opinion which Mr. Duhamel does not think improbable, because, in effect, very few of those moths are ever found in corn where there are many weevils.

It has been found by Mr. Banger of Madeira as stated in the Survey of Middlesex, that steaming such grain as is infested with the weevil has the effect of preserving it. He has found that by steaming the grain once on the first of January and again on the first of June, the grain may be kept in a state of perfect preservation from the effects of the weevil. The writer found that the waste of grain not badly infected with the weevil, was one per cent. in weight in one month. And in the West Indies the destruction of this insect on grain is still more rapid.

WEIGH, a weight of cheese, wool, &c. containing 256 pound avoirdupois. Of corn, the weigh contains 40 bushels; of barley or malt, 6 quarters. A weigh of cheese or butter in Suffolk is 256lbs. and in Essex 336lbs.

WEIGHTS and MEASURES, the proportions or quantities by which various sorts of agricultural or other produce, are disposed of. They vary greatly in different districts of the kingdom and even in different places of the same district or county.

It may be observed, Dr. Hutton says, that the regulations of weights and measures properly belongs to the legislature, and that for the convenience of the public these ought to be universally the same throughout the nation, the better to reduce the prices of articles to equivalent values. But that as weights and measures are things in their nature arbitrary and uncertain, it is necessary that they be reduced to some fixed rule or standard. It is however impossible to fix such a standard by anywritten law, or oral proclamation; as no person can by words only give to another an adequate idea of a pound weight or foot rule. It is therefore expedient to have recourse to some visible, palpable material standard; by forming a comparison with which all weights and measures may be reduced to one uniform size. Such a standard was anciently kept at Winchester: and we find in the laws of king Edgar near a century before the conquest, an injunction that, that should be observed throughout the realm.

Most nations have regulated the standard of measures of length from some parts of the human body, as the palm, the hand, the span, the foot, the cubit, the ell (*ulna* or urm) the pace, and the fathom. But as these are of different dimensions in men of different proportions, ancient historians informs us that a new standard of length was fixed by our king Henry 1st. who commanded that the *ulna* or ancient ell which answers to the modern yard, should be made the exact length of his own arm.

A standard of long measure being once gained, all others are easily derived from it; those of greater length by multiplying that original standard, those of less by dividing it. Thus by the statute called *compositio ulnarum et perticarum*, $5\frac{1}{2}$ yards made a perch, and the yard is subdivided into three feet, and each foot into 12 inches, which inches will be each of the length of three barley corns. But some, on the contrary, derive all measures by composition from the barley corn.

Superficial measures are derived by squaring those of length; and measures of capacity by cubing them.

The standard of weights was originally taken from grains or corns of wheat, whence our lowest denomination of weights is still called a *grain;* 32 of which

are directed, by the statute called *Compositio mensurarum* to compose a penny weight, twenty of which make an ounce, and twelve ounces a pound, &c.

Under king Richard 1st. it was ordained that there should be only one weight and one measure throughout the nation, and that the custody of the assize or standard of weights and measures, should be committed to certain persons in every city and borough, from whence the ancient office of the king's ulnager seems to have been derived. These original standards were called *pondus regis*, and *mensura domini regis*, and are directed by a variety of subsequent statutes to be kept in the exchequer chamber by an officer called the *clerk of the market*, except the wine gallon, which is committed to the city of London, and kept in Guildhall.

The Scottish standards are distributed among the oldest boroughs, the elwand is kept at Edinburgh, the pint at Stirling, the pound at Lanark, and the firlot at Linlithgow.

The two principal weights established in Great Britain, are troy weight and avoirdupois weight, as before mentioned, under the head of the former; it may further be added that,

A carat is a weight of four grains, but that when the term is applied to gold it denotes the degree of fineness. Any quantity of gold is supposed divided into 24 parts. If the whole mass be pure gold it is said to be 24 carats fine; if there be 23 parts of pure gold and one part of alloy or base metal, it is said to be 23 carats fine, and so on.

Pure gold is too soft to be used for coin. The standard coin of this kingdom is 22 carats fine. A pound of standard gold is coined into 44 half guineas, and therefore every guinea should weigh 5 dwts. $9\frac{2\,9}{8\,9}$ grains.

A pound of silver contains 11 oz. 2 dwts. pure silver, and 18 dwts. alloy; and standard silver plate 11 oz. pure silver with 1 oz. alloy. A pound of standard silver is coined into 62*s*. and therefore the weight of a shilling should be 3 dwts. $20\frac{8}{2\,1}$ grains.

As the diversity of weights and measures create much perplexity and uncertainty in the purchase aswell as disposal of different sorts of produces, it would not only be highly desirable but convenient, and advantageous to have one universal standard or system of weights and measures.

This has been attempted by philosophers in different ways: after the invention of pendulum clocks it first occurred that the length of a pendulum which should vibrate seconds, would be proper to be made a universal standard for lengths, whether it should be called a yard or any thing else. But it was found, that it would be difficult in practice, to measure and determine the true length of such a pendulum, that is, the distance between the point of suspension and the point of oscillation. Another cause of inaccuracy was afterwards discovered, when it was found that the seconds pendulum was of different lengths in all the different latitudes, owing to the spheroidal figure of the earth, which causes that all places in different latitudes are at different distances from the centre, and consequently the pendulums are acted upon by different forces of gravity, and therefore require to be of different lengths. In the latitude of London, this is found to be $39\frac{1}{8}$ inches.

The premium offered by the Society of Arts in London introduced an improvement on the method of the pendulum, which consisted in measuring the difference of the lengths of two pendulums of different times of vibration, which could be performed more easily and accurately than that of the length of one single pendulum. This method which was proposed by Hatton was put in practice and fully explained and illustrated by the late Mr. Whitehurst in his Attempt to ascertain an universal Standard of Weights and Measures. But still the same kind of inaccuracy of measurement &c. obtains in this way, as in the single pendulum, though in a smaller degree.

Another method that has been proposed for this purpose, is the space that a heavy body falls freely through in one second of time. But this is an experiment more difficult than the former, to be made with accuracy on which account different persons will all make the space fallen to be of different quantities, which would give as many different standards of length. Add to this, that the spheroidal form of the earth here again introduces a diversity in the space, owing to the different distances from the centre and the consequent diversity in the force of gravity by which the body falls. This space has been found to be 193 inches, or $16\frac{1}{1\,2}$ feet in the latitude of London, but it will be a different quantity in other latitudes.

A variety of other inferior expedients have also been proposed for the purpose of universal measures and weights.

At present that which has the best prospect of success, and which is now under the particular experiments of the philosophers of this and the French nation, is by the measure of the degrees of latitude, which would give a large quantity and admit of more accurate measures by subdivision, than what could be obtained by beginning from a small quantity or measure, and thence to proceed increasing by multiplies. This measure might be taken either from the extent of the whole compass of the earth, or of all the 360 degrees, or a medium degree among them all, or from the measure of a degree in the medium latitude of 45 degrees. It will also be most convenient to make the subdivisions of this measure when found, to proceed decimally or continually by 10ths.

It has been suggested by Dr. Hutton, that "an universal standard for lengths being once established, those of weights and measures must easily follow. For instance, a vessel of certain dimensions being filled with distilled water, or some other homogenous matter, the weight of that may be considered as a standard for weights."

It is observed in the Report of the West Riding of Yorkshire that few subjects are of greater importance to the agriculturist, than a reduction of the weights and measures of the kingdom to settled standards, as their present disordered state is productive of innumerable evils both to the seller and the buyer of every home raised commodity. Indeed, it is only on the sale of our own produce that the diversity is felt, as every foreign article is uniformly sold by fixed and well known standards. But notwithstanding this business has repeatedly occupied the attention of the legislature, the confusion which has for ages prevailed is still suffered to remain.

And in another work of the same kind it is stated, that nothing connected with agriculture is involved in such confusion, and attended with such embarrassment as that of weights and measures. "Though," says the writer, the greater part of the denominations be the same every where they do not mean the same thing almost in any two counties; they have not the same meaning even in the same county, when applied to different objects. A pound of butter and a pound of beef often do not express the same quantity, when spoken of by the same person. This confusion causes much uncertainty and trouble, and nothing could render it tolerable, but that people have been long accustomed to it."

In respect to the weights of this country they are directed in the 27th chapter Magna Charta to be the same all over England: but for different commodities there are two different sorts, viz. *troy weight*, and *avoirdupoise weight*.

And the origin from which each of these are drawn is the grain of wheat, gathered in the middle of the ear.

32 of these well dried, made	1	dwt.
20 dwts. - -	1	oz.
12 oz. - -	1	lb. troy.

As by stat. 51 Hen. III. 31 Edw. 1, and of 12 Hen. VII.

And it has been shown in the Philosophical Transactions, Vol. 65, Art. 3, that by the laws of assize, from William the Conqueror to the reign of Hen. VII, the legal pound weight contained a pound of 12 oz. raised from 32 grains of wheat, and the legal gallon measure contains 8 of those pounds of wheat, 8 gallons making the bushel, and 8 bushels the quarter.

But Hen. VII. altered the old English weight, and introduced the troy pound in its stead, being three quarters of an ounce only heavier than the old Saxon pound or $\frac{1}{16}$ heavier. The first statute that directs the use of the avoirdupois weight, is that of 24 Henry VIII, and the particular use to which this weight is thus directed is simply for weighing butcher's meat, all sorts of coarse and heavy articles. This pound contains 7000 troy grains, while the troy pound itself contains only 5760 grains, and the old Saxon pound weight but 5400 grains. Hence there are in common use in England at present two different weights, viz. *troy weight*, and *avoirdupois weight*, the former being employed in weighing most sorts of fine articles as gold, silver, &c. and the latter for coarse and heavy articles, as bread, corn, flesh, butter, cheese, tallow, pitch, &c. And it has been supposed by Mr. Ward, that it was brought into use from the circumstance of its being customary to allow larger weight, of such coarse articles, than the law had expressly enjoined, which happened to be a 6th part more.

TABLES OF WEIGHTS AND MEASURES.

Troy weight.

24 Grains -	make 1	Pennyweight
20 Pennyweights -	1	Ounce
12 Ounces - -	1	Pound

Note. By this weight are weighed gold, silver, amber, bread, corn, and all liquors.—14 oz. 11 dwts. 15½ grains, (or 292 dwts. nearly) are equal to a pound avoirdupoise.

Avoirdupoise weight.

16 Drams	make 1	ounce
16 Ounces - -	1	pound
28 Pounds - -	1	quarter
4 Quarters - -	1	hundred weight
20 Hundred -	1	ton

Note. By this weight are weighed all grocery goods, such as butter, cheese, &c. and all metals, except gold and silver.

7½ Pounds	make 1	gallon of train oil
8 Pounds	1	stone of butcher's meat
14 Pounds	1	stone of horseman's weight.
19½ Hundreds	1	Fodder of Lead

Wool weight.

7½ Pounds -	make	1 Clove
2 Cloves - -		1 stone
2 Stone - -		1 todd
6½ Todds - -		1 wey
2 Weys - - -		1 sack
12 Sacks - - -		1 last

Hay weight.

56 Pounds of old hay, or 60 Pounds of new ditto	make	1 truss
36 Trusses - -		1 load

Bread weight.

	lb.	*oz.*	*dr.*
A peck loaf weighs -	17	6	0½
A half ditto - -	8	11	0
A quartern ditto - -	4	5	8

Dry Measure.

2 Pints	make 1	quart
2 Quarts - -	1	pottle
2 Pottles - -	1	gallon
2 Gallons - -	1	peck
4 Pecks -	1	bushel
4 Bushels - -	1	coomb
2 Coombs, or 8 bushels	1	quarter
4 Quarters, or 32 bushels in the country, and 36 in London	1	chaldron
5 Quarters - -	1	wey
2 Weys, or 10 quarters	1	last

Note. By this measure are measured corn, salt, lead, ore, oysters, and all dry goods. The standard Winchester bushel is a cylinder 18½ inches diameter, and 8 inches deep.

Long Measure.

3 Barleycorns	make 1	inch
12 Inches - -	1	foot
3 Feet - -	1	yard
6 Feet - -	1	fathom
5½ yards - -	1	pole, rod, or perch
40 Poles - -	1	furlong
8 Furlongs - -	1	mile
3 Miles - -	1	league
60 Geographical, or 69½ English miles -	1	degree
360 Degrees - -	The circumference of the Globe.	

This comprehends length only.

Square Measure.

144 Square inches	make 1	square foot
9 Square feet	1	sq. yard

100 Square feet	-	1 sq. of flooring
272¼ Square feet	-	1 sq. rod
40 Square rods	-	1 sq. rood
4 Square roods	-	1 sq. acre
30 Square acres	- -	1 sq. yard of land
100 Square acres	-	1 sq. Hide
640 Square acres	-	1 sq. mile

Note. Square measure comprehends length and breath, and is used in measuring land, in paving, flooring, painting, glazing, plaistering, roofing, slating, tyling, &c.

In land measuring is used Gunter's chain (which is 4 poles or 22 yards, or 66 feet long, and contains 100 links, each link being 7.92 inches long.)

43560 square feet or 4840 square yards, or 160 square poles, that is, 160 poles in length and 1 pole in breadth, or 4 square roods, or 10 square chains, that is, 10 chains in length and 1 chain in breadth, make an acre of land.

Cubic or Solid Measure.

1728 Cubic inches		make 1 cubic foot
27 Cubic feet	-	1 cubic yard
40 Feet of rough timber 50 Feet of hewn ditto		1 load

This comprehends length, breadth, and thickness.

108 solid feet that is, 12 feet in length, 3 feet in breadth, and 3 deep, or commonly 14 feet long, 3 feet 1 inch broad, and 3 feet 1 inch deep, is a stack of wood.

128 solid feet that is 8 feet long, 4 feet broad, and 4 feet deep, is a cord of wood.

Coal Measure.

4 Pecks	- -	1 bushel
3 Bushels	- -	1 Sack
12 Sacks, or 36 bushels		1 chaldron
21 Chaldrons	- -	1 score

Corn Measure.

A load of corn	-	5 bushels
A last of do.	- -	43 do.

It is enacted by 31 George the Third, that a Winchester bushel of corn should weigh as follows:

	lb.			lb.	
Wheat	57	Avoirdupois, Wheat meal		56	Flour, 45lb. of which should be equal to a Winchester bushel unground.
Barley	49	- -	Flour -	48	
Bigg	42	- -	Ditto - -	41	
Oats	38	- -	—— -	32	
Rye	55	- -	—— -	53	

After these statements of the different weights and measures which are in common use, it may not be improper to notice some of the differences of the weights and measures, as they exist in different districts, according to the reports which have been given of them.

In the counties or districts near the metropolis, the statute measures are pretty commonly employed, though there are many deviations; but in those at some distance there are frequently remarkable variations and differences.

It is stated in the Gloucester Report, that in the market of that town, the bushel varies from nine to ten gallons, in the forest district it is nearly ten gallons, on the Cotswolds about nine. In the valnine and an half, and in the lower vale, and at Cirencester nine and a quart, of all sorts of grain.

Near Bristol, potatoes, green peas, &c. are sold by the double peck, containing two common ones struck level with the top, while at Gloucester, and higher up the vale, it is a common peck heaped up. Wool is generally sold by the stone weight of 12½ lb. or the tod of 28½ lb. Butter often by the pound of 18 oz.

In Herefordshire the peculiar weights and measures at present in use, are these, according to the Survey of that district.

A pound of fresh butter,	Eighteen ounces.
A stone, - - - -	Twelve pounds.
A customary acre, -	Two thirds of a statute acre.
A hop acre, - - -	That space of ground, which contains 1000 plants; viz. about half a statute acre.
A lugg, - - - -	Forty-nine square yards of coppice wood.
A wood acre, - - -	Three-eights larger than a statute, i. e. as 8 are to 5.
A day's math, - - -	About a statute acre of meadow or grass land, being the quantity usually mown by one man in one day.
A perch of fencing, -	Seven yards.
A perch of walling, -	Sixteen feet and an half.
A perch of land, - -	Five yards and an half (as statute).
A bushel of grain, - -	Ten gallons.
A bushel of malt, - -	Eight gallons and an half.

In the Shropshire Survey it is stated, that "wheat, barley and pease, are sold by the strike or bushel, which in Shrewsbury market is 38 quarts, but in some other markets it is 40 quarts. The 38 quarts of wheat should weigh 75 lb., the 40 quarts 80 lb. In other markets in the county, the bushel of wheat does not weigh more than 70 lb.: this is chiefly applicable to the eastern district. The bushel of flour is every where 56 lb. Thirty-eight quarts of barley weigh about 65 lb. A bushel of oats means three half bushels of the customary measure at Shrewsbury, and should weigh better than 93 lb. In other markets it means 2½ bushels, sometimes heaped, sometimes stricken, and sometimes a medium between both. A bag of wheat means three bushels customary measure. The quarter bushel is called a hoop or peck; and the fourth of that is called a quarter. Butter, when fresh, weighs 17 oz. to the pound; when salted, 16 oz. The last is reckoned by gawns, which signifies 12 lb. of 16 oz. in Shrewsbury, and 16 lb. of 16 oz. at Bridgnorth. Cheese is sold by the cwt., which at Shrewsbury means 121 lb. and 113 lb. at Bridgnorth. Coals are sold by the ton, which is 20 cwt. of 112 lb. at some pits, and 120 lb. at others: the stack is now rarely used; it was a measure of four feet square, and would sometimes weigh 25 cwt. Hay is sold by the ton, of 20 cwt. of 112 lb. Home-made linen cloth is sold by the ell, which measures a yard and half."

It is added, that "the acre is the statute acre." And that "the workman's rood in digging is eight yards square; in hedging eight yards in length.

It is suggested, that "there is an error in the standard measure, that in the Exchequer not agreeing with the requisitions of the 13 Will. III. c. 5. By that statute "the bushel is ordered to be 18¼ inches

round, and 8 deep; it would consequently contain,
(cubic inches) - - - - - - 2150
" That in the Exchequer contains, - - 2124
" Eight of the standard gallons, - - 2168
" Thirty-two do. quarts, - - - 2240
" Sixty-four do. pints, - - - - 2027

" The difference between the bushel and 32 of the quarts is, therefore, 116 cubic inches, or nearly three pints and a half."

It is stated, that in the northern part of the North Riding of Yorkshire, " the customary bushel exceeds that of the Winchester by full two quarts; but nearer to the southern extremity, seldom by more than one: the bushel of some individuals in the Riding, is still larger, measuring about ten per cent. more than the statute requires."

And that " a stone of wool in York market, is sixteen pounds, and four ounces in each stone are allowed for draught, that is, for the draught of each fleece, the wool buyers being empowered by act of parliament to weigh each fleece *separately*, if they like. At Ripon market, a stone of wool is sixteen pounds twelve ounces. And a stone of wool in the Western Moorlands, is seventeen pounds and a half; the half pound, the writer apprehends, is for draught, as in York market.

But " at Darlington, where the wool grown about Richmond is chiefly sold, the stone is eighteen pounds."

And in the Eastern Moorlands, the weights used by individuals, vary, up to nineteen pounds to the stone."

The pound of butter in the Riding, varies from sixteen to twenty-four ounces. But a stone of all other commodities throughout the Riding is fourteen pounds.

It is stated in the Lancashire Report, that the rod is of no less than six different lengths in different parts of the county; namely, the statute or $5\frac{1}{2}$ yards, 6, $6\frac{1}{2}$, 7, $7\frac{1}{2}$, and eight yards, to the rod, pole, or perch.

And that " the measures are equally variable. At Lancaster a load of wheat, beans, and pease, is four and a half bushels (Winchester); barley, six Winchester bushels; oats, seven and a half Winchester bushels, they have also a measure called a *windle*, which is equal to three Winchester bushels. But that wheat has been sold lately by the weight of 280lb.

" At Ulverstone, a load of wheat is $4\frac{1}{2}$ Winchester bushels; oats, six Winchester bushels. And that at Manchester, a load of wheat is sixteen score; a load of oats nine Winchester bushels; a load of beans five Winchester bushels; a load of potatoes twelve score and twelve pounds, washed; unwashed, thirteen score. That Liverpool town's bushel is $34\frac{1}{2}$ quarts for oats, barley, and beans, making exactly 36 quarts Winchester, or one-eighth more than a Winchester bushel; and by the custom of trade, one given in at every score, or twenty-one bushels; of late wheat, barley, and oats have been sold by weight, but never yet beans; wheat 70 lb. to the bushel, barley 60 lb. and oats 45 lb.; and probably this mode by weight is the fairest for both a buyer and seller; for, besides the difficulty of gettinga true standard bushel or measure, the dexterity of corn-meters is such, that it is asserted they can gain either to the buyer or seller from 10 to 20 per cent. in different modes of measurement; that 5 per cent. can be obtained by this practice by even bunglers in the business: this is an enormous profit, and the unfairness of such practices merits the severest reprehension."

" At Preston the windle of wheat, beans, and barley is three and a half Winchester bushels; but of late 220 lb. has been reckoned a windle of wheat; they have also a measure there called a peck, which is twenty-eight quarts, four of which are called a windle."

In respect to weights, there are three different ones expressed under the general term, hundred weight; namely, 100 lb. 112 lb. and 120 lb. The stone varies. In Liverpool 20 lb. is the weight allowed for the several articles under that denomination, as beef, hay, straw, &c. and probably all the articles produced from land."

And butter is required to weigh 18 ounces, avoirdupoise, or may be seized by the magistrates."

In Westmorland " the pound consists of 12 16, 18, or 21 ounces, and the stone of 14, 16, or 20 pounds. There is a Winchester bushel, a customary bushel equal to three of these, a bushel of two bushels for the sale of potatoes near Appleby, and one of two and a half for that of barley. Rye is sold by the boll of two bushels, and potatoes by the load of four bushels and a half heaped, or more generally a bag, which holds seven and one half bushels is filled and sold for a load of potatoes.

" There is the statute acre of 4840 square yards, the customary acre of 6760 raised from the perch of six and one half yards, and a third acre on the borders of Lancashire, raised from the perch of seven yards, containing 7840, being the same as the Irish plantation acre."

It is remarked in the Cumberland Report, that "the same confusion in weights and measures prevails there as in many other parts of the kingdom.

A Winchester bushel is 32 quarts.
A Carlisle bushel, is 96 quarts.
A Penrith bushel, is 64 ditto, for wheat and rye.
80 ditto, for barley, oats and potatoes.
A stone of tallow, wool, yarn, or hay, is 16lb.
Ditto of butcher's meat 14 lb. but in many places 16 lb.

" The pound is 16 ounces; by which butter, and various other articles are weighed."

The writers of the Northumberland Survey state that there weights and measures are in a sad state of confusion; a pound, a stone, a bushel, a boll are rarely the same in different markets, and frequently vary in the same market for different articles.

At Newcastle.

4 Beatments	-	1 Peck
2 Pecks	-	1 Kenning
2 Kennings	-	1 Bushel, Winchester.
2 Bushels	-	1 Boll.

At Hexham, rye, and pease.

4 Quarts	-	1 Forpit
4 Forpits	-	1 Peck

4 Pecks	-	1 Bushel
2 Bushels	-	1 Boll,=4 Winchest. bush.

For oats and barley.

4 Quarts	-	1 Forpit
5 Forpits	-	1 Peck
4 Pecks	-	1 Bushel
2 Bushels	-	1 Boll,=5 bush. Winchest.

At Alnwick.

3 Quarts	-	1 Forpit
4 Forpits	-	1 Peck
3 Pecks	-	1 Bushel, Winchester.
2 Bushels	-	1 Boll of Wheat
6 Bushels	-	1 Boll of barley or oats.

At Wooler.

4 Quarts	-	1 Forpit
3 Forpits	-	1 Peck
3 Pecks	-	1 Bushel
6 Bushels	-	1 Boll

And that "a stone of wool in some parts is 24lb. in others 18lb.; and a stone of every other article is 14 lb."

The weights and measures made use of in Scotland differ very materially from those employed in England; of course it may not be useless to give a cursory view of them. It has been observed by Mr. Somerville, that "land is measured by the Scotch acre, which is to the English acre very nearly in the proportion of five to four.

That "the boll is the denomination of corn measure always used, but the contents vary according to the species of grain measured." But that there are uniformly four firlots in the boll of all grain, but the firlot differs in size in the proportion of 21, 25, to 31. Wheat, rye, beans, and peas, are sold by the small firlot; malt, barley, and oats, are sold by the large one. Four small firlots are 4.087276 Winchester bushels; four large ones are 5.96263 bushels Winchester. The boll of wheat then is a small fraction more than half a quarter, and the boll of barley, a fraction less than three-fourths of a quarter. But this calculation applies, it must be remembered, to the Linlithgow boll, which is accounted the standard measure of Scotland; the measure actually used in East Lothian is somewhat larger."

It is observed in the Mid-Lothian Report, that "Flour, pot-barley, groceries, iron and ropes, are bought and sold there, by what is termed English weight, being 16 oz. to the pound, and 16lbs. to the stone. But that "butchers meat, oat-meal, and flax, are bought and sold by what is called Dutch weight, of which the proportion to the English is as $17\frac{1}{2}$ to 16.

And that wool, hay, and butter, are bought and sold by trone weight, of which the proportion is to the English, as 22 to 16. That other articles are bought and sold by either of these weights, as it may happen.

But that "in long measure the inch is the root, of which 12 go to the foot, and 37 to the Scotch yard."

And that "land is measured by a chain 24 yards in length, or 74 feet, divided into 100 links, of 8.888 inches each in length, 10 square chains make an acre, or 5760 square yards Scotch equal to 6084.444 English; and as the English acre consists of 4840 square yards, hence the proportion that the Scotch acre bears to the English is, (with a small fraction more) as 5 to 4, as seen above.

That in liquid measure the *pint* is the root, containing 103.404 cubic inches; the half and quarter in proportion.

That "the Linlithgow wheat firlot, the only standard measure for that grain in Scotland, contains $21\frac{1}{4}$ pints; hence in cubic inches 2197.34. The Winchester bushel, (in like manner the English standard,) contains 2150.42 cubic inches; hence the Scotch wheat firlot is about $2\frac{1}{7}$ per cent. greater than the English bushel."

And "the Linlithgow barley measure, (likewise the standard,) contains 31 pints, or 3205.54 cubic inches, hence $5\frac{23}{24}$ bushels, are very nearly equal to the Scotch boll of 4 firlots."

That "straw is sold by tale, 40 windlens to a kemple, generally from 14 to 16 stone trone weight."

In East Lothian, meal is sold by the peck of eight pounds Amsterdam weight. The boll of meal contains sixteen pecks or eight stones.

It is stated in the Clydesdale Report, that "in the dry measure, used in the sale of grain of all kinds, a boll contains four firlots, a firlot four pecks, and a peck four forpets or lippies; 16 bolls make a chalder. The firlot used to measure barley and oats, is almost one half larger than the firlot for measuring wheat, beans, pease, &c. Both these measures are about one sixteenth larger than the Linlithgow standards of the same denominations. But for more than 30 years past, wheat has been bought and sold by the Linlithgow standard, which is now attempted to be introduced for other grains.

In the lower parts of the county potatoes have been measured for these forty years. With a dish of the shape of a cask the peck measure holding 15 Scots pints; its weight, full of potatoes recently dug is 43lb. avoirdupois. In the higher parts of the county potatoes are sold by the barley measure.

The peck, or *sleek* for measuring pears and apples holds about 18 pints. The confusion occasioned by the irregularity of weights and measures, is too obvious to require any comment."

In the Argyleshire Report it is stated that at Inverary the boll of meal is eight stone Scotch troy, or Dutch, 17lb. and a half avoirdupois to the stone. At Campbelton it is 10 stone, of the same weight; or 16 pecks of 10lb. Scotch Troy, or 10lb. 15oz. avoirdupois, each."

And that "in some parts of the Knapdale and Lorn, the boll is nine stone." That in the first of the above places, oats, barley, and malt, are measured by a firlot of 3438.183 cubic inches; equal to one firlot, two pints, one mutchkin, Scotch standard measure; which makes the boll (of four firlots) 7.258 per cent. better than the Scotch standard measure, and equal to six bushels one peck nine pints 10.2 cubic inches, English standard measure.

And that "in Kintyre, oats, barley, or bear and malt, were for time immemorial sold by a heaped peck, of which the standard lay with the dean of guild in Campbelton. Of this measure 17 pecks made, and still make, the Kintyre boll from August to Patrickmas, and only 16 from that date to the new

crop; and the divisions of the boll are regulated by the same proportions.

From the inconvenience of measuring by the heaped peck it has been converted into the striked one containing the same quantity, and this new striked peck, committed to the dean of guild, has been since the standard of the district. The dimensions of it are 12 English inches diameter, equally wide throughout, and 10 and a tenth English inches deep. The contents of it in cubic inches are 1142.28576, equal to 11 Scotch pints, and a very little more than two thirds of a gill, which makes the Kintyre boll 19418.85792 cubic inches, before Patrickmas, and 18276.57216 after it. A lippie more, or 1-64th of a boll, for town dues, is given with every boll delivered in Campbelton. The first is equal to nine Winchester bushels and 65.03112 cubic inches (about $\frac{1}{32}$ of a bushel) and equal to one boll eight pecks 1.61788 lippie, Linlithgow standard measure. The latter is equal to 8 and a half Winchester bushels, excepting 2.0394 cubic inches, and to one boll 6 pecks, $3\frac{45}{290}$ lippies Linlithgow. The Winchester bushel contains 2150.42 cubic inches. The Linlithgow boll standard measure, 12822.096.

And at "Inverary, the peck of potatoes contains 14 pints and one mutchkin, ale measure. At Campbelton, it contains about nine English wine gallons, and is given heaped; and generally weighs about 56lb. avoirdupois."

But "beans and pease are sold in Kintyre by the old peck striked, or by a measure one third less than that for oats and bear. Lineal and liquid measures are the same with the Scotch standards. Butter, cheese, tallow, hay, wool, and lint, are sold by the stone of 24lb. avoirdupois. Butcher's meat by the pound of 24 ounces avoirdupois at Inverary, and of 16 ounces at Campbelton. The herring barrel contains 32 English gallons of wine measure, or 67.28 customary ale pints of 109.866 cubic inches each."

These facts and statements sufficiently show the necessity of some regulation being speedily adopted of adjusting weights and measures to some simple standard.

The following tables of weights constructed by lord Somerville, may be useful to the stock farmer.

TABLE FOR THE EQUALIZATION OF DIFFERENT WEIGHTS.

Scores.	Stones, at 14lb.		Stones, at 8lb.		Scotch Stones 16lb.		Hundred, 112 lb.		
	St.	lb.	St.	lb.	St.	lb.	Cwt.	qrs.	lb.
20 equal	28	8	50	0	25	0	3	2	8
25 —	35	10	62	4	31	2	4	1	24
30 —	42	12	75	0	37	4	5	1	12
35 —	50	0	87	4	43	6	6	1	0
40 —	57	2	100	0	50	0	7	0	16
45 —	64	4	112	4	56	2	8	0	4
50 —	71	6	125	0	62	4	8	3	20
55 —	78	8	137	4	68	6	9	3	8
60 —	85	10	150	0	75	0	10	2	24
65 —	92	12	162	4	81	2	11	2	12
70 —	100	0	175	0	87	4	12	2	0
75 —	107	2	187	4	93	6	13	1	16
80 —	114	4	200	0	100	0	14	1	4

TABLE OF PRICES.

Scores at	3¼d.			3½d.			3¾d.			4d.			4¼d.			4½d.			4¾d.			5d.		
	l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.
1	0	5	5	0	5	10	0	6	3	0	6	8	0	7	1	0	7	6	0	7	11	0	8	4
2	0	10	10	0	11	8	0	12	6	0	13	4	0	14	2	0	15	0	0	15	10	0	16	8
3	0	16	3	0	17	6	0	18	9	1	0	0	1	1	3	1	2	6	1	3	9	1	5	0
4	1	1	8	1	3	4	1	5	0	1	6	8	1	8	4	1	10	0	1	11	8	1	13	4
5	1	7	1	1	9	2	1	11	3	1	13	4	1	15	5	1	17	6	1	19	7	2	1	8
20	5	8	4	5	16	8	6	5	0	6	13	4	7	1	8	7	10	0	7	18	4	8	6	8
25	6	15	5	7	5	10	7	16	3	8	6	8	8	17	1	9	7	6	9	17	11	10	8	4
30	8	2	6	8	15	0	9	7	6	10	0	0	10	12	6	11	5	0	11	17	6	12	10	0
35	9	9	7	10	4	2	10	18	9	11	13	4	12	7	11	13	2	6	13	17	1	14	11	8
40	10	16	8	11	13	4	12	10	0	13	6	8	14	3	4	15	0	0	15	16	8	16	13	4
45	12	3	9	13	2	6	14	1	3	15	0	0	15	18	9	16	17	6	17	16	3	18	15	0
50	13	10	10	14	11	8	15	12	6	16	13	4	17	14	2	18	15	0	19	15	10	20	16	8
55	14	17	11	16	0	10	17	3	9	18	6	8	19	9	7	20	12	6	21	15	5	22	18	4
60	16	5	0	17	10	0	18	15	0	20	0	0	21	5	0	22	10	0	23	15	0	25	0	0
65	17	12	1	18	19	2	20	6	3	21	13	4	23	0	5	24	7	6	25	14	7	27	1	8
70	18	19	2	20	8	4	21	17	6	23	6	8	24	15	10	26	5	0	27	14	2	29	3	4
75	20	6	3	21	17	6	23	8	9	25	0	0	26	11	3	28	2	6	29	13	9	31	5	0
80	21	13	4	23	6	8	25	0	0	26	13	4	28	6	8	30	0	0	31	13	4	33	6	8
85	23	0	5	24	15	10	26	11	3	28	6	8	30	2	1	31	17	6	33	12	11	35	8	4
90	24	7	6	26	5	0	28	2	6	30	0	0	31	17	6	33	15	0	35	12	6	37	10	0
95	25	14	7	27	14	2	29	13	9	31	13	4	33	12	11	35	12	6	37	12	1	39	11	8
100	27	1	8	29	3	4	31	5	0	33	6	8	35	8	4	37	10	0	39	11	8	41	13	4

Scores at	5¼d.			5½d.			5¾d.			6d.			6¼d.			6½d.			6¾d.			7d.			Difference.		
	l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.
1	0	8	9	0	9	2	0	9	7	0	10	0	0	10	5	0	10	10	0	11	3	0	11	8	0	0	5
2	0	17	6	0	18	4	0	19	2	1	0	0	1	0	10	1	1	8	1	2	6	1	3	4	0	0	10
3	1	6	3	1	7	6	1	8	9	1	10	0	1	11	3	1	12	6	1	13	9	1	15	0	0	1	3
4	1	15	0	1	16	8	1	18	4	2	0	0	2	1	8	2	3	4	2	5	0	2	6	8	0	1	8
5	2	3	9	2	5	10	2	7	11	2	10	0	2	12	1	2	14	2	2	16	3	2	18	4	0	2	1
20	8	15	0	9	3	4	9	11	8	10	0	0	10	8	4	10	16	8	11	5	0	11	13	4	0	8	4
25	10	18	9	11	9	2	11	19	7	12	10	0	13	0	5	13	10	10	14	1	3	14	11	8	0	10	5
30	13	2	6	13	15	0	14	7	6	15	0	0	15	12	6	16	5	0	16	17	6	17	10	0	0	12	6
35	15	6	3	16	0	10	16	15	5	17	10	0	18	4	7	18	19	2	19	13	9	20	1	4	0	14	7
40	17	10	0	18	6	8	19	3	4	20	0	0	20	16	8	21	13	4	22	10	0	23	6	8	0	16	8
45	19	13	9	20	12	6	21	11	3	22	10	0	23	8	9	24	7	6	25	6	3	26	5	0	0	18	9
50	21	17	6	22	18	4	23	19	2	25	0	0	26	0	10	27	1	8	28	2	6	29	3	4	1	0	10
55	24	1	3	25	4	2	26	7	1	27	10	0	28	12	11	29	15	10	30	18	9	32	1	8	1	2	11
60	26	5	0	27	10	0	28	15	0	30	0	0	31	5	0	32	10	0	33	15	0	35	0	0	1	5	0
65	28	8	9	29	15	10	31	2	11	32	10	0	33	17	1	35	4	2	36	11	3	37	18	4	1	7	1
70	30	12	6	32	1	8	33	10	10	35	0	0	36	9	2	37	18	4	39	7	6	40	16	8	1	9	2
75	32	16	3	34	7	6	35	18	9	37	10	0	39	1	3	40	12	6	42	3	9	43	15	0	1	11	3
80	35	0	0	36	13	4	38	6	8	40	0	0	41	13	4	43	6	8	45	0	0	46	13	4	1	13	4
85	37	3	9	38	19	2	40	14	7	42	10	0	44	5	5	46	0	10	47	16	3	49	11	8	1	15	5
90	39	7	6	41	5	0	43	2	6	45	0	0	46	15	6	48	13	0	50	12	6	52	10	0	1	17	6
95	41	11	3	43	10	10	45	10	5	47	10	0	49	9	7	51	9	2	53	8	9	53	8	4	1	19	7
100	43	15	0	45	16	8	47	18	4	50	0	0	52	1	8	54	3	4	36	5	0	58	6	8	2	1	8

Weighing *Cage*, a contrivance made in the form of a sort of open box or cage, by which any small animal as, a pig, sheep, calf, &c. may be very easily and expeditiously weighed and with sufficient accuracy for the farmer's purpose. It is shown at *fig.* 8. *plate* XLIII, as constructed on the principle of the common steelyard, in which AAAA, show a strong wooden frame with steel centres in which the pivots of the lever are hung. And upon the short side of the liver is suspended a coop, surrounded by strong net work in which the animal intended to be weighed is placed; the point of suspension is connected with the coop by means of two curved iron rods which at the same time form the head of it. A common scale being hung on the longer side of the lever.

Weighing-*Machine*, a contrivance of the machine kind for the purpose of weighing cattle and other animals alive. A machine of this sort is of vast utility and importance in the grazing and fattening systems where they are carried to any considerable extent, in ascertaining the progress made by the animals, and showing how they pay for the use of any particular kind of food, or what power it has in promoting the fattening process. See *Grazing* and *Stall feeding*.

It is perfectly simple in its construction.

Fig. 1. *Plate* XLIII is a section of the machine supposed to be made in the direction of the dotted line *x x*, in *fig.* 2.

AA, is the beam of the steelyard, B is the pen at the top of which the suspension of the beam is made at C. D is a counterpoise which is moveable along the beam by a sliding socket to which it is suspended. E is also a sliding socket, on which is raised an iron arm supporting a wooden box or scale F, to receive the counterbalancing weights in the operation. H H are two levers, (of 4 which are in the machine, and which may be seen in *figure* 2), these are hung on a projecting pin of the beam at I, by one end, the other resting on an iron support at G, of which two only are seen in this figure. KK is the lid of the machine or platform on which is placed the subject to be weighed; to the under side of this, at each corner, blocks LL, are attached, from which proceed iron pieces similar in form to the supporting piece G G, but reversed in position; by these four pieces the lid stands with its whole weight entirely on the lever H H, the pieces L L applying themselves to the levers at a small distance nearer to the centre of the machine than to the supporting piece G G.

In the operation of weighing, the subject to be weighed being placed on K K, presses by the pieces L L on the levers H, which by their suspension to the beam at I, determine it from its even position by a quantity proportioned to the weight of the subject which is expressed by the counterbalancing weights required to be placed in F.

Fig. 2. Is a plan of the machine, in which every part of it is marked respectively with the same letters of reference as in *fig.* 1. The description of the machine will be rendered considerably clearer by referring to both these figures.

Fig. 3. is a plan of the under side of the lid KK.

Fig. 4. shews the way in which the lever H are supported by the piece G, and pressed on by the piece L.

Fig. 5. is a plan of the lower piece G, the dotted lines referring its parts to the same things respectively in *fig.* 4.

Fig. 6. is a side view of the iron pieces, as spoken of, as G G and L L.

Fig. 7. is a perspective view of the scale or box called F, in the figures 1 and 2 showing its shape.

WELD, the name of a plant much used in giving a yellow colour to woollens, silks, cotton, and thread. It is sometimes called *Dyer's weed*.

It is chiefly grown for the use of its flower-stems in the art of dyeing, "as affording a bright yellow and lemon colour. It is also useful in the manufacture of check and fustian."

In the growth and culture of this plant the soils most suitable are those of the fertile mellow kinds, whether of the loamy, sandy, or gravelly sorts; but it may be grown with success on such as are of a poorer quality, but in the former, the plants will rise to a much greater height, and produce much larger leaves, than in the latter description of lands.

Mr. Young says that the soil most suitable to it in Essex, is the strong stiff loam moderately moist, but not wet.

It is necessary in the preparation of the ground, that there should be a tolerable degree of fineness produced in the mould of the soil which may be effected by repeated ploughings given in the more early spring months, and suitable harrowings. The surface in the seed furrow should be left as level as possible, that the seed may be dispersed more evenly over it.

In this, as in many other cases, the seed should be collected from the best plants, and which has remained upon the stems till rendered perfectly ripe; as such only vegetates perfectly, and the plants in such cases should not be let stand too long, as the seed is liable to shed. It should be perfectly fresh when used, as old seed never comes up well.

In regard to the proportion of seed which is necessary, it is commonly from about two quarts to a gallon per acre, according to circumstances, when sown alone; but when mixed with other crops a little more may be required, which should be blended with a little sand at the time of sowing it on the land.

With respect to the time of sowing, this sort of crop may be put into the ground either in the spring, as about the end of April or beginning of May; or in the latter end of summer, as the beginning of August; being mostly sown in conjunction with other crops in the first period, but when sown alone at the latter season, the produce is in general the best and most full. Mr. Young in his Essex Report speaks of the culture of this sort of crop as simply that of transplanting from the seed beds about Midsummer.

It is mostly sown broad-cast, whether grown in mixture with other plants or alone; and as the seeds are of a very small size, it requires an expert seedsman to perform the business with regularity and exactness; which is a matter of much importance to the success of the crop, as, where the plants stand too closely together, much unnecessary trouble and expense must be incurred in the thinning them out by the hoe after-

wards; and where they stand too thinly upon the ground, there must be great loss from the deficiency of plants. That the sowing may be executed with more regularity, it is the custom with some to blend other substances with the seed that has nearly the same weight, as by this means they suppose it may be effected with greater facility and readiness.

Weld when grown with other sorts of crops, such as barley, buck-wheat, beans, peas, clover, or grass seeds, is usually put in after them; in some cases immediately, but in others, not till some time has elapsed. With the first and second sorts, when sown so late as the beginning of May, it is mostly the practice to sow it directly afterwards, giving the land a slight harrowing with a very light close-tined harrow to cover it in. The barley being sown under furrow, the weld seed with some is immediately sown over the surface and lightly harrowed in, and then rolled. Where the barley seeding is performed so early as March, or the beginning of April, the sowing of the weld seed is better deferred till May, when it may be dispersed over the land, and left in that manner to be washed in by the rains. With bean and pea crops, it is often sown before the last breaking or hoeing of the crops in the latter end of June, or beginning of July. In cultivating it with clover and grass seeds, it is often sown at the same time with them; but a better practice, is perhaps, to delay it till some time afterwards, as both these crops require to be sown at too early a period for this plant to rise safely.

But in cases where no other sort of crop is grown with weld, it is usually sown evenly over the surface of the land, and covered in by harrowing with a light bush harrow, having afterwards recourse to the roller in light sorts of land.

It is common in cultivating crops of this sort, not to pay any attention to them after being sown; but as the plants are of slow growth, and liable to be greatly injured in their progress by the rising of weeds, it must be of much benefit not only to keep them perfectly clean, but also to have the mould stirred about their roots.

In about a month from the time of sowing, the plants are mostly in a state to be easily distinguished; a hoeing should be then given when the weather is dry, which may be performed in the same manner as for turnips only, using somewhat smaller hoes for the purpose. Some direct that the plants in this operation should be set out to the distance of three or four inches; but it is better to let them have more room, as six, seven, or eight inches; which, not only lessens the expence of the business, but contributes to the advantage of the crop. In the spring, a second slight hoeing may be practised about March, in a dry time; and if any weeds rise afterwards, a third may be given in May. Where the land has been well prepared, one hoeing in autumn and another in the spring may be fully sufficient. Hand-weeding though practised by some is in general too expensive.

The proper period for pulling this sort of crop is when the bloom has been produced the whole length of the stems, and the plants are just beginning to turn of a light or yellowish colour: as in the beginning or middle of July in the second year. The plants are usually from one to two feet and a half in height. It is thought by some advantageous to pull it rather early, without waiting for the ripening of the seeds, as by this means there will not only be the greatest proportion of dye, but the land will be left at liberty for the reception of a crop of wheat or turnips; but in this case, a small part must be left solely for the purpose of seed. In the execution of the work the plants are drawn up by the roots in small handfuls, and set up to dry, after each handful has been tied up by one of the stalks, in the number of four together in an erect position against each other.

It is remarked, that "sometimes they, however, become sufficiently dry by turning without being set up. After they have remained till fully dry, which is mostly effected in the course of a week or two, they are bound up into larger bundles, that contain each sixty handfuls, and which are of the weight of fifty-six pounds each: sixty of these bundles constituting a load. These last are tied up by a string made for the purpose, and sold under the title of woold cord," in many places where this kind of crop is much grown.

From the weld plant being extremely uncertain in its growth, and the whole crop seldom becoming in a state to be pulled at the same time, it is proper to have an experienced labourer to direct the business of pulling, in order that the pullers may not proceed at random, but take the different parts as the plants become ready, or in danger from the blight. In which last case the greatest possible dispatch should be made, as the loss of weight in the produce will daily increase, and the grower be of course greatly injured.

After it is become sufficiently dried, which is known by the crispness of the leaves, and the stems turning of a light colour, and when the plants are ripe, the seeds shelling out; according to some, it should be stacked up lightly in the barn in order to prevent its taking on too much heat; while others advise, that it should be stacked up closely in the manner of wheat, being left to sweat in the same way as hay, as the more this takes place the better; the quality of the weld being thereby increased, if there be no mouldiness. When it has stood till fully ripened, the seed may be taken before it is put into the barn, which may be easily procured by rubbing, or slightly beating each of the little handfuls against each other over a cloth, tub, or any other convenient receptacle, as, by threshing, the quantity of the weld would be much reduced in weight. The price of this sort of seed is mostly about ten or twelve shillings the bushel, which may be sold to the seedsmen in a ready manner.

In crops of this kind the produce is in some degree uncertain, depending much upon the nature of the season; but from half a load to a load and a half is the quantity most commonly afforded, which is usually sold to the dyers at from five or six to ten or twelve pounds the load, and sometimes considerably more.

It is mostly bought by persons who afterwards dispose of it to the dyers occasionally as they find it convenient. The demand for it is sometimes very little, while at others it is so great as to raise the price to a high degree.

The usual expense of cultivating this sort of crop has often been stated to be "below one pound the acre; but that is much too low where proper attention is bestowed in preparing the land, and in the hoeing and other management of the crop afterwards. Without taking in the value of the land, tythes, or other charges, it must constantly stand much higher." Where grown with other crops without regarding the preparation of the land, it may stand thus per acre:

Expenses.	£.	s.	d.
Seed, &c.	0	1	3
Sowing	0	0	3
Two hoeings	0	7	6
Pulling the crop and tying it in handfuls	0	8	0
Binding into bundles	0	1	6
Woold cord	0	1	0
Carting and stacking	0	3	0
	1	2	6

This sort of crop is particularly liable to be injured by the blight, which is probably the reason that has induced cultivators to raise it with those of other sorts, especially those of the grass kind, as by that means, where the weld does not succeed, a portion of sheep-feed may be afforded for winter and spring use. It is remarked that the "blight frequently comes on so suddenly, that crops which appeared healthy and in a vigorous state of growth during the winter and spring, promising a large produce, are about the month of May attacked so as to be nearly destroyed. It is known by the plants, especially about the lower parts of the stems, turning of a yellowish or pale reddish colour, while the upper parts remain green and seem healthy. When it appears early in the month of May there is always danger of the crop being destroyed; but when it comes on at a later period, or where the plants from other causes, as the dryness of the season, begin to change colour in the shanks, the only chance is that of having them pulled as expeditiously as the business can be performed."

But though the practice of sowing this with other crops has been general, it would seem better to cultivate it alone, as in the former way it must be much injured in its growth, from the closeness and shade produced by the plants that surround it. The only objection to the cultivating of it alone is the danger of the crop being destroyed by the blight, in which case the farmer will have nothing left to repay him for his expense and trouble; while when grown with other crops, they may in such cases in some measure defray them. When grown with other crops, especially those of the grass kind, it is common to feed them down, in the winter and spring, with sheep or other sorts of live stock, under the notion that they will not touch the weld plants: but this is not the fact, as they are found to feed upon them, and must of course be greatly injured in their growth: caution must therefore be used in directing the feeding down of clover or other crops where the weld plant is blended with them.

In some cases, it may be grown with profit, as where the soil is adapted to its growth, and from its nature not disposed to the blight, or to lose its moisture too much in the summer months; but under other circumstances it should not be attempted. Besides, from the great consumption of vegetable matter which it causes, without contributing any thing in the way of manure to the land, it can only be introduced with propriety, perhaps, in situations where manure can be easily obtained. But in cases, where the crops are cultivated with sufficient attention, it may be a good preparation for wheat or turnips. In cases where this sort of produce cannot be disposed of soon after it is pulled, it may be preserved perfectly good several years by being put up in stacks, either in the barn or the open air, care being taken to keep it from being damaged by the attacks of rats or other vermin, which are very apt to do much mischief in it: the price of this sort of produce is in Essex from four-pence to eight-pence the stone.

WELL, a deep pit, excavation or sort of shaft sunk in the soil for containing the water of the spring which is to supply it, for domestic or other purposes. It is usual to have wells bricked round from the bottom to the top, and frequently to have pumps fixed in them. The width is mostly from three to four feet, which where the springs are strong, may afford and contain a sufficient quantity of water.

As the business of sinking wells is much connected with the nature of springs, it may be observed that these are caused by rain which penetrates the earth till such time as it meets a clayey subsoil or stratum which proving a bottom sufficiently solid to sustain and stop its descent, glides along it that way to which the earth declines, till, meeting with a place or aperture on the surface through which it may escape, it there forms a spring. That the rain is sufficient for this effect is evident from various circumstances. We commonly find springs which rise at the bottom of mountains collect most waters and give them the greatest descent the same way. And where they are found on high grounds, and even on the tops of mountains, they must come from other remoter places considerably higher, along beds of clay or clayey ground, as in their natural channels. So that if there happen to be a valley between a mountain on whose top is a spring, and the mountain which is to furnish it with water, the spring must be considered as water conducted from a reservoir of a certain height through a subterraneous channel, to make a jet of an almost equal height.

The manner in which the water is collected so as to form reservoirs for the different kinds of springs, seems to be this: the tops of mountains usually abound with cavities and subterraneous caverns formed by nature to serve as reservoirs, and their pointed summits which seem to pierce the clouds, stop those vapours which float in the atmosphere;

which being thus condensed they precipitate in water, and by their gravity and fluidity easily penetrate through the beds of sand and the lighter earth, till they become stopped in their descent by the denser strata, such as beds of clay, stone, &c. where they form a bason or cavern, and working a passage horizontally or a little declining, they issue out at the sides of the mountains. Many of these springs discharge water which running down between the ridges of hills, unite their streams, and form rivulets or brooks, and many of these uniting again on the plain, become rivers. See *Spring*.

In this way water is likewise supplied in wells, as the operator digs down till he reaches the stratum on which the water is conducted from such elevated situations where it flows into and rises up in the well, so as in many cases to nearly or even quite fill it. And in some cases the water thus procured has been found to flow over the top. But the height to which the water may rise in wells must always depend much upon the situation, nature, and manner in which the strata lie, as well as the height of the reservoir or place from which it is drawn.

In the execution of the work of digging wells, there is no great difficulty, the person employed in the business chiefly working down by means of a small short handled spade and a small implement of the pick-axe kind; the earthy materials being drawn up in buckets by the hand or a windlass fixed over the opening for the purpose. Where persons conversant with this sort of business are employed, they usually manage the whole of the work bricking round the sides with great facility and readiness; but in other cases, it will be necessary to have a bricklayer to execute this part of the business. As the expence and trouble of digging and getting up the materials in these cases are considerable, other means have been had recourse to, in order to lessen or prevent them. The most ingenious of these is that proposed by a French chemical philosopher, who has advised that the ground should be perforated by means of an auger, or borer: a cylindrical wooden pipe being then placed in the hole and driven downward with a mallet and the boring continued that the pipe may be forced down to a greater depth. In proportion as the borer becomes filled with earth it should be drawn up and cleared, when by adding fresh portions of pipe the boring may be carried to much extent under ground, so that water may in most cases be thus obtained. It is stated that wells made in this manner are superior to those constructed in the common method not only in point of cheapness, but also by affording a more certain and abundant supply of water while no accident can possibly happen to the workmen employed. In case the water near the surface should not be of a good quality, the perforation may be continued to a still greater depth, till a purer fluid can be procured, and where wells have become injured or tainted from any circumstance or accident, when previously emptied and the bottom perforated in a similar manner, so as to reach the lower sheet of water, it will rise in the cylindrical tube in a pure state into the body of the pump fixed for the purpose of bringing it up.

It is stated by Mr. Middleton in the report of Middlesex that "in the year 1791, the present vicar of Northall (Mr. archdeacon Eaton) agreed with Mr. White of Putney to sink a well in the court adjoining to the vicarage. The workmen first dug through a bed of solid blue clay 60 feet in depth under which was a stratum of rough porous stone about a foot thick. To this succeeded a second stratum of clay (differing a little from the former in colour) 29 feet in depth then a stratum of fine grey sand intermixed with extraneous fossils as oyster shells, bivalves, &c. This stratum continued for twenty-three feet, and was succeeded by another of clay of a red or ferruginous colour, less firm in its consistence than that which occurred before, and intermixed now and then with gravel and stones of a considerable size. After digging through this stratum for fifty-one feet (at the depth of one hundred and sixty-four feet from the surface) water was found, which on the removal of the stone which lay immediately over, the spring burst up with such force and in such abundance, that the workmen immediately made the signal to be drawn up. Within the first four hours after its discovery the water rose to the height of eighty feet, in the next twenty four hours about forty feet more, after which it continued to rise gradually for the next fortnight till it reached its present level, which is only four feet from the surface of the earth, the depth of the water being now only one hundred and sixty feet.

Strata.		
1 Clay	-	- 60 feet
2 Stone		1
3 Clay	-	- 29
4 Sand	.	- 23
5 Clay	-	- 51
		164 feet.

And it is added by the same intelligent writer that "At Mr. Munday's brewery at Chelsea in the same county, a well was dug about the year 1793 to the depth of three hundred and ninety-four feet, within twenty or thirty feet of the edge of the river, mostly through a blue clay or marl. At the depth of near fifty feet a quantity of loose coal twelve inches in thickness was discovered: and a little sand and gravel was found about the same depth. The well digger usually bored about ten, fifteen, or twenty feet at a time lower than his work as he went on, and on the last boring, when the rod was about fifteen feet below the bottom of the well, the man felt as the first signal of water a rolling motion, something like the gentle motion of a coach passing over pavement; upon his continuing to bore, the water presently pushed its way by the side of the auger with great force, scarcely allowing him time to withdraw the borer, put that and his other tools into the bucket and be drawn up to the top of the well. The water soon rose to the height of two hundred feet.

Also that "in 1794, a well was sunk for Mr. Vulliamy at Norland house, on the road from London towards Uxbridge, to the depth of two hundred and thirty-six feet, and then a hole of five inches and a quarter was bored, and a copper pipe of the same diameter as the borer was drove down to the additional depth of twenty-four feet into a stratum of sand filled with water; a mixture of sand and water instantly rushed upwards through the aperture of the pipe in such abundance as to rise one hundred and twenty-four feet (i. e. one hundred in the well and twenty-four feet in the pipe) in eleven minutes, and one hundred and nineteen feet more in one hour and nine minutes, or on the whole it rose two hundred and forty-three feet in one hour and twenty minutes. A sound line was then let down, which discovered that sand had rose in such quantity as to fill the well to the height of ninety-six feet. This was repeatedly dug out, by which the sand was reduced so considerably as to permit the water to rise through it more and more freely, till it flowed over the top of the well at the rate of forty-six gallons per minute. There still is a great body of sand in the well through which the water filters by ascent, which is excellently calculated to free the water from every impurity. If a greater supply of water at this well were necessary for the valuable purpose of turning machinery, it may certainly be obtained after the rate of several hundred gallons per minute, by continuing to clear out the sand till its obstruction should become of little consequence; but its quality is of more consequence than quantity. Mr. Vulliamy now has it in a high state of purity, originally excellent water, rendered so by flowing in a stratum of clear sand, and further improved by filtering by ascent through many feet in thickness of the same."

These facts and statements sufficiently explain the manner in which water is obtained in the digging and forming of wells, as well as the nature of the strata by which it is conducted, contained, and supplied. However before the sinking of wells is undertaken, the nature and circumstances of the particular cases should be fully considered, and the probability of success maturely weighed from the examination of the springs and wells in the vicinity; as where this is not done, much money may often be expended to little purpose. See *Draining* and *Spring*.

Well, a term sometimes applied to a chimney or vent hole left in a rick or mow of hay or other similar materials, to prevent its overheating.

WELT-*Root*, a term signifying the dying away or falling off of wheat crops in the winter or early spring seasons. It has been supposed to arise from different causes, and most frequently occurs where the wheats have been put in on clover leys. Some however think it depends upon the want of a sufficient degree of closeness and firmness in the soils, as where they lie too open and porous, due nourishment and support is not supplied to the young plants from below, of course that they do not form their roots in a proper manner. This opinion is supposed to be supported from the utility of treading in wheat crops. See *Wheat*.

WEY, a term signifying a quantity of cheese of 256lb. See *Weigh*.

WHEAT, the name of a well-known grain, much cultivated in many districts. It is a sort of grain, of which there are two distinct species cultivated in this climate, the *smooth* or *polled wheat*, and the *rough* or *bearded;* of the first sort which is by much the most cultivated, there are numerous varieties, but the latter species, which is often named *rivet*, as yielding a large produce on stiff wet clayey soils, and being less liable to disease and injury in the field, is frequently grown on such sorts of land. It has been observed by an intelligent cultivator in the county of Kent, Mr. Boys, that the number of sorts of this grain is annually increasing by importation from foreign countries. But that the *old* sorts are the *brown* and *yellow lammas*, the *white straw*, *Fulham*, and the *white* or *egg-shell*. The *brown lammas* was the kind chiefly cultivated in that county till within these twenty or thirty years; but it has now given way to a variety of new kinds, as well as some of the old sorts; experiment has however shewn it to be the least productive of the several soils. It is the common *brown-strawed wheat* that grows with a long jointed ear, the chaff of a dark brown colour, the straw long and apt to fall, the hull or bran thin, the flour very white, and the corn mellow in grinding, for which reason it is esteemed by the millers as the best of the *old* sorts for their use; and that the *yellow lammas* resembles the *brown*, in every respect, except that the colour of the grain is of a yellow hue, and the chaff of a somewhat lighter colour than the others. A red lammas with a red straw, red ear, and red kernel, is noticed by Young as being reckoned by many farmers the best of all the sorts hitherto known, and yielding the finest and whitest flour. The first writer says that the *white-strawed wheat* takes its name from the colour of its ear, and in other counties has the title of the *Kentish white straw*. It sends out a greater number of stems from the stool or plant than the other sorts, and in that way is often a very thick crop on the land. The straw is generally somewhat shorter than that of many other sorts, and not quite so liable to fall in rainy seasons. It is on these accounts much sown in the eastern parts of that county; but from its dull colour, its having a thick bran, and often grinding very steely, is not much approved by the millers of the district. It is remarked, that "the *Fulham* produces a white straw, which grows short and coarse; it is very productive particularly on poor land; but the grain is coarse and the bran thick, which circumstances render it the least valuable to the millers of any of the sorts described above. And the *white* or *egg-shell* wheat, is known by its producing a white straw, a smooth white chaff, and very white grain: the bran of which is very thick, but the flour remarkably white. It works mellow in grinding, is very early ripe, and so full in the ear as to blow out in windy weather.

Of the *new* sorts of wheat in that county as the *hoary white*, the *nonpariei*, the *pilbeam*, the *square ear*, the *hoary brown*, and the *hoary white*,

called by some the *velvet-eared*, the last is by far the most valuable, as being very productive, and the best for the miller's use. It has the straw white and short, the chaff covered with a thick fine down, somewhat of a brownish hue; the grain remarkably small, and of a dull white colour, the bran very thin, so that the grain is almost transparent when held up to the light. It grinds very mellow, and makes a beautiful fine white flour. But from the quantity of the down upon the chaff, and its small ears binding very close in the sheaf, it is apt in the rainy season to vegetate too freely in the field; on which account it is not so proper to cultivate in a moist climate, and in small inclosures that are not open to the influence of the sun and winds. But the nonpareil is a sort said to have been brought from America; it has a bright straw, with a brown ear; and the grain is very white, large and plump. It is very productive on all soils, thrashes very free, and yields in this operation the greater part of its chaff; thereby producing a great quantity of horse-meat. It grinds very mellow, and is well esteemed by the millers in most districts. And the *pilbeam* is a brown wheat growing very stiff, and is generally thick on the land. The grain is small and plump, somewhat of a yellow brown. It is accounted very productive on rich lands, and is a valuable kind to mix with others, but will not of itself make good bread, from its not fermenting properly. In regard to the *squared-eared wheat*, it is a very productive sort, but it is apt to drop out in the field, before it is ripe, and in gales of wind, from which it is not so much cultivated. And the *hoary brown* is but lately introduced, consequently little known at present. The *Clarke-wheat*, which has a red blossom, chaff, and straw, but white grain, is much cultivated in Sussex. The *hedge wheat*, is also white and very productive. And the *velvet wheat* is distinct from the hoary white, but is white, not weighty, yet affording much flour, being very thin in the skin.

And there are also different varieties of cone wheat, a sort which is named from the form of the ear. Of the *rivet wheat*, there are two sorts, the white and the brown; neither of which are much cultivated in Kent. They both ripen late in the season, and are so coarse and steely, as to be unfit for making bread, unless mixed with a large proportion of a better sort of flour. They however, produce very abundant crops on strong wet lands. It is however, remarked by Mr. Young, to be productive on very poor, wet, cold land, though a coarse grain, selling at an inferior price in the markets. And the bearded or rivet kind is likewise thought by some cultivators, to be the most adapted to such kinds of rich lands as have been newly broken up, and where there may be danger of the crop lodging from too great luxuriance, as it possesses the property of a greater firmness of straw or stem than the common kinds. The white and the red are the sorts the most esteemed in general among the polled kind; the former affording the whitest flour, but the latter has the greater produce in most cases.

In Essex, according to Mr. Young's Report of that district, "Mr. Kemp of Hedingham compared wheat from Italy, from Scotland, and from Dantzic; the last by far the best, and next the Scotch; but the Italian was full of smut in spite of every attention in brining and liming; and sowing it a second time with still more precaution, the result the same.

And Mr. Wakefield, of Burnham, has cultivated a sort of wheat from Italy which he approves of much; the straw is remarkably stout and stiff. He cultivates also a sort called the *Sopsodite*; red grain, red chaff, and purple straw; this is a very good sort. Taunton Dean is beautiful, but will not bear rough weather. For two years past the Hamburgh white, white grain, and white chaff has been fashionable; the white American also.

"The sorts, he says, usually sown at Kelvedon are the *burrel red chaff*, and red grain; *white rough*; white chaff, and white grain, the chaff rough: this sort stands the weather well, and does not shell easily; but is rather difficult to thrash. Mr. Cooper, at Langenhoe, generally, he observes, sows white wheat on his heavy land, and rarely rivets; *rough chaff*; *York white*, also *American red*.

It is remarked that "a few years ago, as a gentleman at Bradfield was walking through his wheat fields when the corn was in full blossom, he was struck with the variety of hues, or colours which the blossoms assumed: at first he conceived it might be owing to the different stages of forwardness in the blossom; but on particular examination and more mature reflection concluded that they were certain signs of a specific difference in the quality of the wheat; impressed with this idea, he selected the ears of different hues and particularly marked eleven distinct numbers; noting very minutely their characteristic qualities and appearances in the field: these he gathered and kept separate when ripe, and planted them apart from each other in his garden, the same characteristic difference was observed to continue upon the several numbers when growing in the garden as was observed in the field the preceding summer, and are as follows:

"*First year in the garden.* No. 1. A stiff straw, thick ear, the rows or chests in which, set closer than in any other.

2. Dark straw, full blade, and large open ear.

3. A large long ear, ripened late, and well set.

4. Full foliage, and a long open ear.

5. Straight handsome straw, large well set ears, flag or leaf small.

6. Red rusty leaf before spindling, red straw with little leaf at harvest and smaller ears than any.

7. Very like No. 6. in straw, the ears small but well set.

8. Straw leafy at harvest, of a good colour, well eared and handsome.

9. and 10. Straw full of flag or leaf at harvest, ears set wide.

11. Very like No. 5.

"*Second year in the garden.* No. 1. Short upright stiff straw, thick well set ears, and later by four or five days than any of the others.

2. Very dark straw, upon which there remained a full dark blade at harvest; long open ears.

3. Strong leafy straw, of a good colour, with a thick long ear, well set, rather later than Nos. 5, 8, and 11.

4. Thick leafy brown straw, with a small ear.

5, 8, 11. Short handsome bright leafy straw, ears long, thick and well set.

6. Long straw with a good deal of flag, ears ill set and open.

7. Straw handsome, but small ears, and subject to root falling.

9, 10. Long weak straw, very leafy and subject to root falling.

N. B. It is remarked that the lemon-coloured blossom was observed to attend Nos. 5, 8, and 11; but the colour of Nos. 1 and 3, was not particularly remembered. These are the numbers which had been preserved, Nos. 5, 8, and 11 coming to the sickle about a week earlier than Nos. 1 and 3, the produce of which, when compared with the rejected numbers, is an excess of from 6 to 8 bushels per acre, and weighing about 3 pounds more to the bushel."

The *Windsor* sort. "Mr. Willes, at Bradwell, had this year, it is observed, a crop of Windsor wheat, white grain, white straw, and white chaff, which is a most beautiful sample, the strength of the straw is middling."

"Of all the different sorts of wheat Mr. Hardy has tried on his farm, the best has been the white egg shell, and this is the sort most cultivated in Foulness Island.

"The *Red American*, is a sort which yields remarkably well with Mr. Wright of Rochford hall; it is much approved in Mersea isles. Mr. Bennett Haws has had the best success with it. Mr. Strutt, at Terling, sowed a barrel of remarkably beautiful wheat from New York, in part of a field, the rest of which was sown with English wheat, and the American was so blighted in the ear as to produce a poor and miserable grain both in quality and quantity. He sowed it again, and the result was the same, and repeated the experiment the third time, the result again the same, though the adjoining English wheat in all three years produced a fair crop free from all blight. The *habit* of this wheat, therefore, was not changed in three years sowing.

"*Rough chaff*, a white chaff and white grain, with a velvet ear; Mr. Wakefield of Burnham, finds it excellent; for there they are subject to strong easterly winds, and it does not shell easily. Mr. Spurgeon of Bradwell, however, does not like it on heavy land, as it has not straw enough. Mr. Wright, of Rochford Hall, remarks that it should stand till ripe, or it will not thrash well.

"About Hallingburg Rise, and indeed through all the districts of the Roodings they find the *rivet* sort a very useful wheat, which is very general, and is found to yield on that heavy soil much better crops than any common sort; but on lighter soils the Kentish red.

"In Norfolk about Reddlesworth they have an opinion that *red wheat* will not answer on black sand, white succeeding to much better advantage.

But at Winborough red is only sown by Mr. Salter, the white sorts not answering so well on the heavy soils, it is termed the *old red*. Some prefer the *red chaff*, or red wheat to the white, as being less liable to grow at harvest, white however a better sample and produces a better price."

In Hertfordshire the rivet or bearded sort is the common sort on the clays and strong loams about Sawbridgworth, on which it yields more abundantly than the red and white wheats, four or five quarters per acre not being uncommon in favourable years. And a sort termed *polled rivets* is also very productive, 100 grains having been seen in an ear.

About St. Albans, *Day's stout*, which has the ears growing with four sets of kernels is much sown: also about Hitchen where it was discovered by a poor labourer who gathered a few ears. It is said to yield well. It is supposed to be the *pirks* of Ellis. The *red lammas* and *Luswell* brought from Cambridgeshire, are likewise much sown. On the Albury clays the rivets are grown, yielding largely but subject to mildew and selling badly with indifferent straw. They have a *blue* and *white* sort, the latter preferred.

In addition to these, there is likewise another sort of this grain which may probably be cultivated to advantage in some cases as that which is known by the name of spring wheat: See *Spring Wheat*.

The first sort of this grain is in general most suited to the heavier descriptions of mellow soils, which do not retain too much moisture.

They should however be of a fertile quality, and capable of affording a fine surface mould, for the reception of the grain. But good crops may be raised on the lighter sorts; though the introduction of it on such kinds of land, has been suggested as disadvantageous from their being so much more adapted to the raising of other kinds of crops.

This is a sort of crop that is usually grown after the land has been prepared by repeated ploughing and harrowing; but which is often capable of being raised after different kinds of green crops, as well as those of the root and other sorts with equal or more advantage. In some cases flax and hemp also afford a good preparation for this grain; but some consider beans as the most favourable preparation; and experiment has shown tares, and clover, to be nearly equal to them in this intention. In the county of Norfolk, wheat almost constantly succeeds clover, except where pea or bean crops are interposed, the land being scarcely ever fallowed with this view, except in the instances of what are termed *bastard summer tills*. Mr. Young, has indeed well observed, that "if there is one practice in husbandry proved by modern improvement to be worse than another, it is that of sowing wheat on fallows, he therefore only states that in some counties the fallows are ploughed just before harvest on to two bout ridges ready to plough and sow under the furrow in the spraining method, a seedsman to every plough which reverses the ridges. In others they lay their hands into ten or twelve furrow stitches or lands, and sow some under the furrow, some under the harrow. Ridges vary exceedingly, according to their wetness: and in Kent they have by means of the turnwrestplough, no lands at all, but a whole field, one even surface. It would be useless, he says, to expatiate on the circumstances

of fallow-wheat which ought no where to be found. If fallows be or are thought necessary, let them, says he, be sown for barley, or oats, or with any thing but wheat." However after whatever kind of crop this sort of grain may be cultivated, the soil should constantly undergo that sort of preparation that may be sufficient, according to the particular circumstances of the land, to bring it into a state of considerable fineness of mould, especially in the more superficial parts, and thereby prevent as much as possible the rising of weeds; for it has been well noticed by a late writer, that "whoever has attended to the progress of this sort of crop, in such lands as have been well broken down and reduced, and in such as have been left in a lumpy crude state at the time of sowing will have found the difference to be very considerable." But it is added that, "when this kind of crop is taken after clover, the land seldom undergoes more than one ploughing, which is mostly given immediately before the seed is sown. However as the grassy matter in many cases where this mode is adopted is extremely apt to rise and injure the crops in the more early stages of their growth, it may be better to follow the practice adopted in some districts of using a skim-coultered plough, as by this contrivance the remains of the clover weeds, and grassy material on the surface may be cut or skimmed off and turned into the bottom of the furrows, where they are immediately covered with the loose mould from below to such a depth, that little or no inconvenience can be sustained by them, while the land is thus rendered more clean, and capable of being harrowed in a more perfect manner than where the common plough only is employed, besides perhaps a better bed of mould is turned up in this way for the seed to vegetate in, provided the furrow is not made of too great a depth and breadth, and remain some time before it is sown; which should constantly be attended to by the agriculturist in preparing this sort of ground for wheat crops." But it is the custom of Norfolk and Warwick, where the land is often continued for two years in a state of clover, to break them up in the latter end of June, in the second, giving two, sometimes three ploughings. Where the situations is favourable, and the weather turns out suitable for reducing the soil to a proper state of tilth, this may be an advantageous practice, as by such means great benefit may be obtained by cutting the grass in the beginning of the season, in which it is to be ploughed up; but where circumstances of so favourable a nature do not occur, such a method of preparation must be less beneficial than that of giving only one ploughing. In the preparation of a clover ley for wheat, Mr. Ducket has noticed a singular experiment; he had a field in which wheat rarely escaped being greatly rootfallen; not to lose sowing it with that grain, and at the same time to guard against the experienced malady, he scarified it repeatedly, till he had torn up the clover, and also produced tilth enough for drilling it in; then he collected the clover fragments, and carted them into the farm-yard to make dung, and drilled the field; the wheat having a firm bottom in an unstirred soil, escaped the disease, and yielded an ample produce. The clover bulb which would have secured the dreaded looseness of soil, had it been turned down, made a large quantity of dung, and therefore was not lost to the farm, though the particular field was deprived of it. And it has been stated on the authority of an agricultor of much experience, that in cases where the clover crops have been such as to leave the land in a foul condition in respect to weeds, it would be highly improper to sow them with this sort of grain, as from its remaining for such a great length of time upon the ground they may be liable to have their seeds perfectly evolved, and brought into a state of vegetation. In such cases, Mr. Middleton suggests it as more advantageous to have recourse to such sort of crops as may require the operation of hoeing during the time they are upon the ground. The putting in of wheat after pea crops, is a practice that may probably be pursued with the most propriety and success in those districts that are from the nature of their situation sufficiently early to admit of the land being fully cleaned and prepared by repeated ploughings and harrowings, after such crops have been removed, before the proper time of sowing such grain. But where they are so late as only to allow of the land being prepared by one ploughing before the period of sowing, it is supposed by some to be an extremely hazardous practice to attempt the culture of wheat after such crops; as unless the ground be in a high state of tilth, there is little chance of a good crop being produced; this is the opinion of Mr. Donaldson, but the Norfolk farmers are in the constant habit of setting wheat upon a pea stubble with a single ploughing, and consider it a very safe and excellent husbandry, the pea crop ought to have been kept clean, and after it is harvested, the haulm harrowed off. They never plough a bean stubble more than once, in some counties it is the constant practice to cultivate beans and wheat alternately on the same land for some time. This is the case on the stronger kinds of soil in Kent, on which it is found to answer in a very advantageous manner; where wheat is only occasionally sown after such crops, it is often found an useful practice, but in such cases the beans should be cultivated in drills at from twenty to thirty inches distant, in order that they may admit of being hand and horse hoed in the most perfect manner. If this method has been followed, and the business of hoeing during the growth of the crops effectually performed, the land may be sufficiently prepared for the succeeding wheat crops by one ploughing, as the soil from being thus kept clean, and in high tilth can scarcely fail of affording a good produce. Mr. Young remarks, that "where the farmer has a bean stubble intended to be sown with wheat, he should give it the due tillage as early as possible, which should be regulated by the soil, as on some it may be better to trust the skim and scarifiers than the plough. Where the land is very clean, the great skim of the isle of Thanet is capable of cutting through every thing, and loosen the surface

sufficiently to enable the harrows to render it as fine as possible, being picked and burned by women. Where not so clean, the Kentish broodshare may be more effective. In other cases the scuffler may be sufficient for the purpose." It is added, that "when the farmer has got the surface to his mind, he is to consider whether or not he should plough it, which is adviseable if the soil be of a firm solid tenacious quality; and if he does not intend to drill the wheat, if he (the farmer) ploughs such a soil he may not have any apprehension of rootfalling wheat (failing roots, from a loose bottom); but he will bring up a new surface that may drill with difficulty, whereas that which has received the influences of the crop, atmosphere, and of his late operations, will be in exactly the right temper for the drill to work in. If the soil is of a more loose friable quality, and he should plough down the fine surface he has gained, he will give the wheat too loose a bottom, and he will run the chance of a rootfallen crop. In all such cases, or in any that have a tendency to this circumstance, he should determine not to plough at all, but drill directly: a method in which he saves tillage, and has the probability of a better produce."

This is a new practice on strong land, but he has seen such success in it as leaves no reason for doubting the soundness of its principles. Mr. Ducket, on a sandy soil did it, he says, for years, and with great effect. It should be remembered, that whatever circumstances may influence the growth of this grain, it loves a firm bottom to root in, and rarely flourishes where it is loose and crumbly; nor will a depth of such mould do, if the under stratum in which it will attempt to fix its roots, be from its quality repellant. The best basis is the cultivatable earth firm from not having been lately disturbed. These observations are certainly deserving of the farmer's attention. Where the district is early, and the land is preserved in good order by proper modes of cropping, wheat may be grown after beans, whether cultivated in the drill or broadcast system, with success, as there may be sufficient time to give the necessary preparation before the time of sowing, which cannot be done where they are late, and there is only time for one ploughing. And in other situations it is found advantageous when this crop is to be grown after either peas, beans, or tares, to plough the land in as light or shallow a manner as possible, and then harrow and take out the roots and weeds, so that they may be consumed on the ground in heaps; the field being after this formed into proper ridges for the reception of the seed by ploughing again a few inches deeper than at the first. And in some cases, it is even harrowed after the second ploughing, and ploughed a third time for the putting in of the grain.

This sort of crop may sometimes be cultivated after turnip crops to advantage on the heavier turnip soils, particularly where they have been kept clean from weeds by repeated hoeings, and fed off upon the land at such early periods as to admit of the ground being prepared by once ploughing, in a light manner. In cases where this kind of crop is intended to be cultivated after potatoes, which from their having a great tendency to lighten the soil as well as to exhaust it, should never be done on the lighter sorts of land in backward situations, or under any circumstances where a sufficient proportion of manure has not been applied for the potatoe crops, one light ploughing immediately before the seed may be in most cases an adequate preparation; as where proper attention has been bestowed in the culture of such crops, the soil is generally left in a sufficiently fine condition for the purpose. It has been remarked, "that the cause of wheat not succeeding well after potatoe crops, in many instances is, that, besides the land being too light and porous by the growth and cultivation that are requisite for them, the wheat is more exposed to the injurious attacks of the grub, earthworm, and other insects; and in some exposed situations, from the seed time being too long protracted, the practice becomes obviously improper." In growing this crop after those of hemp and flax, as weeds are apt to rise it is always proper that the land should be ploughed over two or three times, in order that a fine state of tilth may be produced. The custom of giving but one earth after such sorts of crops, can seldom or ever ensure full returns of this grain. It has been remarked in "Practical Agriculture" on the authority of Mr. Middleton, that experience has shewn in the most clear and satisfactory manner, that this sort of crop should never, when it can be avoided, be grown after other kinds of grain crops, as rye, barley, or oats; and that the manure should not be applied to it, but for such crops as may precede it. But that where the contrary is practised, the crop is not only liable to be injured by the rampant growth of weeds, but from its being more apt to be diseased."

In regard to the proper period of sowing this sort of crop, it may, the author of Practical Husbandry says, be useful to remark that "the earlier the autumnal sowings can be put into the soil, the greater chance the young plants will have of being well established before the frosts takes place, which has been seen to be a circumstance on which the welfare of the crop in a great measure depends. Besides, the state of the land and that of the season is much more proper for the process of vegetation, when the crop is put in at an earlier period, than when it is delayed till a late one; the state of the weather in the latter case often admitting of only a very languid and imperfect growth till the spring, by which the crop must be exposed to much danger, from various causes. Indeed experience has abundantly shewn that late sown wheats seldom succeed so well, or afford such plentiful crops as those that are put in early. But when sown too early there may notwithstanding be danger of the crop running too much to straw, and consequently of the grain proving light in the ear." From the beginning of September to the middle or even the end of October, may probably be considered as the most favourable period for this business. This is indeed confirmed by the established practice of the most correct farmers, Mr. Donaldson observes,

in almost every district of the kingdom where this sort of grain is grown. If sown earlier, especially on the heavy kinds of soils, the land is for the most part in too hard and lumpy a state to allow of the seed being properly covered by the harrow; and in the lighter ones in too dry a condition for the grain to vegetate in a proper manner: and when delayed later, the ground in one case is apt to become too wet and close by the falling of the autumnal rains, and in the other too loose and porous from the action of the frost upon it. It is remarked by the writer just mentioned, that more than four-fifths of the whole of this sort of grain is sown between the middle of the first and the end of the last of the above months. Mr. Young thinks September the best season for cold backward wet soils, and October for those of the more dry and warm kinds, after there has been a plentiful rain. There are however circumstances, it is farther observed on the authority of Mr. Banister, that may render the times of sowing different from the above; as where the soils are of the rich fertile, loamy, chalky, or gravelly kinds, it may be better to defer it in many instances to a considerably later period, as when such warm sorts of land are cropped too early, they are apt, it is said, to push the plants forward in such a rapid manner that they become weak and spindling in the early spring months, and at the same time, the crops are more liable to be infested with weeds on account of the season being then more favourable to their growth. But that the practice of putting in crops of this sort, so late as the latter end of November and beginning of December, frequently depends on the crops that precede them not being capable, from the lateness of the situation, or other causes, of being taken off so early as that the land may be made ready for the wheat crop in the proper time. This is often the case after peas, beans, tares, turnips, and other similar crops. In these cases on the lighter sorts of soils, and where drill-culture is employed, it may often be an advisable practice to sow in the spring, as by such a delay the ground may be brought into a more perfect state of preparation than could be the case in sowing it so late in the winter.

The proportion of seed that is necessary must depend upon and be regulated by a variety of different circumstances, but in general from two to three bushels, according to the state of the soil, the nature of the climate, and the period in which it is put into the ground may be the most suitable proportion for soils of a medium state of fertility, under the broadcast method of husbandry; but where the drill system of culture is practised, a considerably less quantity may be sufficient for the purpose. See *Sowing of Seed.*

But in the drilling and dibbling methods of sowing, which are unquestionably the best, where they are performed with correctness, six pecks of seed is sufficient; in the latter mode two rows being put in on a flag, care being taken to have the land rolled after having been ploughed a fortnight or more, and the seed dibbled in to a sufficient depth, without scattering, covering it in by bush harrowing. Where the lands have a known disposition to mildew, a larger proportion of seed should be given, whatever the time or season in which it is put in may be. Much less seed is also necessary in early than late sowings. It is remarked that on the rich soils of Gloucestershire, the quantity generally sown is about seven pecks, while in Yorkshire it is from eight to twelve. Where the lands are in a suitable state of tillage for receiving crops of this grain, ten pecks have been advised by a practical writer, as the medium proportion. But much larger quantities are frequently sown in the northern parts of the kingdom; it is obvious, however, that where such large proportions of seed are made use of, the plants must be liable to be drawn up too much, and the crops in consequence to become weak and imperfectly fed, as well as smaller in the size of the ears. There may be also disadvantages from making use of too small proportions of seed, from the ground not being properly covered with plants; but where care is taken in the after-culture of the crops, less danger is probably to be apprehended from this than the other extreme, as a great number of plants will be supplied by the tillering or shooting out of new stems from the joints about the surface, in consequence of the mould being laid up against them.

In Hertfordshire in the broadcast method, from two to three bushels are usually sown. But in the county of Norfolk they sow broad-cast from two to two and a half bushels, and in the drilling and dibbling methods from five to six or seven pecks.

In Essex they sow broadcast about two and an half bushels, and in the drilling and dibbling modes from seven to ten or more pecks.

The depth of putting the seed in should not probably be more than from one to two inches.

It is also the practice with many farmers in these districts to change their seed wheat frequently. See *Change of Seed.*

As soon as the seed has been put in the land, it should constantly be laid as dry as possible by the construction of proper drains and water furrows, so as in all seasons to keep the water from stagnating upon it. See *Water Furrowing.*

It has been lately suggested as a beneficial practice to have the seed well trodden in at the time of sowing it by sheep, or still heavier stock, on heavy as well as light soils, as by this means the young plants are prevented from dying away in the winter, from the land lying too light and hollow. But more facts are wanting to establish the utility of this method.

In the culture of wheat after it has been put into the soil there may be some difference according as it has been sown; the preparation of the land, or other circumstances. But in all cases it should be kept perfectly clean and free from weeds, either by the horse or hand hoe, as weeds not only injure the crop in its growth, but lessen the value of its sample when brought to the market. And besides the stirring of the mould on the surface amongst the plants may frequently be useful in other ways, in addition to that of preventing the growth of seed weeds; for as in

the heavy kinds of soils that are most adapted to this grain, the more superficial parts are liable to become so hard and baked as not to be easily penetrated by the new formed or coronal roots of the plants in the early spring months, especially when they are very dry, and have been preceded by much wet; loosening of the earth, by any means whatever must of course be of great utility. This effect is generally shewn to have taken place by the appearance and progress of the crop, which becomes of an unhealthy yellow colour, and advances but little in its growth. In such cases it has been suggested that harrowing once or oftener in a place, may be of much service in the early spring months. Where the crops are thin and of feeble growth, this operation may produce beneficial effects, by affording a sort of earthing up to the weak plants, and thereby promote a more vigorous growth, at the same time that a number of new shoots are sent off from the joints thus covered, and the crop in consequence rendered more full and abundant; and where the grain is too thick upon the ground it may also be of utility by drawing out and destroying many of the plants. It has likewise been suspected by Dr. Darwin, that "many of the root fibres by being torn in the operation may prevent the over luxuriance of the stem and leaves, and by that means promote the more early fructification of the grain."

It has been observed by a late writer, that "the scarifying young wheat crops should constantly be performed in an effectual manner and not later than March."

But that "some have not supposed it so very beneficial from not performing it at the proper time. Mr. Cook has, he says, contrived two implements for this use, a fixed harrow and scarifier, the former executing its work merely by common tines or teeth, having three rows, which by varying its position diagonally, one, two, or three of them, may be brought to act in the space of nine inches, without injury to the rows of wheat plants. If two, Mr. Young, he adds, says, "they may be drawn in a breadth of three inches; if three, in a space of four inches, and these spaces widened at pleasure, but still so as to keep quite clear of the rows of wheat. And that by loading the harrow, the teeth are forced to a proper depth. Further that the scarifiers have teeth of various breadths; but for working at this season, between nine and twelve inch rows, the narrowest are to be preferred. By the action of these tools the surface mould is, he remarks, loosened and the air admitted, being performed to the depth of two inches with safety, and without mould being raised so as to cover or bury the plants, the earth being only loosened and not displaced. By these contrivances much work can, he says, be accomplished in a very short time. This process is also useful against the attacks of the worms." They horse and hand hoe their wheat crops repeatedly in Essex, and with great advantage though very expensive.

But the drilled and dibbled crops where this method is not employed, particularly in the latter mode, where only one row is placed on a flag, must be hand-hoed in the intervals, which should be done the first time in the beginning of the above month, and a second time towards the end of it, or a little later. Some likewise do it to the broad-cast wheats, but this has been supposed injurious by many. The business of thistling the wheat crops should also be carefully performed in May, or the very early part of the following month, in all cases where it may be necessary. The practice of rolling should also be employed without either having recourse to the harrow, or after it has been used, being highly beneficial where the surface is cloddy, and the operation is executed when the ground possesses a medium degree of moisture, as well by forcing the roots of the wheat into the earth as by causing the new stems to rise. And in thin light soils, when this sort of grain is cultivated upon them, much benefit may also be produced in this way, by the roots of the plants being prevented from being so easily loosened and thrown out of the ground. And the same practice is recommended as generally useful by Mr. Middleton, where clover or grass seeds are sown with wheat crops, as a means of rendering vegetation more secure and perfect.

It has also been recommended in such cases as where the land is not in a sufficient state of fertility or preparation to bring the crops to perfection, to make use of top dressings. Substances of both the solid and fluid kinds have been made use of for this purpose; the first consist chiefly of the dung of different sorts of birds after being brought into a powdery state, bone dust, soot, peat ashes, and various saline matters. The latter are principally the drainings of dung hills and other similar liquid materials. The former should be thinly sown over the crop with as much evenness as possible, as early in the spring as horses can be admitted upon the land without injury; and if it can be done when the weather is inclined to be moist, it is the better, a roller may then be passed over the crop with advantage. Where the latter substances are made use of, care should always be taken that the plants be not injured by having too large a quantity applied to them. In this practice the expence should be a primary consideration, and small trials first made where dungs are not to be used. The proper season for performing the business is the beginning of February. See *Manure* and *Top dressing*.

It has been suggested that the method of transplanting wheat may be had recourse to in particular cases, with beneficial consequences, as where there are some parts of such crops too thickly set upon the ground, while others are too thin, irregular, or patchy; as by thinning and setting out the plants of such over abundant parts, among those that are deficient, much service may be done to each of them. The first will be rendered more capable of admitting the operation of the hoe, and thereby of supplying more abundant nourishment for the luxuriant vegetation of the plants, and the latter be supplied with the proper number of plants, which could not be accomplished in any other way. And it has been stated that when cultivated in the garden, one acre

would be capable of affording sets for an hundred, when planted after being properly divided at the distance of nine inches from each other; and that as the business of transplanting is to be performed in the spring, it is supposed that crops of this grain may be raised in this manner on lands that possess a greater degree of moisture than is suited to the healthy growth of wheat in general. Besides clean crops may be produced in this way with much greater certainty, as where the ground is ploughed over just before the plants are set out, the grain may rise much quicker from the plants than the weeds from their seeds, and the crop in this way overpower such noxious plants. Advantages of other kinds have been stated by different writers, as the result of this mode of raising wheat crops. It is a practice which as well as that of dibbling has been had recourse to with success both in Norfolk and Essex. *See Transplanting.*

The custom of feeding down wheat crops, where too forward or luxuriant in the early spring months, by means of sheep, is a practice that has been contended to be beneficial in many cases. The good effects in such instances, according to Dr. Darwin, are supposed to arise from the removal of the upright central stems, by which means different new lateral stems or root scions are sent off or brought forward with more vigour, by the acquisition of a larger proportion of nutritious matter from the joints in consequence, that must otherwise have been exhausted in supporting the central stems.

It is however a method which has been found by experience to be the most useful on such strong and fertile lands as are apt to produce a larger proportion of straw than can be properly supported. In which cases advantage has been said to be derived by feeding off the blade at two or more successive times; but in effecting the business great care is necessary, to see that the whole is completed before the crop begins to spindle, otherwise more injury than good may be produced. And on the lighter and more poor descriptions of soils, the practice must be employed with great caution, as on such lands the growth of the crops may be so retarded, as to become weak and spindly. Besides, on those lands where they are very light and the crops thin, injury may frequently be done by many of the plants being pulled up, on account of the closeness of the bite of the sheep. They should therefore never be suffered to remain upon the crops when the weather is wet and the surface of the ground much loosened, or after sudden frosts and thaws; as in such cases much harm may be done by the plants being pulled up and destroyed.

The treading of the animals, may, however, be of great service in all the light sorts of land, and where the crops are thin, as by it the earth will not only be pressed more closely about the roots of the plants, but the stems in many instances so forced into the ground and covered up, that new shoots will be sent off laterally, and the crops be thus rendered more full on the land. But where the soils are very stiff and adhesive, the growth of the crops may be checked and retarded by the practice, and of course the shoots thus caused become weak, affording only small ears and light grain. Observations and experiments have convinced a writer in the Bath Papers that wheat ought not to be fed down with sheep, unless it be very rank in January. And that such crops should only be fed as were sown early. And it has been suggested that, "though this practice has much similarity to that employed in gardening, of stopping the growth of the main stems of some sorts of plants, as those of the cucumber and melon kinds, by rubbing off or cutting away the central buds, in order to expedite their fruiting; yet, in wheat crops where the principal stems are eaten down, except when they are early and of very luxuriant growth, the ears of the new shoots may not have time to perfect their seed, and of course become light and shrivelled in the grain, and the new stems from their weakness be more apt to fall down and be lodged. These are circumstances that have been frequently observed to occur by Mr. Tull, in the feeding down of wheat crops by means of sheep." And that the same philosophical observer supposes that in "the culture of wheat crops, the most beneficial method is that of promoting as much as possible the time of blossoming, while that of ripening is protracted, as it is for the farinaceous reservoir of nutriment, deposited in the cotyledon of the new seed, in order to support the growth of the *corculum* or fresh embryon, that the plant is cultivated; which farinaceous deposition is effected in the interval between the blossoming and ripening of the corn, either before the impregnation of the pericarp or seed vessel, or afterwards; and the weight and plumpness of the grain is thus augmented."

The practice of feeding down young wheats by sheep may therefore often be hurtful, by retarding the period of blossoming as well as by restricting the growth of the stems of the wheat plants.

Sheep have likewise been employed on young wheat crops in other views, as it has been remarked that as the coronal parts of the roots of such crops are liable to be laid bare and exposed for some inches in length about the surface of the earth, during severe frosty winters, the turning in of sheep upon them in such circumstances when the ground is moist, and keeping them in motion may tend to press them into the loose soil, and in that way produce new roots, as well as afford covering and protection, to such as have been denundated. And it is added that some farmers who contend that much advantage is derived from it, turn sheep upon the crops where danger is apprehended from worms, slugs, and other insects; in order that by keeping them constantly in motion, such animals may either be wholly destroyed, or so fixed in the surface mould as to cause their more gradual death. There are a very great variety of these animals, which are supposed injurious to wheat as well as other crops: and for the destruction of which, lime, soot and other saline matters have been had recourse to with supposed advantage. See *Grub*, *Soot*, &c.

Wheat crops are supposed to be much injured

from different sorts of vegetable diseases, as the blight, mildew, smut, &c. &c. *See these different heads.*

In the Essex Report Mr. Young has mentioned meeting with a disease which he had not before noticed or heard of, at Copdock in that district which is called the *purples*. The ears affected, are he says, perceived at once by their colour, a dirty brown mixed with green, as if part was ripe, with some chests quite green: they feel nearly, but not quite, like blighted or abortive ears, which are brown while the ears in general of the crop are of a bright red or white; when rubbed in the hand, as if to get the grain no wheat is found, but apparently the small grains of a flattened indented globular form, and of a darkish purple, greenish or dark hue. It has not the smallest resemblance in appearance or scent, to smutty grains or bladders, and is certainly a distinct distemper. In many of these purpled ears are found some grains of good wheat. In order to discover if all the ears from the same root were affected, which Mr. Ambrose had not before examined, we made, says he, the experiment in many instances, and found all similar from every root. It appeared to him very singular, that no account (to his recollection), should have been given of such a strange malady, and so distinct from all others. Smutty ears were found in the same field, under all the common circumstances of that distemper. In Kent this distemper is called *cockle-eared.*"

It has likewise been noticed that particular states of the weather have considerable influence on wheat crops, at particular periods of their growth. As when the season is sufficiently dry, there is seldom much injury done to them during the winter months, however severe they may be in other respects, nor in those of the summer, provided the weather is not too moist about the time of blooming, as where that is the case the crops are mostly deficient in their produce.

And several sorts of weeds are injurious to wheat crops, where they have been sown upon lands in an imperfect state of preparation, as *charlock* on the light calcareous soils. The *corn poppy* on those of the chalky kind as well as *cockle*, *white-darnel*, *puck-needle* and *couch*.

Likewise *coltsfoot* on the rather heavy kinds of lands. *See these different heads*, and *Weed* and *Weeding*.

This sort of crop is shown to be ripe and ready for the reaper by its straw turning of a yellow colour, its ears beginning to bend in the neck and hang down, there having no greenness in the middle of them, and the grain becoming hard and plump.

It is remarked in the Essex Report that Mr. Spurgeon of Bradwell, does not like to cut wheat green, except it be the American white, which is brittle and must be cut early, to prevent a loss of ears. It rarely lays. And in Rochford hundred, Mr. Vassal and Mr. Prentice do not cut till the wheat is ripe; but Mr. Scratton, and this year Mr. Barington, reaped while it was yet green. And it was observed by Mr. Wright that most rough chaff wheat, if they do not stand till fully ripe, will not thrash well.

And it is stated in the Norfolk Survey that Mr. Farmenter, miller at Aylesham, a considerable farmer also, and a very intelligent sensible man, remarked that the farmers let their wheat stand too long before cutting. They are apt to have a notion, that when millers give this opinion it is speaking for their own interest; but he cuts his own wheat before it is ripe, and would do so on the largest scale, if he was not a miller. The quality is far superior, and the corn just as good. And Mr. M. Hill prefers cutting green, and never yet commenced harvest but he wished he had begun three days sooner.

In the first of those surveys, Mr. Young mentions a practice termed *fagging* which is, he says, an operation which he met with for the first time. When the wheat crops are very heavy with broad luxuriant leaves, men with sickles move regularly through it, strike off many of them, for lightening the top, as a preservative against being beaten down by rain. It should, he says, be done carefully, or damage may ensue. See *Harvesting of Grain*.

In respect to the quantity of wheat produced upon an acre, it must vary considerably, according to the circumstances of soil and preparation, as well as the state of the season; for it has been found that in some years the yield is under twenty, while in others it is upwards of thirty bushels the acre, the soil and culture being in every respect the same. And the average return of this crop throughout the whole of the kingdom, is probably not more than from three to three and a half quarters. And Mr. Donaldson has indeed stated it at not more than three quarters the acre. The greatest crop of wheat which the author of the Report of Middlesex has any account, is, he observes, sixty-eight bushels per acre; the least about twelve. The medium between these extremes is forty, which he conceives would be the average of land highly conditioned. But the average produce of Britain, does not, he imagines, exceed one half of this quantity, and yet he thinks wheat is as certain a crop as any that is cultivated. And the proportion which corn bears to the straw in that district, is, he observes, nearly as follows; namely,

"The yield of 1793 was $17\frac{1}{2}$ bushels to a load of straw,

of 1794	-	$8\frac{1}{3}$ ditto
of 1795	-	11 ditto
of 1796	-	$9\frac{8}{9}$ ditto
The medium of 4 years		$11\frac{1}{2}$ ditto

"Straw sold during the same period from 25s. to 40s. per load. The load consists of 36 trusses at 36lb. per truss. Two loads of wheat straw per acre is reckoned a tolerable crop, which may be averaged at eight pence per truss, or 24s. a load, or 2l. 8s. per acre. In other parts of the kingdom, the value of the straw is supposed equal to nearly the expence of reaping. Perhaps at an average of 30s.

(it has lately been as high as 3l. 12s.) which is on the corn, equal per bushel to	£.0	2	7
Short straw and chaff -	0	0	1
Wheat, at an average price for many years -	0	5	6
	0	8	2

The entire produce of wheat per bushel, is full 8*s.* 2*d.*

The weight of the wheat grown in the strong land district, is usually 61or 62lbs. per bushel."

It is necessary with the view of ascertaining the goodness of a sample of wheat, to determine by the eye whether the berry be perfectly fed, or full, plump, and bright, and whether there be any adulteration proceeding from sprouted grains, smut, or the seeds of weeds; and by the smell, whether there be any improper impregnation, and whether it has been too much heated in the mow or upon the kiln; and finally by the feel to decide if the grain be sufficiently dry, as when much loaded with moisture, it is improper for the uses of the miller and baker. In cases where a sample handles coarse, rough, and does not slip readily in the hand, it may be concluded not to be in a condition either for grinding or laying up for keeping.

Spring-Wheat, a sort of wheat which has been advised as proper for cultivation, by being sown at the same time with other grain crops in the early spring season. The sowing of this sort of wheat has been long practised in some degree, in both the northern and southern districts of the island, but lately a still greater attention has been bestowed upon it, and at present it is grown in considerable abundance in different districts. It has been found to answer well in Hertfordshire, as well as in many parts of the North of England, and in Scotland.

In this method of culture, it is considered by some as necessary to sow the particular sort or variety of wheat, which has been known by the title of *spring-wheat;* while others contend that this is a matter of little consequence, as any of the common wheats may be made use of, and answer well in this way of putting them into the ground.

It has, however, been suggested by Dr. Wilkinson, a very intelligent cultivator, that the sort called *triticum æstivum* by Linnæus, is the true summer or spring wheat. The common sort having been sown in the spring season, without succeeding in the northern districts of the kingdom. He describes it as having "four flowers in the calyx, three of which mostly bear grain: the calyxes stand pretty distant from each other on both sides of a flat smooth receptacle. The leaves of the calyx are keel-shaped, smooth, and they terminate with a short arista. The glumes are smooth and bellying, and the outer leaf of the glumes in every calyx is terminated by a long arista; but the three inner ones are beardless. The grain is rather longer and thinner than the common wheat. It is supposed to be a native of some part of Tartary." And that "Mr. Ray also classes it as a distinct species. It is generally supposed to have been introduced into this country about the year 1773, under the name of Siberian wheat, Switzerland wheat, or *bled de mars.* It is, however, mentioned by Harrison an historian in the time of Elizabeth, though, he says, it was known only to few husbandmen."

The doctor has found from experience, that this species, though sown so late as the 11th of May ripens with the autumnal wheat; and remarks, that "spring wheat was known to the Romans as a species distinct from the common wheat, and described as such by Columella, who conceived it very acceptable to the farmer, when, on account of floods or rains or other causes, he had been prevented from sowing the autumnal kind." And that "Mr. Dickson considers it as well adapted to the wet climate of Scotland, where owing to heavy rains, the farmers are frequently restricted in regard to the quantity of wheat that can be sown. The experiments detailed in Dossie's Memoirs on the culture of this sort of wheat, the doctor says, likewise, agree with his own experience. The latest sown, however, was the latter end of April, the produce is there stated at three, and two quarters per acre. The trials seem to agree in deciding that no advantage was gained by sowing it early. Wheat sown in April ripened as early as what had been sown the beginning of March. That it does not tiller like common wheat, but shoots up immediately from its first appearance above ground. That the grains are smaller than common wheat, but increase in size when sown on rich land. That it is liable to the smut. That it would succeed in fens and low lands, which are subject to winter floods. That it would be worth trying in the mountainous parts of Derbyshire, Yorkshire, &c. where little or no wheat is sown, the situation being too cold for wheat sown in the autumn to stand the severity of winter frosts and rain without perishing."

And Sir William Fordyce has given an account of an experiment on spring or Siberian wheat, in the Transactions of the Society of Arts, in which two bushels of wheat produced two quarters of grain. It was sown the beginning of April after turnips, and was found to prove an excellent nurse of clover and rye grass, sown at the same time. The turnips had been drawn, and not feed off by sheep: the soil a mixture of gravel and clay. Some interesting experiments on spring wheat are also recorded by Mr. Ruggles, of Clare. Seed two and three bushels per acre: the produce from two to three quarters. Time of sowing the end of March. In which it is observed, that this wheat is apt to receive injury from frost and dry weather. That it requires a dry mouldy soil; if moist, so much the better; but it is not conceived as a crop equal to spring corn, unless the price of wheat should exceed the average difference between that grain and barley, or when, from an uncommon quantity of rain in autumn, the wet lands may not have been sown. The weight sixty-three pounds and a quarter each bushel, containing eight gallons three pints. The ingenious Mr. Ducket, the doctor adds, has cultivated spring wheat on a large scale, drilling two bushels per acre about the middle

of March, and growing it on the same land for three years successively. He has reaped this wheat on the 24th of July, got in turnips and then wheat again in spring. And that Mr. Marshall in his Rural Economy of the Midland Counties says, that spring wheat is cultivated and approved of in that district.

On the whole he gives it as the result of his extensive experience on the cultivation of this sort of wheat, in the Monthly Magazine, "that it is a distinct species of wheat, as observed by Columella, Linnæus and Ray. He has sown it in spring, at the same time and in the same field with common wheat. The common wheat failed while the spring wheat rose to a crop. Secondly, that being liable to be hurt by frost, no advantage is gained by early sowing. That though the proper season may be about the middle of April, yet it may be sown so late as the 15th of May, as he found by experience last year, when, notwithstanding the unfavourable season, it ripened before barley sown at the same time and on the same field, and was cut on the 20th of September immediately after the autumn sown wheat; the crop two quarters per acre. Thirdly, that about two bushels may be the proper quantity per acre, when drilled, less, has been sown broadcast, that the average produce may be about two quarters per acre, unless when sown after turnips, when he has gained three quarters per acre. Fourthly, that the average value may be about one shilling less per bushel than the common wheat; he sold this year the spring wheat at 10s. while 11s. was given for the common sort. Fifthly, that being a smaller grain than the common wheat, it ripens earlier and with less sun: in a wet harvest, therefore, it dries sooner for grinding, as he experienced last year. That it receives but little injury from a wet summer and autumn, but will ripen earlier than barley in such a season. And sixthly, that when harrowed in, in autumn sown wheat, in place swhere the crop has failed, it will ripen at the same time without injuring the sample, which would not be the case with either barley or oats. It may, therefore, he thinks, on a large farm deserve the attention of the husbandman and be worth his while to cultivate a small quantity, as the best means of restoring a thin wheat crop. Magazan beans, when dibbled in, will answer the same purpose, but perhaps not equally well, as they may be longer in drying than the wheat."

But notwithstanding these remarks it has been contended upon the conviction of many experiments, by Dr. Pike, that "common wheat will thrive as well, and produce as full a crop, if sown in the spring, as if it had been committed to the ground the autumn before; and in many situations he is of opinion (where it is subject to much wet during the winter), the crop will be much better in quality and more abundant in quantity. He has frequently sown, he says, in the spring both the white and the Kentish red wheat, sometimes as late as the middle of March, and never had a crop fail that was sown at that time, nor has he ever found any considerable difference in the times when the autumnal and the spring crops ripen."

And "though the *Tritieum æstivum* has been above advised as best adapted to spring culture, he admits that in some northern parts of the island where the common wheat is generally found to fail when sown in spring, it may probably be so: but maintains that he has *repeatedly* sown both the common red or Kentish wheat, and the white in the spring, and had excellent crops."

It is likewise stated on the ground of much experience, by Dr. Wilkinson, that a sort of wheat denominated *Egyptian* or *prolific wheat*, though little attended to by farmers, is highly beneficial in this way, as he found on three acres of moist loam which had been previously fallowed, that the first year nine bushels of seed produced nine quarters of wheat, while in the same field, after a similar preparation, the same proportion of white wheat, sown at the same time, produced three quarters four bushels per acre." That "in both cases the fallow was dressed with about one hundred bushels of lime per acre, at 7d. per bushel delivered." But that "four bushels of the Egyptian wheat, though weighing four pounds more than the same quantity of white wheat, yet produced twelve pounds less of flour, the bran being coarser and heavier." That as after the month of May the growth was more rapid than that of common wheat, he should suppose it might be sown with advantage in spring. The straw so nearly resembles reed that it has been called reed wheat, and being heavy and tough it is cut with difficulty; on which account the reapers require an extraordinary price. However it is excellent for thatching, and he has employed it for the purpose on a large hay-barn; the trusses from their weight appear so small that the straw is not saleable in the London markets. The ears are bearded like cone wheat, but in shape resemble the square wheat or rivet. The length of the straw and weight of the ear make it liable to lodge in cases of much wet weather.

A great objection to it was that "the millers were not inclined to buy it on its being exposed to sale. They considered it of too horny a nature, and that it grinds hard, and obliges them to set their stones too close. And the flour is coarser and darker than that of common wheat." A miller, says he, who purchased some was charged by his customers with grinding rivets: great part of the crop sold at a price but little above that of good barley. As the crop though apparently thin on the ground had yielded three quarters per acre, he entertained hopes that the cultivation might answer, even at the price of barley, if on lighter land, and a warmer soil he could secure a larger produce. With this view, therefore, the following year, he sowed on a lighter loam two acres with this wheat and the remaining six acres of the field with the common red wheat: the whole on a clover lay. The produce of the red wheat was three quarters per acre, but of the Egyptian not above two quarters per acre, and he found great difficulty in disposing of it even at the price of barley. He concludes, therefore, that this wheat will not answer in this country where wheat of a superior quality can be cultivated to advantage, unless it can be intro-

duced as spring corn. He has since met with an account of this grain having been sown in the spring as Egyptian or Siberian barley, under which name it was introduced into this country in the year 1767." And that "the Rev. Dr. Pike has sown it as spring corn in the middle of April and has had above four quarters per acre. It was on very good land and kept perfectly clean from weeds. If it be truly a native of Egypt, he should, he says, have judged that a light but very rich soil might have been most proper for it, nevertheless, he thinks, he has found that (like English rivets) strong land suits it best. It gives a very plump, bold, sound grain of a good colour. He cannot think that it is the same as the Siberian wheat (or barley as some call it). The grains do not answer the description which some authors give of that species. That was, he says, introduced into this country about the year which Dr. Wilkinson mentions: but this was known here at least above 120 years before, for he has found a short description and a tolerably good figure of it in Parkinson, page 1120, under the name of *Triticum multiplicis pica.* In the figure, its very remarkable distinction from all other sorts is well expressed, by a number of short ears growing out of the sides of the chief ears; he calls it in English double eared wheat, and says that it grows about *Lyons* in France."

It is stated in the Essex Survey that "Mr. Wakefield of Burnham this year (1805) sowed a part of a field with spring wheat in April. He saved the crop, when it was quite black with mildew, and the only piece mildewed in the country: the grain not good enough for fowls."

"Mr. Wright of Hatfield, has this year sown a bushel of spring wheat, which is for the soil a fair crop, apparently at the rate of two quarters and an half per acre; the ears good and the grain plump, it is drilled and rather too thin, or it would bear a full crop.

"Mr. Weston sowed this year a small space, but it was too late, and the crop so thin, that the produce will be small; but a true spring corn; for common wheat sown at the same time by it, is not above nine or ten inches high in the grass, without any appearance of shooting the stalk."

It is likewise observed, that "Mr. Rogers of Arleigh, has for three years cultivated Egyptian wheat in that district, increasing the quantity till he has now got ten acres, and which promises to be very productive. The reason why many persons have given up this article of culture, he conceives to arise from their taking it from the beards to be a sort of rivets, and therefore to demand wet or strong land; but on such a soil it is good for little; it likes a dry light land, and on such will be found very profitable. He made an experiment in a large field of barley, which the writer viewed, sowing at the same time with the barley four rows of this wheat. It is evident that it will ripen, though late."

In the fifth volume of the Communications to the Board of Agriculture the following statements are given of the cultivation of eighty-two acres of spring wheat, in the fen district of Lincolnshire, by Mr. Calthrop in year 1805.

Soil.	A.	R.	P.
Moor upon clay	42	0	14
Moor upon sand	40	0	0
Total	82	0	14

Sort of wheat.—Horned or rough-eared spring wheat.

Quantity of Seed.—20 Quarters, which is 8 pecks per acre. The 14 perches were included in the 20 quarters.

Produce.	QRS.	C.	S.
Good wheat	413	1	3
Refuse, or hinder ends	26	1	2
Total	440	1	1

Value of the Crop.

QRS.	C.	S.			L.	s.	d.
413	1	3	at 50*s.*	=	1034	13	9
26	1	2	at 25*s.*	=	33	8	9
Total 440	1	1		=	1068	2	6

It is remarked that "the crop suffered in some slight degree from the *smut*, or *bunt*; the usual effects of which disease are, that the ear of the plant affected assumes the appearance of a black powder." But that he has been in the habit of growing spring wheat for twenty-five years, and never knew it suffer from the mildew, as winter wheat frequently does."

With respect to the produce, half of the quantity is estimated at four quarters per acre; the other half at three quarters four bushels per acre. But the quantity can only be estimated, as a small part of it only is yet threshed out.

It is remarked that "most of the ears are set five kernels broad, which is not often found in any wheat."

And Mr. Wedd of Cambridgeshire has been a grower of this sort of wheat nearly in the same proportion. It was nearly all grown upon fen land, with turf earth underneath, which is, he says, "most adapted to the growth of spring wheat; as fen land in the spring will grow more rapidly than any other."

And the previous cultivation of the land was ploughing, then burning, being then cropped with cole-seed, fed off by sheep, and afterwards sowed with spring wheat.

The first sowing commenced the beginning of March, and finished as late as the last day in April.

The earliest sown is the best quality, and the produce the greatest. Average value is about 10*l.* per acre.

In regard to the quantity of seed per acre it was two bushels; but the earlier sown the less seed will be required.

The spring wheat was free from mildew at the time the red and white wheat were much affected by it.

In the same work Mr. Speechley, of Woodborough Hall Nottinghamshire, is stated to have made the following experiments in the culture of this sort of wheat: "First, with a view to ascertain the comparative difference in point of quantity, between autumnal sown lammas wheat, and spring wheat, on clover lea." And "secondly, the effect of top-dressings on spring wheat, on clover lea. Also whether spring wheat, sown on clover lea, or upon turnip fallow, would prove the more successful.

Experiment 1. "In October, 1804, one half of a close (called Little Stocking), containing eight acres, was sown with lammas wheat, on clover lea. The soil a crumbly loam, but thin, by laying near a scaly rock bottom.

"On the 10th and 11th of April, 1805, the remaining half of the close was also sown with spring wheat; and on a small portion of which the following top-dressings were applied:

No. 1. Dove manure.

2. Soot.

3. A compost of sheep dung, leaves of trees, &c.

4. Very rotten stable yard manure.

"The pigeon's dung was from his own dovecot, but if it had been purchased it would have cost at the rate of ten shillings per quarter.

"For the soot he paid three shillings per quarter, at Nottingham, a distance of upwards of seven miles from hence. The expence, therefore, of carriage and spreading, &c. greatly enhances the charge of this article.

"No. 1 and No. 2 were laid on with such apportionment as to bring the whole expence of each to between twenty and thirty shillings per acre.

"No. 3 and No. 4. were laid on discretionarily.

Result of Experiment 1. It is observed that "the crop throughout was slender, both in the autumnal and spring sown. Indeed he purposely made choice of this thin and weak soil, supposing from thence that the effect of the top-dressings would appear the more distinguishable.

	Qrs.	Bus.
"When threshed, the division of autumnal sown lammas wheat did not yield a produce per acre of more than - - -	2	5
"The spring wheat (where not any top dressings were applied) only -	2	1½
Difference in favour of lammas wheat	0	3½

Top-dressings. "No. 1. The dove manure was somewhat the best.

(No. 2.) Soot very little inferior to No. 1.

(No. 3.) The compost of sheep's dung, &c. proved only about equal to rotten stable manure (No. 4), and did not exceed it, as he was in expectation it would have done.

"Their produce appeared in the following proportions, above the average of the crop where not any top-dressings were applied:

	Qrs.	Bus.
No. 1. Dove manure - } No. 2. Soot - }	per acre 0	6
No. 3. Compost of sheep's dung, &c. } No. 4. Rotten stable yard manure - }	per acre 0	3

It is stated that "as the various portions of corn, where the top-dressings were applied, would have required much barn room to have been separately kept: as it would also have been both troublesome and expensive in threshing and dressing up each by itself, and after all very subject to error by the respective labourers employed; he thought it therefore best by endeavouring to form a judgment of each from its bulk and quality when cut, and by afterwards coming to the knowledge of the produce of the general crop (after having been threshed,) where not any top-dressings were applied, he trusts that he could not have erred much by estimating from their various comparative differences.

Experiment 2. "On the 22d and 23d of April, 1805, a close (called West Field Close) containing four acres, was sown with spring wheat on turnip fallow, the soil a deep loam, and in a high state of cultivation." The writer observes, that "the turnip crop (which had been eaten off upon the ground by sheep), was throughout unusually fine, and perfectly clean from weeds." It may be proper here to observe, he says, "that this close had also been sown with turnips the preceding year, viz. in 1803, but as the ground could not then be got clean of weed, &c. the turnip crop was but very indifferent. Instead, therefore, of sowing barley (as should have been in common course of husbandry), he again fallowed. This brought the land into excellent condition, and it was again sown with turnips in 1804 also."

Result of Experiment II.—"The wheat crop from the beginning showed, he says, the highest marks of vigour; and what was very fortunate in so generally heavy crop, not any part thereof was lodged or laid when cut, (about one rood was gently *lolled*, as the workmen term it)." He adds, that "when nearly ready for the sickle, his neighbours, who had long had their eyes upon it, estimated the crop at upwards of four quarters per acre. The crop was cut on the 12th of September. From the number of sheaves per acre, and from the produce of what has already been threshed out, there are grounds for supposing that it will make good the foregoing calculation. But from the wheat proving of the first quality, he shall reserve the principal part of the produce in the straw, until the spring, for seed."

On these results the following remarks are offered: "1. That the spring wheat crop, both in Experiment I. and II. was ready to cut quite as early as his autumnal sown wheat on similar soil and situation, although the close, Experiment II. was not sown until the 22d and 23d of April. 2. That "it is highly probable, that the success of spring wheat on clover lea, may hereafter be found to depend more on the coming season, than autumnal sown wheat. If the following season should prove dry, the crop would, one may well suppose, be more hazardous in the former than in the latter. In a dry summer, it may seem that spring wheat would have a better

chance upon land that has been longer upon tillage than upon clover lea." 3. That "turnip and rape fallow, where the soil is not too light, seem highly proper for spring wheat." 4. That "pease and bean fallow may also in many instances prove eligible for spring wheat, and especially after having been ploughed early in the autumn, and benefited by the winter's rains and frost." 5. That "in the common course of husbandry, the close, Experiment II. should have been sown with barley, and at the same time have been lain down in seeds. Therefore, when the spring wheat was harrowed in, at the last light harrowing, clover seeds, &c. were also sown. The ground is now well set, and the seeds have prospered equal to any he ever saw." 6. That "the difference in produce, in point of quantity, between Experiment I. on clover lea, and Experiment II. on turnip fallow, ought not to be considered as any data to go upon in future experiments, because the superior quality and state of the soil in the close, Experiment II. might reasonably have been expected to have given nearly such decided difference." 7. That "in the application of top dressings for spring wheat, it may seem, that in a long continued dry season, the most eligible way would be by applying them at the same time when the wheat is sown. Only once lightly harrowing after may suffice." But 8. that "in a moist and continued rainy season, top dressing would probably prove to act more powerfully by being sown upon the surface of the soil; because top dressings are most particularly calculated to invigorate the coronal roots of the wheat plants, and thereby to cause them to tiller well." And 9. that "when top dressings are sown on the surface of the soil, the best time of applying them, it may seem, would be when the wheat is grown to the height of three or four inches; because if laid on before the blades of the corn crop afford a kind of shelter, the finer particles thereof are liable either of being exhaled by the sun, or blown away by high winds, which frequently occur at that season. Moist and showery weather, at that critical period, will always be found of the highest importance; therefore the farmer would do well by having due attention to the state of the weather, when employed on this business." And 10. that "as a crop of spring wheat is so much more valuable than any other kind of spring sown corn, there are good grounds for supposing that top-dressings cannot any other way be more beneficially employed."

The writer also states a further advantage in the cultivation of spring wheat, which is, that "on various soils, and in some seasons, it often happens that the autumnal sown crop of wheat may be seen to fail and to go off in patches. Consequently "in the beginning of April, by raking spring wheat into the vacant places, as also where the wheat plants may appear weak and thin set, the uniformity of the crop may be restored, and the spring wheat be ready for the sickle quite as early as the autumnal sown."

And that "although such a mixed crop would render its produce highly improper for seed, for the miller's use, it would afford no objection."

The trials of Mr. Coggan, made under the unfavourable circumstances of a newly broken up furz common, of poor quality and wet cold nature, as well as on a poor field which had been long in cultivation, sown broadcast after a summer fallow, with three bushels of spring wheat per acre on the 11th and 19th of April, also show that this sort of grain may be had recourse to with considerable success in many cases. He has also had five quarters per acre on rich good land in perfect cultivation of excellent wheat of this kind when put into the soil, so late as the fourth of May. It is evident, that this sort of wheat has a rapid growth, being equally forward at harvest with the autumn sown crops.

On the whole it seems probable from the success that has attended this kind of culture in the fen, and the more northern districts of the kingdom, that it may be advantageously introduced in many different situations and circumstances of arable land.

WHEE, a term signifying a heifer. It is sometimes written Whey and Qui.

WHEEANG, a provincial term signifying a thong of leather.

WHEEL, a simple contrivance consisting of a circular piece of wood, metal, or other matter that revolves on an axis.

In regard to the use of wheels in carriages, it may be said to be twofold, as that of diminishing or more easily overcoming the resistance or friction from the carriage; and that of more easily overcoming obstacles in the road. In the first, the friction on the ground is transferred in some degree from the outer surface of the wheel to its nave and axle, and in the latter they serve easily to raise the carriage over obstacles and asperities met with on the roads. In both these cases the height of the wheel is of material consideration, as the spokes act as levers, the top of an obstacle being the fulcrum, their length enables the carriage more easily to surmount them, and the greater proportion of the wheel to the axle, serves more easily to diminish or to overcome the friction of an axle, as has been shown by Jacob in his work on Wheel carriages.

And the wheels should be exactly round, the fellies being at right angles to the naves, according to the inclination of the spokes.

And it is the most general opinion, that the spokes should be somewhat inclined to the naves, so that the wheels may be dishing or concave. Indeed if the wheels were always to roll upon smooth and level ground, it would be best to make the spokes perpendicular to the naves or to the axles, because they would then bear the weight of the load perpendicularly. But because the ground is commonly uneven, one wheel often falls into a cavity or rut when the other does not, and then it bears much more of the weight than the other does, in which case it is best for the wheels to be dished, because the spokes become perpendicular in the rut, and therefore have the greatest strength when the obliquity of the road throws most of the weight upon them, while those on the high ground have less

weight to bear, and therefore need not be at their full strength.

It is added, that the axles of the wheels should be quite straight and perpendicular to the shafts or to the pole. When the axles are straight, the rims of the wheels will be parallel to each other, in which case they will move the easiest, because they will be at liberty to proceed straight forwards. But in the usual way of practice, the ends of the axles are bent downwards, which always keeps the sides of the wheels that are next to the ground nearer to one another than their upper sides, and this not only makes the wheels drag sideways as they go along, and give the load a much greater power of crushing them, than when they are parallel to each other, but also endangers the overturning the carriage, when a wheel falls into a hole or rut, or when the carriage goes on a road that has one side lower than the other, as along the side of a hill. Mr. Beighton, however, has offered several reasons to prove that the axles of wheels ought not to be straight.

It is also found that large wheels are more advantageous for rolling than small ones, both with regard to their power as a longer lever, and to the degree of friction, and to the advantage in getting over holes, ruts, and stones, &c. If we consider wheels with regard to the friction upon their axles, it is evident, that small wheels by turning oftener round and swifter about the axles than large ones, must have much more friction. Again, if we consider wheels as they sink into holes or soft earth, the large wheels by sinking less, must be much easier drawn out of them, as well as more easily over stones and obstacles, from their greater length of lever or spokes.

Hence it appears, that wheels are the more advantageous as they are larger, provided they are not more than five or six feet diameter, for when they exceed these dimensions they become too heavy; or if they are made light, their strength is proportionably diminished, and the length of the spokes renders them more liable to break; besides, horses applied to such wheels would not be capable of exerting their utmost strength, by having the axles higher than their breasts, so that they would draw downwards, which is even a greater disadvantage than small wheels have in occasioning the horses to draw upwards.

And carriages with four wheels are much more advantageous than carriages with two wheels, as carts; for with two wheels, it is plain, the tiller horse carries part of the weight in one way or other; in going down hill, the weight bears upon the horse, and in going up hill the weight falls the other way, and lifts the horse, which is still worse. Besides as the wheels sink into the holes in the roads, sometimes on one side, sometimes on the other, the shafts strike against the tiller's sides, which destroys many horses; moreover when one of the wheels sinks into a hole or rut, half the weight falls that way, which endangers the overturning of the carriage.

It is supposed that it would be much more advantageous to make the four wheels of a coach or waggon large, and nearly of a height, than to make the fore wheels of only half the diameter of the hind wheels, as is usual in many places. The fore wheels have commonly been made of a less size than the hind ones, both on account of turning short, and to avoid cutting the braces. Crane necks have also been invented for turning yet shorter, and the fore wheels have been lowered so as to go quite under the crane-neck.

It has been contended, that it is a great disadvantage in small wheels, that as their axle is below the bow of the horse's breasts, the horses not only have the loaded carriage to draw along, but also part of its weight to bear, which tires them soon, and makes them grow much stiffer in their hams, than they would be if they drew on a level with the fore axle. But Mr. Beighton disputes the propriety of fixing the line of traction on a level with the breast of a horse, and says it is contrary to reason and experience. Horses, he says, have little or no power to draw, but what they derive from their weight, without which they could not take hold of the ground, and then they must slip and draw nothing. Common experience also teaches that a horse must have a certain weight on his back or shoulders, that he may draw the better. And when a horse draws hard, it is observed that he bends forwards, and brings his breast nearer the ground, and then if the wheels are high, he is pulling the carriage against the ground. A horse tackled in a waggon will draw two or three ton, because the point or line of traction is below his breast by the lowness of the wheels. It is also common to see, when one horse is drawing a heavy load especially up hill, his fore feet will rise from the ground, in which case it is usual to add a weight on his back, to keep his fore feet down, by a person mounting on his back or shoulders, which will enable him to draw that load which he could not move before. The greatest stress or main business of drawing, says this ingenious writer, is to overcome obstacles; for on level plains the drawing is but little, and then the horse's back need not be pressed but with a small weight.

With respect to the utility of broad wheels in amending and preserving the roads, it has been so long and generally acknowledged, as to have occasioned the legislature to enforce their use. At the same time, the proprietors and drivers of carriages seem to be convinced by experience, that a narrow wheeled cart is more easily and speedily drawn by the same number of horses, than a broad wheeled one of the same burthen: probably because they are much lighter and have less friction on the axle.

In order to lessen the friction of wheels in carriages, Mr. Brown of Pool in Dorsetshire has obtained a patent for an ingenious contrivance, in which "the axle, instead of reposing on the ring of the nave of the wheel, rests upon a frictious wheel, which turns round with it, and by this means the attrition is transferred from the circumference of those interior wheels to their pivots, or to the several centers round which they move." And it has been observed, that "the principle is precisely the same as that resorted to in the common pulley, which

resists less when turning upon its axis than when it is fixed; in both, the friction is removed from the circumference to the centre."

This is an ingenious practical invention, which deserves attention, and has been well explained by proper figures.

It has been lately observed by Mr. Cumming, in an excellent paper in the second volume of Communications to the Board of Agriculture, that the wheels of waggons, and other heavy carriages, which have been required to have a certain breadth of rim, and a flat bearing on the road, have not been constructed in such a form as is best suited to lessen resistance in drawing them, or to have the best effects, in regard to the roads over which they are to pass. He remarks, that the soles or rims, instead of being cylindrical, have mostly been the portion of a cone, the properties of which have lately been shewn by various experiments to be those:—of their having a natural tendency, in rolling, to revolve in a circular direction round their conical centres; of their requiring a constant power or force to keep them to a straight line or course; in their being confined or compelled to move in such straight direction, a rubbing and friction occurring at the rim; their augmenting friction on the axis; their causing a rubbing against the sides of deep ruts or tracks; their throwing up dirt from the hind part of the wheel; their pulverizing and greatly reducing the best sorts of materials in dry seasons, thereby causing much sludge in wet, and much dust in dry weather; their deranging and breaking the texture of the surface of the roads when in a soft or compressible state, and leaving them in a broken condition, ready to imbibe moisture, which causes all the bad effects of wet seasons and intense frosts; their promoting the destruction of paved roads, by forcing open the joints and letting in the water under the stones, which by ultimately floating and discharging the gravel, renders the stones loose and permits the pavement to sink into holes; their augmenting the labour of the cattle or team, and accelerating the wear of the tires of the wheels by their constant tendency to drag and grind in their passage on the roads.

While he contends, that "the cylindrical form of rims are free from these inconveniences, having a constant tendency to proceed in a straight direction, without friction or rubbing at the circumference, or against the sides of deep ruts; not throwing up dirt by the hind part of the wheel; not increasing friction on the axis; not having pressure against the lynch-pin; the sole obstacle to their proceeding in a straight line arising from the compressing and levelling the materials over which they pass; having no disposition to displace or break up the texture, or prevent the consolidation of the parts of the roads on which they run; their frequent rolling on compressible substances rendering them more level, compact, and impenetrable to water, leaving them in a condition more favourable for consolidation, and by contributing to keep the interior and softer parts of the roads dry, they are more enabled to resist injury, and support the crust that is the protection of them; not having the effect of opening the joints in paved roads, but, on the contrary, to improve them, by operating as a rammer on the stones over which they pass, from the dead pressure arising from the equal velocity of all the parts; and advancing in a straight course with the least possible resistance, and with greater advantages than any other shape, serving equally to improve the roads, relieve the cattle which draw them, and preserve the tires of wheels."

These interesting and practical conclusions are established on different facts and experiments, which are more fully explained in the valuable paper mentioned above; though the results of the various trials are concentrated and arranged in the table below, in such a manner as that those made under a similarity of circumstances, both with the conical and cylindrical wheels, may be easily brought into a state of comparison. Consequently the first column, A, furnishes the number of each experiment, in the order in which they were made, for the purpose of referring to them when necessary. And a description of the particular circumstance under which each experiment was attempted, is afterwards given. The column B explains the number of weights which were required to draw the carriage under such a combination of circumstances, in such a manner as just to begin its motion without being assisted. While the last column, C, exhibits, on the scale of acceleration, the number of spaces that the carriage advances after the weights have ceased to act upon it; which, the writer says, "by estimating each division on the scale as equal in value to one-tenth of the weights that draw the carriage, we ascertain how much the resistance to the progress of the carriage is less than the power by which it is drawn in decimals of that power."

TABLE OF EXPERIMENTS.

A. Number of the experiments according to the order in which they were made.	The circumstances under which the experiments were made, with the different sets of wheels.	B. Numbers of weights required to make the carriage begin its motion.	C. Number of spaces which the carriage advances after the weights have ceased acting.
1st.	The Conical Wheels bearing on their whole breadth, were drawn by	9	$0\frac{1}{2}$
4th.	The Cylindrical Wheels, do. do. - - -	6	$3\frac{1}{2}$
2d.	The Conical Wheels bearing on a fourth of their breadth on the middle tire	6	1
5th.	The Cylindrical Wheels under the same circumstance -	6	2
3d.	The Conical Wheels bearing on two slips on the extremities of their rims	11	0
6th.	The Cylindrical Wheels under the same circumstances	6	$2\frac{1}{2}$
7th.	The Conical Wheels drawn on friction bars, that remove the friction at the rim	6	$0\frac{1}{4}$
8th.	The Cylindrical Wheels on do. at liberty, but the friction bars do not move	6	1
9th.	The Conical Wheels on the friction bars (fixed) bearing on their whole breadth	9	$0\frac{1}{3}$
10th.	The Cylindrical Wheels, do. do. - - - -	6	$2\frac{2}{3}$

And he draws the following interesting deductions from a comparison of the effects of each class of wheels under similar experiments, as shewn in the table, which are that from "the *first* and *fourth* experiments," it seems evident, that the same load that is drawn on *conical wheels* by a power of nine, is drawn on *cylindrical ones* by a power of six; and that after the power has done acting, the carriage with the former kind of wheels proceeds only one *half a space* on the scale of acceleration; while that with the latter sort, though drawn by a third less power, has sufficient *motion* left to advance it forward *three spaces and a half*. And that by the *second* and *fifth*, it is clear that when the conical wheel is made to bear on a fourth part only of its breadth at the middle of the rim, it is drawn by a power of six, and proceeds *one space*, after the acting power ceases; but that cylindrical wheels bearing on the same breadth, and drawn by the same power, advance on the scale *two and a half divisions*; which demonstrates that even the *narrow* cylindrical is drawn with more ease than the *narrow* conical wheel, and that the difference in favour of the former is, in this instance, equal to $\frac{3}{20}$ of the power by which the carriage is drawn. Further that the *third* experiment proves, that when the conical wheel bears equally on the opposite extremities of the rim, *eleven weights* are requisite to draw it; that with this increased power it stops the moment the action of the impelling weight ceases: the uniform resistance to its progress being equal to the uniform action of the power, no residue of motion being left to force it forward. That the sixth evinces, that with the cylindrical wheels bearing in a similar manner on the extremities of their rims, the *same load* is drawn by *six* weights only: and the motion so accelerated as to carry the carriage *two and a half* spaces forward, after the weights have ceased to act upon it.

In short that the result of all these experiments, fully shew that the greater resistance which takes place with the broader conical wheels, does not depend on the breadth of the rim alone, but upon the breadth and the conical shape conjointly. That, in conical wheels, the *increase* of *resistance* depends upon the difference of the velocity of the greatest and of the smallest parts of their circumference, and that the exertion of the cattle must necessarily increase in the same ratio or proportion. Further that the resistance is increased in the same conical wheel, when the pressure of the load is confined to those parts of the rims that have the greatest difference of velocity. That, on the same principle, the resistance with the conical wheel *on a hard bottom*, is diminished by narrowing its bearing; but that on yielding substances, the effect is directly the contrary. That, since this friction and dragging of the conical rim is owing to the different velocities of the several parts of the circumference, it follows, that every wheel which has not an equal velocity in every part of its circumference, must have a dragging and unnecessary resistance, that is, a resistance that may be avoided by giving to every part of the circumference, or rim, the same degree of velocity. That, the only means by which an equal degree of velocity can be obtained in every part of the circumference of a wheel, is, by making all the parts exactly of the same diameter; and every wheel that has all its parts of the same diameter, must necessarily be cylindrical. And that thus on the whole the conclusions from the result of experiments, and from theory, concur in proving, that so far as regards the labour of cattle, or the facility of the progress of carriages, the cylindrical shape of a wheel is preferable to any other possible shape: and that this superiority of the cylindrical wheel, which has hitherto been illustrated by considering only the causes from which the greater resistance with conical broad wheels arises, is further proved by the experiments that have been made with the cylindrical wheels; in each of which *the same number of weights* were required to make the loaded carriage begin its motion, under the same variety of circumstances, which with the conical wheels occasioned the difference shewn in the table, in the num-

ber of the weights required to draw the same load; and the number of weights that were capable of drawing the loaded carriage under each of those various circumstances on the cylindrical wheels, was only equal to the least that was required with the conical; and when the conical wheels bear on the extremities of their rims, *five more weights* are required with them than with the cylindrical wheels. In fact although no difference appears by the number of weights required to begin the motion of the carriage with the cylindrical wheels, whether they bear on the whole breadth of the rim, on a narrow part of its middle, or on the extremities of the fellies; it seems clear by the spaces which the carriage advances, on the scale of acceleration, after the weights have done acting upon it, that when the cylindrical wheel bears on its whole breadth, it advances on that scale $3\frac{1}{2}$ spaces, when bearing on one-third of its breadth only, it advanced only $2\frac{1}{2}$ spaces; and when bearing on a fourth of its breadth only, it advanced no more than two spaces: here then, says the writer, is seen a most important difference between the cylindrical and the conical wheel; which is that the *broader* the *bearing* of the *cylindrical wheel*, the more easily it proceeds, and that the broader the bearing of the conical wheel, the greater is the resistance to its progression on the road.

It is suggested that on these principles the use of low broad cylindrical wheels, with light carts may be advantageous for many purposes of the farmer, such as conveying manure on tillage and meadow land, in all kinds of seasons and circumstances. And that consequently on the whole cylindrical wheels must be beneficial to the proprietors of waggons, not only by their *lessening* the labour of the cattle on the *same road*, but by their keeping the roads in better order, and to the trustees of them by their improving and rendering less expence in the repairs of them necessary, independently of the less injury done to them when employed by the farmer in his various business. See *Cart* and *Waggon*.

Other improvements in the construction of wheels or particular parts of them have been lately contrived with the view of lessening the resistance caused by friction. Thus in the nave of the wheel improved by Mr. Plucknett the resistance is greatly reduced by the more perfect retention of the unctuous material applied as grease.

In this case the friction is not only lessened in the box, but the effects of the weather on the spokes guarded against, as well as the removal of them when damaged rendered more easy.

The first is accomplished by the contrivance of making the inner surface of the box to consist of a certain number of angles, instead of being one smooth cylindrical surface, so that the friction is on these points or angles of the box instead of being as before on the whole extent of the inner surface.

The angles of the octagon, which of course are always undisturbed by the motion of the axle, form receptacles for the grease.

Wheel *Carriages*, all such vehicles or carriages as move by means of wheels. See *Cart* and *Waggon*.

Wheel *Ploughs*, such ploughs as are constructed with wheels. It has been lately observed that large wheel ploughs are injurious in putting in wheat crops from their laying the land too hollow, which renders it too open for the healthy growth of that sort of grain. See *Plough*.

WHERRY, the provincial name of a liquor made from the pulp of crabs after the verjuice is expressed. It is often called crab wherry.

WHEY, a provincial term applied to the serous part of the milk, from which the curd has been separated. See *Dairy*.

Whey-*Butter*. See *Butter*.

WINNOWING-*Machine*. See *Fan* and *Fanner*.

WHICKS, a name sometimes applied to the young plants of the white-thorn kind. Also to couch grass.

WHIE, provincially a heifer.

WHIG, a name provincially given to acidulated whey, which is sometimes mixed with butter milk and sweet herbs to give it flavour. It is a good summer beverage.

WHIN, a term applied to furze. See *Furze*.

WHIP REIN, a rein formed of cord or leather, by which a plough or other team is directed in working. See *Rein*.

Whip *rein plough*, a term applied to a small plough, drawn by two horses or oxen, which are guided or driven with proper reins, made in such a way as to answer the purpose of a whip to the ploughman.

Whipping *Wheat*, a term applied to a practice in some of the northern districts by which the wheat crops are lashed or whipped out on a wooden or wattled frame-work contrived for the purpose. The former is constructed by nailing two or more thick boards in a slanting manner to the height of about two and an half or three feet, on a sort of frame of suitable strength supported by legs having the upper part a little rounded and made smooth. This, which is termed the whipping or lashing-frame, is placed in some convenient situation so as to prevent the grain from flying about during the operation, which is then begun. Where the latter contrivance is made use of, the frame is woven with strong sticks in the manner of a hurdle, being placed in the same situation when used.

The process is performed by taking large handfuls of the corn in the straw by the but, and striking the top or ear ends over the upper part of the frame so as to force out the grain from the ears of the top part without breaking the straw, which in this way becomes much better for thatch, and at the same time the grain is less injured than by the flail method of threshing it out. The but parts of the straw are sometimes afterwards thrashed over, in order to get out any wheat that may have been left in the short ears. This is an excellent mode of providing seed wheat as the finest grain is chiefly procured.

And it is suggested as a particularly good method in cases where wheat is infected with the smut, as during the operation of threshing, the flail breaks the smut balls, and reduces them to a powdery state, which causes the good wheat to have a blacker appearance than would otherwise be the case when ground. It may likewise be used to advantage with other sorts of grain.

The above is also a term applied in the northern districts, to the practice of shaking it over a

stone hurdle or other contrivance in order to get out the grain, and leave the straw unbroken. It is sometimes termed lashing.

WHIPSTITCH, a term sometimes used in ploughing, to signify a sort of half ploughing, or what is termed a *rafter*, it is used to keep the lands more dry and healthy. *fig.* 3.

WHIPPLE-TREE, a term signifying the bar or part by which a horse or team is attached to a plough, harrow, or other tool.

WHISKET, a term provincially signifying a basket.

WHITE-CLOVER, a well known plant of the clover kind, which affords sweet feed, and which is perennial, or lasts a number of years in the land. See *Clover*.

WHITE-*Crops*, a term applied to all sorts of grain crops, as wheat, barley, oats, &c.

WHITE BLAZE, in *Horsemanship*, a white mark upon a horse's face, descending from the forehead almost to the nose. See *Mark*.

WHITE *Foot*, in *Horsemanship*, a mark that often happens in the feet of many horses, both before and behind, from the fetlock to the coffin.

WHITE-*nebbed-crow*, a provincial name of the rook.

WHITE-*Lands*, a term sometimes applied to chalky lands.

WHITE *Rent*, a rent or duty of eightpence payable annually by every tinner in Devonshire to the duke of Cornwall.

WHITE *scour*, a destructive disease with which sheep are too often affected.

The following medicine has been often given with success, provided the sheep are at the same time removed into a dry pasture:

Take a pint of old verjuice, half a pound of common or bay-salt, dried well before the fire, pounded, and sifted through a sieve. Then mix the verjuice with the salt by degrees; and add half a pint of common gin, and bottle it up for use. When any sheep are seized with this disorder, separate them from the flock, and give each of them three large table spoonfuls of the mixture for a dose, repeating it two days afterwards, if they are not better.

It is, according to some, a violent and uncommon looseness, occasioned by sheep feeding on putrescent vegetables, especially the shells of turnips, when suffered to lie on the ground after the flesh or pulp has been scooped out. The diseased sheep should, as advised above, immediately be separated from the flock, and have the above mixture given them every second or third day, as the nature of the case may require: As poverty of keep is the primary cause of this malady, the animals must be allowed the best and most wholesome dry food that can be provided.

WHITE-*Thorn*. See *Hedge*.

WHITE-*Thorn-Layer*, such plants of the white thorn as are laid down in hedges.

WHITE *Water*, in *Farriery*, a disease in sheep. See *Water White*.

WHIT-TAWER, provincially a collar maker.

WHITTLE, the provincial name of a pocket-knife.

WIDDY, a provincial name for a withe or withy.

WIKES, a term signifying temporary boundaries or marks, set up to divide swaths, to be mown, such as boughs, in the common fields, or meadows. Also boughs set upon haycocks for tithes, &c.

WILD-*Oats*. See *Weed*.

WILDS, a term sometimes used by farmers to express that part of a plough to which the draught is attached. It also signifies a barren deserted situation.

WILF, provincially the white willow.

WILLOW, the name of a well known tree, of which there are several species, some of which may be propagated to great advantage. But though there are a great number of species of this sort of trees, those mostly cultivated for farm purposes are the *common white willow*; the *purple* or *red willow*, the *sallow*, and the *broad leaved*, or *Huntingdon willow*.

The first is a well known tall growing tree, of the deciduous kind. It has a fine silvery appearance in the leaves. Is quick of growth, and the wood is very useful where lightness and cleanness of the grain is beneficial, as for hurdles, gates, hop poles, &c.

The second, is a free shooting willow, growing nearly to the size of the first sort; but its wood is inferior for many uses, especially those of the farmer.

The third sort is well known, delighting in a rather dry soil; being a tree below the middle growth. It has numerous branches, of a smooth appearance, and dark green colour. Its wood is very useful for hurdles and other similar purposes.

It has two varieties, the *long-leaved*, and the *striped* sallow.

The fourth sort, or red hearted willow, is supposed by some as the best sort for planting, for the use of the farmer, as growing quickly; the stools having been found to produce three or four poles each at eight years growth of from thirty-three to thirty-six feet in length, most of them being "large enough to make three rails, two at the bottom and one at the top; but the great use to which they are applied, is the purpose of making hurdles, stakes, gates, and other farming implements, being a wood uncommonly tough and light, owing, as is conceived, to a new method used in planting them close to the ground. If it is the design of the planter to let them grow into timber (which would be far superior to *deal* for the purpose of flooring, or other light work, particularly as it will neither splinter nor fire; and if suffered to remain for twenty or twenty-five years, would make good masts for small craft, as they shoot up perfectly straight, and without any collateral branches) it is necessary, at the first or second year's growth, to observe which pole is the strongest, as the remaining poles must be cut away. In about fifteen years time it is supposed they will want thinning; of course the inferior must be taken out and the superior be suffered to remain.

In cultivating them on waste moist lands, laying out the ground into lands, like hop lands, as from three to four yards wide, with a ditch on each side; three feet wide at the top, one foot at the bottom, and two and a half deep, is advised by a late writer as the best mode from much experience. The earth that comes out of the ditch should be thrown on the land. But if there is not fully sufficient fall for the water to get off, the ditch should be deeper and wider, till there is near a yard of earth above the level of the water. As soon as this is done, the ground must be double dug, "that is, trenched two spades depth, except it be very boggy, which will afford room for the plants to shoot, and will save the expense of weeding, which otherwise must be incurred in the first summer after the plants are set; for if they are not kept clear of weeds the first year the hopes of the planter will certainly be destroyed.

In respect to "the times of planting they must be from January to the end of March; but the sets for that purpose should be cut from December to the end of February; when the sap is down. And the reason is, that if poles are cut in the spring (the sap being up) the stool will at least be weakened by bleeding, if not killed; and of course prevented from shooting so vigorously as if cut at the preceding time. If however there are people so injudicious as to sell sets in spring, it will be to the advantage of the purchaser to plant them, as the sap is then in the poles. The reason why many are induced to cut at that time is on the supposed account of their peeling better; but it can be affirmed from experience, that poles cut in December, January, or February, and laid in rows upon the ground, or the ends put in water, will peel as well in the spring as at the usual time."

In regard to the sets, or truncheons, they may be cut from twenty inches to two feet long; particular care should be taken in the cutting, that the bark be not fridged or bruised, or in any other respect injured; for in that case the plant will be weak and puny. They should be cut not on a block, but in the hand; obliquely, and with a very sharp bill, or instrument. They must be dibbled into the earth, by an iron crow, to the depth of fourteen or twenty inches, so that not more than six, nor less than four appear above. If the truncheon should not fill the hole, the earth must be trampled close round it, in order that the air may be excluded. Care must be taken that the plant be set as the pole grows. The cuttings should be from poles of about three years growth. Maiden poles are the best: they should be set three feet asunder in the quincunx order.

And those truncheons will shoot out many branches, two or three of which will grow to poles if the land be good; if not, only one. The poles have been sold at eight years growth, for 214l. per acre, net money; the *kids* or brushwood pay for the felling. Had they been suffered to have stood two years longer they would have produced 300l. per acre. Should any of the plants look weak or puny, or not shoot vigorously, it will be necessary to dig in a skuttle full of manure to the roots, which will pay the proprietor well for the business. What the value per acre would have been had they remained on the ground for fifteen or twenty years, has not been ascertained by the writer having been called on for sets by the gentlemen of the neighbourhood, which he has sold for three pounds a thousand. The plantations should be carefully fenced in, as without care in this respect no advantage can be obtained. All the other sorts may be raised from cuttings which should be set out in the autumn or winter, being made from the last year's wood or shoots.

WILLOWEED, a name provincially applied to smart-weed, or persicaria, which is a troublesome weed.

WIND, a violent motion of the air, produced by its rarefraction being greater in one place than another, or any other cause.

After making various observations on the nature and theory of winds, which are yet very imperfectly understood, Dr. Darwin recapitulates his opinions in the following manner. 1. The "*north-east wind* consists of air flowing from the north where it seems to be occasionally produced: has an apparent direction from the east, owing to its not having acquired in its journey the increasing velocity of the earth's surface; these winds are analagous to the trade winds between the tropics, and frequently continue in the vernal months for four or six weeks together, with a high barometer, and fair and frosty weather. 2. They sometimes consist of south-west air, which had passed by us or over us, driven back by a new accumulation of air in the north. They continue but a day or two, and are attended with rain."

The "*south-west wind* consists of air flowing from the south, and seems occasionally absorbed at its arrival to the more northern latitudes. It has a real direction from the west, owing to its not having lost in its journey, the greater velocity it had acquired from the earth's surface from whence it came. These winds are analogous to the monsoons between the tropics, and frequently continue for four or six weeks together, with a low barometer, and rainy weather. 2. They sometimes consist of north-east air, which had passed by us, which becomes retrograde by a commencing deficiency of air in the north. These winds continue but a day or two, attended with severe frost, with a sinking barometer; their cold being increased by their expansion as they return into an incipient vacancy."

The *north-west wind* consists first of south-west winds which have passed over, been bent down, and driven back towards the south by newly generated northern air. They continue but a day or two, and are attended with rain or clouds. 2. They consist of north-east winds bent down from the higher parts of the atmosphere, and having there acquired a greater velocity from the earth's surface, are frosty and fair. 3. They consist of north-east winds formed into a vertical eddy, not a spiral one with frost or fair."

The "*north winds* consist first of air flowing slowly from the north, so that they acquire the velocity of the earth's surface as they approach, are fair or frosty, seldom occur. 2. They consist of retrograde south winds, these continue but a day or two, are pre-

ceded by south-west winds, and are generally succeeded by north-east winds, cloudy or rainy weather, the barometer rising."

The "*south winds* consist first of air slowly flowing from the south, losing their previous westerly velocity by the friction of the earth's surface as they approach; moist seldom occur. 2. They consist of retrograde north winds, these continue but a day or two, and are preceded by north-east winds, and are generally succeeded by south-west winds, colder barometer sinking.

The *east winds* consist of air brought hastily from the north, and not impelled farther southward, owing to a sudden beginning absorption of air in the northern regions, are very cold, barometer high, generally succeeded by south-west wind."

The "*west winds* consist of air brought hastily from the south, and cheked from proceeding farther to the north by a beginning production of air, in the northern regions, warm and moist, generally succeeded by north-east wind. 2. They consist of air bent downwards from the higher regions of the atmosphere; if this air be from the South, and brought hastily, it becomes a wind of great velocity, moving perhaps 60 miles in an hour, is warm and rainy; if it consist of northern air bent down it is of less velocity, and cooler."

Various other interesting remarks and reflections on this curious subject may be seen in the notes to the Botanic Garden.

The ingenious author of the original Survey of Middlesex has stated that "The winds from the *south-west* to *north-west* and from *south east* to *north east*, are the most prevalent in that district."

But Mr. Middleton observes that "this passage would correspond more with his own observations, if it stood thus: the winds from *south-west* to *west* and from *east* to *north-east*, are the most usual, as he thinks they prevail ten months in every year.

"Winds blowing from every point of the compass, between the *west*, *north-west*, and *north*, are, he says, so very dry as not to produce a day's rain in a year, though he has observed, as an uncommon circumstance, small rain for two or three hours from the north-west. An east wind is, he says, always dry, generally with black clouds, and the same from the other points, till the wind gets about to or near the North-east, which with a few points on either side of the North east, most frequently brings the like dry black cloudy, but sometimes gentle rain, for a day or two.

"When the wind veers from the north, through the west, it continues dry till it passes the south-west, from which point, to the south, it almost certainly brings rain; but it seldom stops there a day, but returns to the same point; and when it passes southward through the eastern points, all is perfectly dry till it reaches about the south-east. The atmosphere then begins to give the appearance of rain. The wind, however, seldom rests there, but veers to the south, and from that quarter, and a few points more westerly, we receive the greatest rains."

It is added that "during the spring months the wind frequently blows warm and steadily from the south-west for near a fortnight; in a few hours it changes to the opposite point, or the north-east, and blows a steady cold gale for about another fortnight. This is repeated very often in the course of the year. The former winds induce people to leave off their winter clothing, the latter take them by surprize, thus thinly clothed, and is the cause, he thinks, that many diseases at that time prevail."

He further states that "the westerly winds blow over the great Atlantic ocean, passing, before they reach London over part of Great Britain for about 200 miles, and over Ireland when they veer to the North. They are generally moist, although much drier than when they arrive at the west coast of the island. They are commonly most prevalent in February, September, November, and December. The Easterly winds blow over the large continent of Europe; they are always dry, they are most prevalent in January, March, and the beginning of April. They are cold except sometimes when they prevail in July and August, while the westerly winds are almost always warm except in November, if they verge to the north."

A greater number of facts are wanting to render the subject of winds clear and intelligible, as well as to show the manner in which they are connected with the nature of the weather in respect to moisture or dryness.

Wind, in *Farriery*, a disease in sheep of a very dangerous kind. It is observed in the Shepherd's Guide, that "the sheep, immediately after being shorn, appear to be in violent pain, their sides are somewhat extended, and their breathing very short, the head is hung drooping, and they have a great aversion to moving or walking. These symptoms continue to increase until the sheep dies, in a very few hours, unless a violent purging comes on, which generally gives immediate relief. On inquiring for the name, the writer says, he found it was called the *wind*, but where the seat of it lay few could tell him; some thought it was in the head, others in the lungs, and the remedies they applied were as various as their opinions of the disease."

"Not satisfied with these accounts he endeavoured, by inspecting the carcasses of sheep that died of the disease, to discover the cause and seat of the complaint. On opening four sheep that died of the disease he found all the intestines rather distended with flatus, but not in any great degree. Their blood-vessels were very turgid, and of a deep red, particularly those of the large intestines, excepting the rectum, or what is called the *bum-gut*, which had a healthy appearance, as likewise had the *stomach*, *milt*, *caul*, *liver*, *heart*, *lungs*, and in short all the viscera contained in the cavity of the trunk. From these appearances he will venture to say that the disease in question is a violent inflammation of the intestines, perhaps in some measure arising from bruises in shearing, but more so from losing a warm clothing, and being suddenly exposed to cold air and to cold feeding."

He therefore recommends to farmers, that "on the first appearances of the complaint they put the sheep into a stable or other warm place, and immediately bleed it freely. Bruise a quarter of an ounce of some carminative seed, such as carraway, anise,

cummin or fennel, and mix these with two ounces of Glauber's purging salts, in a pint of water; place it on a fire and make it boil for a few minutes, then strain it off. Then add a quarter of an ounce of powdered jalap, and while luke warm give the sheep a quarter of a pint of this liquor, well shaken together every half hour till it dungs. It should have no food or cold water till recovered, but a little warm water might be of service."

This disorder is in general so suddenly fatal that recourse should be instantly had to any remedy that may have been found beneficial; but bleeding is probably that on which the greatest dependence may be placed.

WIND, the name of a winch or wince in some places.

WIND, in *Horsemanship*, another name for the breath, or rather for the power with which the lungs are endowed in the exercise of their functions. See *Broken-Wind*.

WIND-GALL, in *Farriery*, a puffy kind of swelling or tumour, which yields to the pressure of the finger, but upon removing the pressure recovers itself and pushes out as before. They have been thus named from a false notion of their containing nothing but air, or wind. These tumours are often seated on both sides of the back-sinew of a horse, above the fetlock on the fore-legs, but most frequently on the hind-legs. They are quite loose and detached from the parts on which they grow, and exhibit the same signs wherever they are met with, whether in the hocks or about the knees; for these swellings are not confined to the lower limbs only, but appear in any of those parts of a horse's body where the cellular membrane can be easily separated; and they exist, for the most part, without occasioning any pain. They are usually caused by riding on very hard roads, or on dry hilly grounds. Sometimes travelling horses, when they are worked too young, before the limbs are grown firm and vigorous, will have them. And Gibson says they sometimes proceed from constitutional weakness, especially in bulky horses, that are somewhat underlimbed and fleshy about the fetlock joint. These, he says, he has known to have wind-galls without any strain, hard riding, or other ill usage of any kind.

It is observed, that "when these tumours appear upon the hind-legs they never cause lameness, though such horses are often stiff behind after riding. When on the fore-legs they always make a horse go lame at first; but afterwards that tenderness goes off in a great measure, and they seldom go lame, but stiff, and inclinable to stumble. They generally recover, however, with a day's rest. Those flatulent swellings indeed that come in the ligaments of the hocks are always troublesome, disfigure the animal, and, unless speedily assisted, will cause incurable lameness. At first they are but small, but in time they grow to the size of a pullet's egg, perhaps, and push out on each side of the hollow of the hock. Swellings of the same kind also appear above the knee, where they often precede a diseased joint. Very small similar swellings under the fore part of the knee, in the interstices of both sides of the joint, are also dangerous; but these seldom happen, and are usually caused by some violent strain, especially when a horse falls down upon a descent with his whole weight upon his knees. The other flatulent swellings which horses are subject to seldom cause lameness, but are, for the most part easily cured. We mean those that arise in the interstices of the large muscles of the hips and thighs, which are distended like little bladders filled with air. These come by strains and over exertion; for draught-horses are the most subject to them of all others."

Wind-galls that proceed from mere weakness are seldom curable, unless the constitution can be improved; but we often see horses that were subject to wind-galls when young, get the better of them as they advance in age. The methods of cure in these cases is by means of blistering, firing, and the use of astringent applications.

WINDER, provincially to clean corn with a fan-machine.

WINDLESTRAWS, a term applied to the naked stems of the crested dogs-tail, and other natural grasses.

WIND-ROW, a term signifying the green parts, or borders of a field, dug up, in order to carry the earth on other land to mend it; so called because it is laid in rows, and exposed to the wind. It also signifies a row of peats set up to dry. Likewise a row of hay exposed to get dry. And also of turfs cut up in paring and burning.

WINE, a general name given to any brisk, agreeable, cordial liquor, drawn from vegetable substances, and fermented, but especially that procured from the juice of the grape.

It is well observed by Dr. Thomson in his excellent System of Chemistry that "there is a considerable number of ripe fruits from which a sweet liquor may be expressed, having at the same time a certain degree of acidity: of such fruits we have in this country, the apple, the cherry, the gooseberry, the currant, &c. but by far the most valuable of these fruits is the *grape*, which grows luxuriantly in the southern parts of Europe." That from these when "fully ripe, may be expressed a liquid of a sweet taste, to which the name of *must* has been given. This liquid is, he says, composed almost entirely of five ingredients namely, *water*, *sugar*, *jelly*, *gluten*, and tartaric acid partly saturated with pot-ash." And that "the quantity of sugar which grapes fully ripe contain is very considerable; and which may be obtained, he says, in crystals, by evaporating must to the consistence of syrup, separating the tartar which precipitates during the evaporation, and then setting the must aside for some months. The crystals of sugar are gradually formed." It is added that "from a French pint of must the Marquis de Buillon extracted half an ounce (French) of sugar and $\frac{1}{16}$ ounce of tartar." And that "according to Proust, the Muscadine grape contains about 30 *per cent.* of a peculiar species of sugar."

With regard to the manner in which it undergoes the vinous fermentation, it is remarked that "when the must is put into the temperature

of about 70°, the different ingredients begin to act upon each other, and what is called the *vinous fermentation* commences. The phenomena of this fermentation are an intestine motion in the liquid; it becomes thick and muddy, its temperature increases, and carbonic acid gas is evolved. In short, the very same changes take place as in the fermentation of ale. In a few days the fermentation ceases, the thick part subsides to the bottom or rises to the surface, the liquid becomes clear, it has lost its saccharine taste and assumes a new one; its specific gravity is diminished, and it has become the liquid well known under the name *wine*."

It is stated that "as this fermentation takes place without adding any ferment, it is obvious that the requisite substance is present in the juice. This substance was separated and found by Fabroni to be analogous to the gluten of plants; and gluten being substituted for it, the fermentation succeeded." This writer "has, the Dr. says, shown that the saccharine part of must resides in the cells of the grapes. Hence it follows that in the fruit these two substances are not in contact. It is only after the juice is squeezed out that they are mixed. All other juices which undergo a spontaneous fermentation at the requisite temperature, have been shown by Theward and Sequin to contain a similar substance of the juice, precisely as happens in the fermentation of ale."

Further, that "all those juices of fruits which undergo the vinous fermentation, either with or without the addition of sugar, contain an acid. And that the vegetable acids are obtained chiefly from fruits. The apple, for instance, contains malic acid; the lemon, citric acid, the grape, tartaric and malic acids. The Marquis de Buillon has ascertained, the Doctor observes, that must will not ferment if all the tartar which it contains be separated from it; but it ferments perfectly well on restoring that salt." And that "the same chemist ascertained that the strength of wine is considerably increased by adding tartar and sugar to the must. We may conclude from these facts, Dr. Thomson says, that the presence of a vegetable acid is of importance in these spontaneous fermentations." That it deserves notice, that "Buillon obtained more tartar from verjuice than from wine, and he observed, that the more the proportion of sugar in grapes increased, the more that of tartar diminished."

In fact, he thinks that it seems more than probable from the experiments of Buillon and Chaptal that "the tartaric acid is partly decomposed during the fermentation, and that a portion of malic acid is formed. The process, therefore, is more complicated than was suspected by Lavoisier. It is obviously, he supposes, analogous to combustion, as is evident from the evolution of caloric and the formation of carbonic acid, which is a production of combustion. Proust, the Doctor says, has ascertained, that, during the fermentation, not only carbonic acid but azotic gas also is disengaged. This is a demonstration that all the constituents of must are concerned; for sugar does not contain that principle. Thenard could detect no azotic gas in the carbonic acid from wort."

The Dr. concludes by observing, that "after the fermentation has ceased the liquor is put into casks, where the remainder of the sugar is decomposed by a slow fermentation: after which the wine is decanted off, and the extractive matter is put up in bottles," to be perserved for use.

In regard to the properties of wine, it is stated that they "differ very much from each other, according to the nature of the grapes from which the must was extracted, and according to the manner in which the process was conducted. These differences are too well known to require a particular description. But all wines contain less or more of the following ingredients, not to mention water which constitutes a very great proportion of every wine."

It is remarked, that as "all wines give a red colour to paper stained with turnsole, they of course contain an acid. Chaptal has ascertained that the acid found in greatest abundance in wine is the malic, but he found traces also of nitric acid, and it is probable that wine is never entirely destitute of tartar. All wines which have the property of frothing when poured into a glass contain also carbonic acid, to which they owe their briskness. This is the case with champagne. These wines are usually weak; their fermentation proceeds slowly, and they are put up in close vessels before it be over. Hence they retain the last portions of carbonic acid that have been evolved."

Further, that "all wine contains less or more of the alcohol principle to which it is indebted for its strength, but in what particular state of combination it exists in wine cannot easily be ascertained. It is undoubtedly intimately combined with the other component parts of wine; as Fabroni has shown that it cannot be separated by saturating the wine with dry carbonate of pot-ash, though a very small portion of alcohol, added on purpose to wine, may be easily separated by means of that salt. But if alcohol separates along with the carbonic acid, during the fermentation, we can scarcely doubt that it has been formed. When wine is distilled the alcohol readily separates. The distillation is usually continued as long as the liquid which comes over is inflammable. The quantity obtained varies according to the wine distilled. The spirit thus obtained is well known under the name of *brandy*." It is remarked, that "Buillon has observed, that when wine is distilled new it yields more alcohol than if it be allowed to get old. What remains after this distillation in France is known by the name of *vinasse*. It consists of tartar, &c. &c. and when evaporated to dryness, and subjected to combustion, yields pot-ash."

It is likewise added that "*extractive matter* exists in all wines; but its proportion diminishes according to the age of the wine, as it gradually precipitates to the bottom." And that "every wine is distinguished by a peculiar flavour and odour, which probably depend upon the presence of a *volatile oil*, so small in quantity that it cannot be separated." Further that "the *colouring matter* of wine is originally contained in the husk of the grape, and is not dissolved till the alcohol be developed. This matter

is analogous to the othercolouring matters of plants;" a set of bodies possessed of remarkable properties, but which have yet been too little examined. "This colouring matter precipitates when the wine is exposed to the heat of the sun. It sometimes also precipitates in old wine, and it may be easily separated by pouring lime-water into wine."

These are some of the most interesting facts and circumstances respecting the process of making, as well as the nature and properties of wine.

In regard to the method of procuring wine from the grapes of this country, it is thus described as having been practised by a very intelligent cultivator of that fruit in this climate, by Mr. Speechley in his Treatise on the Culture of the Vine.

In Mr. Hamilton's trials, after many years experience, he says, the best method he found of making and managing white or champaign wine was this: "he let the grapes hang till they had got all the maturity the season would give them: then they were carefully cut off the vines with scissors, and brought home to the wine-barn, in small quantities to prevent their heating, or pressing one another; then they were all picked off the stalks, and all the mouldy or green ones, were discarded before they were put upon the press, where they were all pressed, in a few hours after they were gathered, much would run from them before the press squeezed them, from their own weight one upon another. This running was as clear as water, and as sweet as sirrup, and all this of the first pressing and part of the second continued white; the other pressings grew reddish and were not mixed with the rest. As fast as the wine ran from the press into a large receiver, it was put into the hogsheads, and closely bunged up. In a few hours one could hear the fermentation begin, which would soon burst the casks, if not guarded against, by hooping them strongly with iron, and securing them in strong wooden frames, and the heads with wedges. In the height of fermentation he has frequently seen the wine oozing through the pores of the staves. These hogsheads were left all the depth of winter in the cool barn to reap the benefit of the frosts, when the fermentation was over, which was easily discovered by the cessation of noise and oozing; but to be more certain, by piercing the cask; when it would be quite clear, then it was racked off into clean hogsheads, and carried to the vaults, before any warmth of weather could raise a second fermentation. In March, the hogsheads were examined; if any were not quite fine they were fined down with common fish-glue, in the usual manner those that were fine of themselves; were not fined down, and all were bottled about the end of March; and in about six weeks more would be in perfect order for drinking, and would be in their prime for above one year; but the second year the flavour and sweetness would abate, and would gradually decline till at last it lost all flavour and sweetness; and some that he kept sixteen years became so like *old hock*, that it might pass for such to one that was not a perfect connoiseur. The only art he ever used to it was putting three pounds of white sugar-candy to some of the hogsheads, when the wine was first turned from the press, in order to conform to a rage that prevailed to drink none but very sweet *champaign*. He is convinced much good wine might be made in many parts of the south of England. As many parts are south of his situation, many soils may be yet fitter for it, and many situations must be so; as his was much exposed to the south-west wind, (the worst of all for vines) and the declivity was rather too steep; yet with these disadvantages it succeeded many years. Indeed, the uncertainty of our climate is against it, and many fine crops have been spoiled by May frosts and wet summers; but one good year, he remarks, balances many disappointments. It is therefore conceived that in the making of wine in this country, the prospect of success, even from the first trial seems almost certain, if the business is conducted by the above rules, and recourse is had to the assistance of a person well versed in the mechanic operations of the process: nor is it improbable but that this country may be supplied with native wines, very superior to those which are now imported from foreign countries."

A similar management in the making of vinous liquors wine from other sorts of fruit may probably succeed in affording much better wines than have been commonly produced in this country.

WINTER, the cold inclement season of the year, in which the live stock of the farmer demands particular attention, especially in respect to food, litter, and other management.

WINTER-*Corn*, such as is to stand the winter season, as wheat, &c.

WINTER-*Crops*, such as are capable of withstanding that season, or of being converted to the use of food for animals at that period of the year.

WINTER-*Evenings*, the long evenings of that season. Mr. Young advises, that "on the winter evenings all sorts of work for the next day should be arranged, whether for a fine or a rainy day, and the farm book, be made up for the transactions of the past day. Besides these the farmer should have another book for miscellaneous observations, queries, speculations and calculations, for turning and comparing different ways of effecting the same object, for estimates of the different kinds of food, he may have it in his power to give to the same cattle; with all such inquiries, doubts, or propositions, worth attention, as he may have heard in conversation. Loose pieces of papers are generally lost after a time, so that when a man wants to turn to them to examine a subject formerly estimated or discussed, he loses more time in searching for a memorandum, than would be sufficient for making half a dozen new ones; but if such matters are entered in a book, he easily finds what he wants, and his knowledge will be in a much clearer progression, by recurring to former ideas and experience." It is added that "formerly farmers never read books of husbandry: many do read them now; and there are few that will not furnish very valuable hints. These should be noted, that when an occasion offers use may be made of them. Such an employment of a winter evening, is a very different one from spend-

ing it at a public-house in the same company over and over again, which after a time becomes a pump, he says, that yields no water."

WINTER-*Fallows*, such lands as are laid up to fallow in that season.

WINTER-*Food*, such as is made use of at that period or season of the year. As various kinds of roots, hay, straw, and some sorts of green vegetables.

WINTER-*Proud*, a term provincially applied to such wheat as in winter puts on a more green and luxuriant appearance than it is able to support in the following summer, or in which the ramifications become too numerous to be supported, or brought to maturity, from the previous over exertion of the soil. In these cases the crops decline during the spring and summer, and at harvest yield imperfectly, falling much below such crops as had a more backward appearance in the winter.

WINTER-*Rig*, a term signifying to fallow or till the land in the winter season.

WINTER-*Tares*, that species or variety of tare which is capable of standing the severity of the winter season; or which is used in winter.

WINTER-*Weed*, a term applied to the ivy-leaved speed-well, which is a troublesome weed.

WIRE-HEELS, in *Farriery*, is a defect in the form of the heels of horses. According to Gibson, "narrow heels, are for the most part a natural defect, but they are often rendered incurable by bad shoeing. Some farriers hollow the quarters so deep and so thin, he says, that one may pinch them in with one's fingers, and think by that means to widen them out by a strong broad-webbed shoe; but this turns them narrow above and *wires their heels*, and dries up or rots the frog. The best way in all such cases is not to hollow the foot in shoeing, and to pare nothing out but what is rotten or foul. If the foot be hard or dry, or inclined to be ragged, bathe it often with chamber-lye; or, boil two pounds of linseed bruised in two quarts of chamber-lye to the consistence of a poultice, then add to it six ounces of soft soap, and anoint the foot with it every day, rubbing a little of it upon the sole; or,

Take of Bees-wax, two ounces;
Hogs lard, six ounces;
Tar, one ounce;
Linseed oil, as much as will make it into the consistence of a smooth ointment. Mix.

"This may be used daily in the same manner as the foregoing."

WIRE-WORM, the name of a most mischievous worm in wheat crops. It has been described in the Swedish Transactions by Class. Bierkander as having in the grub state a yellow colour, with the head brown and the extremities of the jaws black; the body constituted of twelve joints, shining, and hard skinned; when it changes its skin it is for some time white; a few hairs are scattered here and there, but mostly upon the head and last joint; under the three first joints are six horny and pointed feet, and at the beginning of the last joint, which is round, there are two black spots, one on each side, which are probably, apertures through which it breathes.

The *pupa* is white, three lines long, eyes black, over which are two brown horns; the breast is smooth and round, antennæ moniliform; the belly has ten joints, the last of which is furnished with two fine points in the corners.

Elater segetis; the whole body black; the antennæ brown, and the length of the breast. The *elacræ* have longitudinally black and brown lines. Feet black, with the last joint brown.

After having, the writer says, fed these worms with corn roots in jars for five years, some of them at length, this year, in the month of July became *pupa*, from which, about the tenth of August the *elater* appeared in its perfect state. This length of time before they undergo a change was the reason why they were not described with the other root-worms.

These worms are destructive to barley and oats, attacking them in the spring and autumn. It has been often observed that a single worm has bitten from 8, 12, to 20 stalks in one place; when one destroys so much, what may not thousands do? They object most to low places, for which reason the greatest damage is done in the ridges. In a square ell, of four square feet, turned with a spade in some fields 4, 6 to 8 worms have been found.

It is remarked, that while the fields lie fallow they subsist on grass and other vegetables, from which, it is evident, that their increase is encouraged when the fallows are not taken care of, when couch and other sorts of grass grow in them, and when there are many and large plots of grass in the fields. As they are more than one year in reaching maturity, some are a line long, some half grown, and others full grown and ready to undergo their change; it is, therefore, more than one year that each worm has an opportunity of destroying the corn in the blade.

It is observed by Mr. Young, in the Essex Report, that "the ravages of the wire-worm in the country about Burnham form a very serious evil; he found on Mr. Wakefield's farm great mischief done by them: large patches of wheat crops destroyed, and acres that should be cole quite bare. That gentleman has very heavy stone rollers, which he uses as a preventive and a cure, but thinks that good trampling is more effective, and with this view sows cole seed largely on fallows where wheat is intended, which he feeds off for the purpose of consolidating the soil. He cannot observe that the worm depends at all on the course of crops, but some fields are much more subject than others. Rock or sea gulls, give no security, for here are 1000, and they will follow close at the ploughman's heels. Heavy rolling good, and he has a four-horse stone roller on that account, but he never saw a crop saved entirely when once they began with it. As treading and trampling are certainly beneficial, and whatever keeps land in a consolidated state, he thinks the whole furrow of clover leys and feeding green crops (as cole before winter) on the fallows, the most beneficial preventive. They are rarely found on strong land.

"In Foulness they have the worm on new broken up land, but not very common in old tillage. And that the strong loams on tile clay at Sandon, are very

subject to the wire-worm. Mr. Tweed also finds heavy rolling beneficial against them. And "on the strong and rich loams and clays of Little Oakley, the Rev. Mr. Scott has found the treading of sheep excellent against it. It abounds even in crops that were fallowed for; a flock of sheep broke into a field of fallowed barley, and trod a part of it very much, in that part no worm appeared, but many in the rest of the field. Mr. Hitchen of Burnham, remarked that where cole is seeded there the worm is greatly checked; and he further observed, that where hedge-row earth is carted on to the land there the worm most abounds."

It is added that "Mr. Barrington, near Rochford, is much plagued with this insect on the lighter soils; much harrowing and rolling, and at last rolling down with a heavy stone roller drawn by four horses, is the system adopted by him to prevent or check its ravages."

It is further stated, that "Mr. Wright of Rochford-hall has also suffered dreadfully by the prevalence of this pernicious insect, and he has paid of course much attention to the means of prevention and cure. Stone rolling is the principal reliance; he has a roller that weighs two tons, and drawn by six horses, which he uses regularly. In sowing spring corn he rolls it immediately, and even does half a field across, not to wait for finishing, and for wheat also in the same manner, though it is not so injurious to wheat as it is to spring corn. When he has seen wheat in November attacked by it he has carted and spread turnips, eating them with sheep on the wheat, and this has proved effective."

They have plenty of rooks but find no security in them.

Mr. Young remarks that "in various parts of the kingdom the notion is, that clover and other leys breed the worm much more than land in tilth, but here they abound much more in spring corn sown on fallows, and no where are fallows better made. Mr. Wright had a field of wheat sown early, that made a beautiful appearance through February, but it was attacked in March without his suspecting the worm. Riding over it he found the surface slightly bound, (called here being *capt*) and his horse's feet sinking through the hollowness left by frosts, he discovered the enemy. He stone-rolled it immediately, and the wheat which had been at a stand, recovered directly and grew rapidly; but this sudden luxuriance after the check from the worm was mischievous in another respect, as the whole was mildewed. He has had turnips and cole eaten even after hoeing, and Swedish turnips are particularly subject to it. Inquiring if potatoes had any effect in clearing land, by acting as an attraction to them? Not at all, he replied, for he had had the worm in oats after them. Deeper ploughing than common rather encourages them; a field that had been ploughed very deeply, being sown with oats, they were so eaten, that he ploughed up the crop and sowed them again; and a neighbour who had for ten years ploughed deeper than common, left off the practice, as he thought that it increased both weeds and worms. Mr. Wright some years ago, ploughed up a wheat stubble in December, and leaving it till oat sowing, put them in without any more tillage, these oats were also severely attacked. He did the same for four acres of barley, here he escaped and the crop was good. The ravages of the insect may be conceived from Mr. Wright having from this fine soil, capable of yielding ten or twelve quarters of oats per acre, threshed only 29 quarters of oats from 22 acres drilled, after cole on a fallow, manured and sheep fed, and notwithstanding the oats came up beautifully."

And it is added, that "Mr. Prentice of Prittlewell is troubled sometimes with this worm, but not much; he stone-rolls for it, but driving bullocks and other cattle and sheep is the best remedy, as the more the land is trodden and pressed the better. He has before Christmas found the rolling had been insufficient, and drove sheep and bullocks, and thus effected the cure."

"Sometimes he has dibbled in fresh seed on the eaten spots. The land at Prittlewell so nearly resembling Rochford-hall; and Mr. Prentice more generally taking turnips or cole on the fallows than Mr. Wright, whose great complaint is in the spring corn, seems to afford a suspicion that a crop is a better preventive than a fallow, not by treading as the crop is taken off, but by a much more impeded system of tillage; the looser and more frothy the soil the more is the worm harboured."

The writer remarks, that "Mr. Parsons, of North Shoebury, finds the worm more in clover-ley wheat than in that following beans. It attacks the oats as soon as they are up. The stone-roller which he uses against it weighs a ton and a half, and is drawn by four horses. He rolled 200 acres last spring. He sows three bushels of wheat on account of the worm."

But "Mr. Knapping of Shoebury, who has been much injured by the wire-worm, has rolled for it so often in vain that he is tired of trusting to that method; he thinks hoeing the wheat the best remedy. Last year he had nineteen acres of fine wheat eaten up by them in Foulness Island; but for oats he rolls; driving sheep for treading better than rolling, and sheep better than beasts. Folding sheep would knead too much, so that the wheat might not get through.

"Dr. Asplin, at Little Wakering, informed him that the wire-worm is very mischievous; stone rolling the remedy, with three horses on sowing, and with four in marsh, as soon as the land is dry enough. His father finding a crop attacked, mustered all the horses he could collect, and had them led in strings on the wheat backwards and forwards, and it answered well. Sheep and sometimes oxen are driven for the same purpose. He has had less wire-worms after cole that was seeded than usual, even in a field very subject to it. The seed-earth upon a fallow (five ploughings) he gives as thin as possible, *because the less stirred the less worm.* The bean stubbles they plough but once for wheat; it was the practice to *case* them, but they left it off for the same reason. All this affords some reason to think that a journey to Suffolk would answer well to the farmers of this county, to learn to put crops in without any seed-earth at all."

It is further added "Mr. Thomas Pitman of Bar-

king, has been much more troubled with this worm in his wheats after clover than in those after potatoes: rolls for it with a two-horse roller, but trampling the land with sheep, or horses, or cows, or bullocks, better far than any thing, and beats all the rolling that can be given; seventeen acres that were much attacked was part of it, much trampled in hunting, insomuch that it was thought to be greatly damaged, but there the wire-worm was so checked that the crop was good, the rest of the field much damaged."

And that "Mr. Coverdale of Ingatestone, has found that sowing cole on fallows, and feeding it off for barley or oats, is a preventative against the worm. He summer fallowed a field for barley, and the crop was entirely eaten; he then fallowed and manured, and sowed cole, which is very fine for a late sown crop. He has found rolling the wheat down immediately after the ravages of this insect, beneficial, and equally useful against the effectsof frosts, laying bare the roots in which case so many plants are apt to die. He had a crop of barley on a fallow, which was so attacked by the worm that it was plain it would destroy the whole; he hoed it thoroughly and saved the crop."

"Mr. Cooper of Langenhoe, is also troubled with the wire-worm, especially in wheat upon fallows, but not on clover, there theslug is apt to abound: against the former he rolls heavily, and then hand-hoes well, which are the best remedies.

"They are also sometimes troubled with this worm in Mersea, and it is an inducement with Mr. Bennet Hawes for dibbling wheat, as the treading is some security against it, and he uses this also as an argument for feeding clover."

It is supposed by some, notwithstanding the general opinions of farmers, that the disease of wheat crops, which has been ascribed to this insect, depends upon some fault in the ploughing by which the land is left in too open and porous a condition, by which the young plants are prevented from being fully nourished, and of course from forming its roots in a proper manner in the ground.

And this idea is in some degree supported from the circumstance of the benefit which is afforded by treading and rolling.

It has been shown by various trials that the wire worm is an insect not easily destroyed being extremely tenacious of life.

WIRING, in *Farriery*, the operation of putting a sharp-pointed wire up the nostrils of a sheep, so as to pass into the brain, and produce a discharge in cases of the turn gid or vertigo. It seems, however, a dangerous remedy, though it is said to have been successful in curing the disease.

WISP, a term signifying a small bunch of straw which is used in rubbing horses down; it is also sometimes applied to a rowel or seaton.

WITHERS, in *Horsemanship*, the part which begins where the mane ends, being joined to, and ending at, the tip of the shoulder blades. The withers, are parts which when well raised, are reckoned a sign of strength and goodness in horses. They keep the saddle from coming forward upon the horse's shoulders and neck, which otherwise would gall him, and a hurt in that part is very difficult to cure. The withers should not be too fleshy, for then they will be more subject to be galled. The treatment of bruises in the withers, which frequently imposthumate, and, for want of proper care, become fistulous is described under the head *Fistula*. See *Fistula*.

All pinches of the saddle on the withers, should be treated with discutient remedies; for this purpose bathe the tumour well with hot vinegar three or four times a day: if that does not succeed alone, an ounce of oil of vitriol may be put to a quart of vinegar, or half an ounce of white vitriol dissolved in a little water, and added to the same quantity. These are generally very effectual repellers for this purpose in horses, and will frequently prevent imposthumation: when the swelling is attended with heat, smarting, and little watery pimples, the following mixture will be more proper to bathe with:

> Take two ounces of crude sal ammoniac, boiled in a quart of lime-water; where that cannot be had, a handful of pearl or wood-ashes may be boiled in common water; pour off the decoction when settled, and mix with it half a pint of spirit of wine: anoint the part afterwards with linseed oil, or elder ointment, to soften and smoothe the skin. See *Fistula*.

WITHER-*Band*, in *Horsemanship*, a band or piece of iron, laid underneath a saddle, about four fingers above the withers of the horse, to keep tight the two pieces of wood that form the bow.

WITHY-CRAGGED, in *Farriery*. See *Strain*.

WITH-WINE, a term provincially signifying couch. See *Bind-weed*.

WITHY, a term sometimes applied to the willow.

WIZZARD, a term applied in Norfolk, to a particular sort of cart.

WIZZENED, provincially applied to signify withered or shrivelled.

WOAD, the name of a plant, cultivated for the use of the dyers.

It is a plant which has a strong thickish fibrous root, which penetrates deep into the soil, and which is principally raised for the use of the leaves, which, after being properly manufactured, are made use of in the art of dyeing to produce a blue colour, as well as the basis of black and some others.

It is evident from the nature of its root that it requires a soil which has much depth or staple, and which is perfectly fresh, such as those of the rich, mellow, loamy, and deep vegetable kind. Where this culture is carried to a considerable degree of perfection as in Lincolnshire, the deep, rich, putrid, alluvial soils on the flat tracts extending upon the borders of the large rivers are chiefly employed for the growth of this sort of crop; and it has been shown by repeated trials that it answers most perfectly when they are broken up from a state of sward immediately for it. In some places it is the practice to take lands of this description at high prices, for the purpose of breaking them up and growing it

upon them for two or three years;—on the more low rich soils, for four years, but on those of less fertility only for three; and in some which are more elevated and exposed two is considered sufficient. For this sort of culture, people are employed who move from place to place and form a sort of colony. Mr. Cartwright in the above county has however found that it is capable of being confined to one spot with equal or greater success, by having a sufficient extent of ground, for changing the place of its growth as may be necessary, and for appropriating an adequate proportion annually to the raising of the plant, by which the houses and expensive machinery that are necessary for its preparation may be kept constantly and regularly employed in the business.

In order to prepare the land for this crop it is advised by some to plough it up with a good deep furrow, immediately before the winter commences, laying it in high narrow ridges to have the full effect of the frosts; and early in the spring to give another ploughing in the contrary direction, leaving the ground in the same kind of ridge as before. When it has remained in this state some length of time and weeds appear, it should be well harrowed down with a heavy harrow, repeating the operation so as to render it perfectly fine and clean. About the beginning of June a third ploughing should be given to the full depth with a narrow furrow, and the land afterwards well harrowed down as before the fourth or final ploughing, being given towards the beginning of July in a light manner, leaving the surface as even as possible for the seed. But some take much less trouble in the business of preparation. In cases where the soils are sufficiently dry, only breaking them up early in the month of February; and where the contrary is the case, deferring it to a later period, taking care to plough the land in a perfect manner to the depth of five inches or more. And that the furrow-slices may be well turned, laid flat, and nicely jointed, a person is employed with a spade for the purpose of adjusting them. This prevents the grassy matters from rising in the seams. When this has been done the surface is repeatedly harrowed over, to raise a sufficient depth of good mould for the drill to work in; and before the seed is put in a roller is passed over the land.

It is probable however, that this method is inferior to the former, as the land is not brought nearly to so fine a state of mould, or the grassy material so effectually covered and destroyed, from which injury may be done to the woad plants in their early growth.

But a method which is equally effectual with the first, more expeditious, and which has a superiority over it in more completely destroying grubs, insects, and other vermin, which are apt to feed on the plants in their early growth, is that of paring and burning. This is, however, chiefly practised where the sward is rough and abounds with rushes, sedge, and other plants of the coarse kind, but might be had recourse to on others, with vast benefit.

Where the latter modes are made use of, as soon as the seed has been put in, the land should be carefully drained by forming grips in suitable directions, as wherever water stagnates the woad plants are liable to be injured or destroyed.

In respect to the seed it should be collected from ground that has been left covered with the best plants from the preceding season, as they only run up to stem and form seeds in the second year. And in order to have good seed the leaves should not be cropped at all or but once, the stems being suffered to remain till the seeds in the husks become perfectly ripened: which is shown by their attaining a brownish yellow colour, and the pods having a dark blackish appearance. It should then be gathered as soon as possible, by reaping the stems in the manner of grain, and then spreading them in rows thinly upon the ground if the weather be fine, when in the course of a few days they will be in a state to be threshed out from the husks or pods. When they are suffered to remain too long, the pods are liable to open, and shed the seed. Although the pod, in which the seeds are contained is of a large size, the seeds are less than those of the turnip. New seed where it can be procured, should always be sown in preference to such as has been kept for some time; but when of the latter kind, it should be steeped for some time before it is put into the ground.

In regard to the quantity of seed which is necessary, it must be regulated by the soil, and the manner in which it is sown. Where the drill is employed, less will be required than in the broad-cast method. It has been found that a rood of land, where the crop is good, will in general afford seed sufficient for eight or ten acres. And in some cases, in the broad-cast method, five or six bushels are made use of to the acre.

The time of sowing crops of this nature must be regulated in some degree, by the mode of preparation that has been employed. Where the first of the above methods has been followed, it will be much later than in the other cases. But early sowing is in general to be preferred, as there will be less danger of the plants being injured by the attacks of the fly or grub. Where the weather is suitable, and the land in a proper state of preparation, the seed may be sown in the latter end of February or March, continuing the sowings, in different portions of land, till about the middle of May, at suitable intervals of time to vary the times of cropping the leaves of the plants. The late sowings are commonly executed about the latter end of July, or early in the following month at the farthest.

With respect to the manner in which the seed is sown, it differs according to the nature and state of preparation of the land. Where it is in a fine state of mould, the drill, or row method, is the method mostly practised, which is by much the best, as by it the plants may be kept more easily clean and free from weeds, becoming more strong and vigorous from the earth being more stirred about the plants: but where the contrary is the case, the broadcast mode is generally followed; but which does not by any means admit of the plants being kept so free from weeds, or the mould so well stirred about the roots of them.

Where the first method is had recourse to, the seed is sown by a drilling machine such as is used for turnips, in equi-distant rows, eight or nine inches apart, covering it in, either by means of a harrow attached to the implement, or by passing a light common harrow over the ground afterwards once in a place, raking off any clods that may be present, to the sides, or into the furrows. But in the latter mode, it must be dispersed by the hand in as equal a manner as possible over the whole of the land, being then harrowed in by a light harrow, so as to leave the land in as even and level a state as possible. The ground is frequently rolled afterwards, that the surface may be left as even as possible.

In favourable seasons with good seed, the plants mostly appear in the course of a fortnight; when much attention should be paid to see that they are not destroyed by the turnip-fly, or the frosts in those of the more early sowings; as, where that is the case, the land should be immediately resown; as in some cases it is not uncommon to sow the greatest part of the crop two or three times over. In the very late sowings, where the crops rise thin on the ground, it is sometimes a practice to give a better plant by forming holes with a hoe in the vacant spots, and directing seeds to be dropped into them by the hand by women or children. This is the case with the late spring sowings till the beginning of June, or a later period.

From much of the goodness of the woad plants depending on the luxuriance of their growth, and the thickness of their leaves, it is necessary to bestow great attention in the culture of the crop while growing. It is advised that the spring sown crops, as well as those that are sown in the latter part of the summer, should have the first hoeings given them as soon as the plants are fully distinguishable above the ground, as by this means the weeds will not only be prevented from retarding the vegetation of the plants, but these by being thinned out to greater distances, be more at liberty to advance and become vigorous in their first or early growth, which is a matter of much consequence to the success of the crop. And second hoeings should be given in the course of four or five weeks afterwards, when the plants should be thinned out to the full distances at which they are to stand, which may be six or seven inches or more, according to the goodness of the soil, constantly leaving sufficient room to prevent the plants from being in any way crowded. The work is sometimes executed in much the same manner as for turnips, by hand-hoes; but in others by small short spuds, used with one hand, while the other is employed in clearing away the weeds; the labourers, mostly women and children kneeling while they perform the work. When this work has been done, nothing further is necessary till the first cropping of the leaves has been performed, when the plants should be again immediately well weeded; and after each cropping the same operation be had recourse to; the extent of crop cleared in the day being, in most cases, weeded before night.

With the late sown crops after the second weeding in October, nothing further will be requisite till the spring, about the middle of April, when the work should be again well executed, the mould being completely stirred about the roots of the plants, that they may derive the fullest benefit from the operation. This will be sufficient to keep them clean till the taking of the first crop; after which they must be again weeded, and the same operation be had recourse to after each cropping of the leaves, as in the above case.

In regard to the expenses of this culture, they will be different in different cases; but where labourers are abundant, the first hoeing will mostly be executed at about six or seven shillings the acre, and the succeeding ones at about half that expense, provided it be executed before the weeds have risen to too great a height. In some cases the works of weeding and cropping the leaves of the plants are executed by the same persons, at a fixed price per acre, according to the circumstances of the situation.

In respect to the business of gathering the crops with the spring sown ones, the leaves will generally be ready to be gathered towards the latter end of June or beginning of July, according to the nature of the soil, season, and climate; but for those put in at a later period in the summer, they are often fit to be gathered earlier. This business should however, constantly be executed as soon as the leaves are fully grown, while they retain their perfect green colour and are highly succulent; as when they are let remain till they begin to turn pale, much of their goodness is said to be expended, and they become less in quantity, and of an inferior quality for the purposes of the dyer.

In the execution of this sort of business, a number of baskets are usually provided in proportion to the extent of the crop, into which the leaves are thrown as they are taken from the plants, which is effected by the hand, by grasping them firmly and giving them a sort of a sudden twist. In favourable seasons, where the soils are rich, the plants will often rise to the height of eight or ten inches; but in other circumstances they seldom attain more than four or five: and where the lands are well managed in the culture of the plants, they will often afford two or three gatherings, but the best cultivators seldom take more than two, which are sometimes mixed together in the manufacturing of them. It is necessary, that the after croppings, when they are taken, are constantly kept separate from the others, as they would injure the whole if blended together, and considerably diminish the value of the produce. It is said that the best method, where a third cropping is either wholly or partially made, is to keep it separate, forming it into an inferior kind of woad.

Upon an acre of land, when well managed, in favourable seasons, the produce is mostly from about a ton to a ton and a half. The price varies considerably; but for woad of the prime quality, it is often from twenty-five to thirty pounds the ton, and for that of an inferior quality six or seven, and sometimes much more.

With such parts of the crops as are reserved for seed, it is a practice with some to crop the leaves two or three times the first year, and then leave the

plants to run up to seed in the following; but it is a better practice to only remove the side leaves, as in this way the plants are less weakened, and the produce of seed much increased. The plants are likewise sometimes fed down by sheep during the winter season; but this, from its tendency to weaken them, is equally improper and prejudicial.

The woad after it has been gathered undergoes several processes to prepare it for the dyer: but "in the improved method, it is conveyed in one-horse carts, so contrived as to be lifted from the axis, and, by folding doors in the bottoms, to discharge their contents upon the floor above the mill, on being hoisted up to their proper situation: round this floor holes are formed for putting the plants down through, in order that they may drop under the grinding wheels. The mills for this purpose have several wheels for grinding the plants, which have less diameters on one side than the other, and are about three feet in width, being constructed with iron bars for crushing the woad. They are wrought by horses, or any other power, as may be the most convenient. The materials are preserved under the grinding wheels by proper contrivances, which, as soon as they are sufficiently reduced, force it out of the tracks upon the stone floors on the sides; thus making way for new parcels without the mill being stopped. The bruised woad is then thrown into rooms on the sides of the mill, destined for its reception, by means of shovels. In these it remains till the juice is so much drained off as to leave it in a proper condition for being formed into balls; which is done by labourers, with apparatus for the purpose, and then laid upon trays to be conveyed to the drying ranges, in which they are placed upon grating shelves that slide on sledges in the drying houses. These are placed on the sides of galleries for the convenience of being easily deposited upon them and removed again. It is kept in these till it is sufficiently dried to be laid up in other rooms, until the whole of the crop has undergone the same operations, and the workmen are ready to manufacture it."

It is stated in the Lincolnshire Report, that "to prepare it for use in the art of dyeing, it is necessary for it to take on a proper state of fermentation, which is accomplished in the course of seven or eight weeks, and, in the technical language of the art, is termed couching. It is effected by regrinding the balls, in the same mill as before, to a fine powder, and then spreading it upon the floors of the rooms in which the balls were formed, to the thickness of about three feet; where it is then moistened with water, so as to keep it in a proper slow state of fermentation; and so managed by turning as that it may pervade the whole in an equal manner. In this business the direction of an experienced workmen is necessary. In the turning, it is of much importance that the parts of the materials be perfectly divided, which can only be effected by a nice management of the shovel." And it is added that "much advantage has been found in the goodness of the woad, from the drying and storing of it being performed in a careful manner. When this attention is neglected, the woad will not, on being broken between the finger and thumb, draw out into fine hair like-filaments, or in the technical language of the manufacturer, beaver well; as the use of this substance in the blue vat of the dyer, is not merely to afford the colour of the plant, but, by bringing on a very gentle fermentation, excite the indigo in the same vat to yield its colouring principle more perfectly. This is even necessary for its own colouring matter being fully imparted. The substance should therefore be so prepared in the different operations as to produce this effect in the most certain and perfect manner. When the heat in the process of couching has gone too far, the substance will be what is termed foxy; and when it has not proceeded to a sufficient degree, it will be what is called heavy. If the material be good, it does not soil the fingers on being rubbed between them; but such as is heavy does. In the conclusion of the process, the cooling is effected in so gradual a manner as to render it not fit for taking on the same process; and of course proper for being preserved in casks, or in any other way. It is then ready for use." An excellent apparatus for effecting the preparation of this plant is seen in the annexed plate taken from the above Report, and which is employed by Mr. Cartwright with much success.

Woad is a sort of crop which appears best suited to rich lands which are unfit for oats or any sort of grain-crops, on their being first broken up, as it may in these cases be had recourse to one or two years, when they will be in a proper clean state for grain. From this crop not returning any thing to the land, it must of course be in some degree a deteriorating one; but in a more moderate manner than most other sorts of exhausting crops; while at the same time, from the nature of its culture, it leaves the land in a more clean and perfect condition for the growth of other crops. In the practice of Mr. Cartwright, it has been introduced as a regularly returning crop in the rotation of woad for two, three, or four years; then oats for one or two; after that cole, then oats again; the land being then laid down to sward, with white-clover, rib grass, a slight portion of trefoil, the best hay-seeds, some parsley, and a little ray-grass. Where land is left in this way, if constantly fed down close, with sheep and a few neat cattle, it is supposed it would be in a condition to be planted again with woad in the course of seven or eight years or thereabouts.

It may however be observed, that "as the demands for this article are in some degree confined, it is not a kind of culture that can be extended in an unlimited manner. Besides, as there is much trouble, risk and anxiety attending the cultivation and preparation of such sorts of crops, and a great expense of machinery, it is probable that many other kinds of root and other crops that are less exposed to hazard in their growth, and trouble in their preparation and after-management, may be grown on soils that are proper for this plant, with more profit and advantage to the farmer. However where the culture of woad is established, and the necessary apparatus provided, its cultivation, by confining it to a particular place, and introducing it in a regular course as stated above, may be extend-

ed, and rendered more easy and profitable than under other circumstances.

It has been suggested by a late writer to be a crop capable of being grown to benefit on light sandy or gravelly sorts of soil among clover, as from its having a long naked stem, it will not be injurious to that crop, and it will be ready for pulling before the time of cutting the clover. It is raised in this manner with little or no expence.

WOALDS, a term applied by some writers on husbandry, to crops of the woad kind. See *Woad.*

WOLD, a term signifying a plain down or open champain ground, hilly and void of wood. There are many extensive tracts of this sort of land in different parts of the kingdom, as in Yorkshire, Wiltshire, Kent, &c. See *Would.*

WOOD, a close, thick, and large plantation of trees.

The collections of trees to which the general denomination of woods has been given, may be considered under three divisions, as,

1st. Such woods as chiefly consist of timber trees, with little or no underwood.

2d. Those coppice woods which principally contain underwood for the purpose of being cut over at certain periods for their produce in bark, fuel, &c.

3d. The woods, properly so termed, which comprise a mixture of different sorts of trees with undergrowths for the purpose of being cut over at certain distances of time.

Which sort of woods may be the most advantageous and proper to raise in different cases, must be determined by the particular circumstances and nature of the lands. In many situations, great profit may no doubt be obtained by raising timber woods; but in others much greater advantage may be gained by rearing those of the coppice or mixed kind.

The coppice woods, wherever the demand for the various small stuff which they afford is great, will afford very considerable returns to the proprietors, especially where due care is bestowed in fencing and preserving them.

But mixed woods will probably be found the most profitable in general, particularly where the practice of raising oaks, as an under growth, is had recourse to, as it is obvious, that trees of this sort, of from fourteen to twenty or twenty-five years growth will afford a considerable produce in bark. It has been stated, that in some woods of this kind, in the very northern districts of the island, "the under-growths have been sold every twenty-five years at the rate of from 30l. to 50l. per acre, the purchasers being at all expences of cutting, carriage, &c. which is from 24s. to 40s. *per* acre *per annum*, independent of the value of the timber trees left, 250 of which may stand on each acre."

But in the lower and less exposed parts, they would grow much faster, so as to afford two cuttings in the same distance of time, and in some instances probably more, however, it may be safely stated, that "in most situations it will produce upwards of 2l.; and in many places upwards of 4l. *per* acre *per annum*; and would probably far exceed these amounts in both cases, were proper culture bestowed upon the plants." But it must be observed, that "this profit is independent of the produce of the timber trees; which if it be supposed 250, or even only 200, are cut down every fifty years from each acre, at 3l. each, this is 12l. more *per* acre *per annum* for the woods.

And another point which ought to weigh in raising woods of this sort, is the easy charge with which it may be accomplished. As it is, beyond doubt, the speediest, and in every respect the best method to raise oaks from the acorn, by sowing them at once where they are finally to remain; and three or four bushels being abundantly sufficient for an acre; which, at 5s. per bushel, is, for the whole acre, much below the price of a single thousand transplanted trees of any kind; and transplanted oaks, which would cost nearly double that price, would be at least three years behind them in point of size four years afterwards, both kinds being planted at the same time. It may, therefore, be stated, that supposing the ground, on which an oak wood was to be planted, summer-fallowed and trench ploughed, at 2l. per acre, and sown broadcast, before the last ploughing, with acorns, the total expence, making an ordinary allowance for the proportion of the expence of enclosing, would be only 3l. 5s. or 3l. 10s. per acre for the whole.

And, that if it were desirable to have the timber trees of some other kinds rather than oak, then 250 ash, beech, or elm, on each acre, which is more than 20 feet apart, could be planted immediately after the acorns were ploughed in, which would only amount to 10s. per acre more, or 3l. 15s. or 4l. per acre in the total; and it is evident, that woods with the soil thus prepared and planted, would far exceed in growth those where the soil is uncultivated, but which are pitted and planted with transplanted oaks at the rate of 7l. or 10l. per acre.

In raising belts, stripes, and all narrow plantations of wood for shelter, under-growth should always be planted: trees alone allow the wind to pass unrefined through their naked stems, and hence afford comparatively little shelter; but trees and undergrowths mixed are like an immense hedge, equally thick from top to bottom, which checks the progress and retards the velocity of the wind for 30 or 50 feet above the surface. In these cases oak is obviously the best kind of undergrowth, and will often produce better crops than in close extensive woods. And it is recommended to those who have bad or inferior hardwood plantations under twenty-five years old, whether in stripes or more extensive plots, to reduce the timber trees to 20 or 30 feet distance, to dig or clean the intervals, and to plant them with acorns. In twelve or fifteen years afterwards, they would find the advantage of such a plan.

But there are thin soils with bad understrata, where fir trees are more profitable than any other kind of wood; there are steeps, and rocky banks, where no tree can be so advantageously cultivated as the common oak; and rich moist places where no sort will turn out so profitably as osiers, but, generally speaking, it may be safely asserted that woods are the kind of plantation that ought to be most generally formed, and, that, though the kind of tim-

ber grown in these woods must vary according to the consumption of different places, yet that oak will be found the best and most profitable undergrowth of any that can be had recourse to by proprietors.

In situations and soils where trees thrive well, it is in many instances, both convenient and profitable to raise, protect, and preserve woods in the intention of cutting for farm purposes, or with the view of sale; in which considerations it is absolutely necessary that they be kept perfectly free from the injurious browsing or cropping of live stock by means of proper fences, and well stocked with the most useful sorts of wood plants which are capable of being grown to advantage on the peculiar soil and exposure, as, without due attention in these points, Mr. Davis says, from most of the stocks that afford the wood "being in fact only pollard trees growing under ground, it is obvious that the produce of such stocks must, like the shoots of pollard trees, be the most abundant when the parent stocks are in the greatest perfection; that until they attain that perfection, it must be small; and that, when past that perfection, they gradually decline; the shoots from thence become weaker and fewer every successive cutting, and the stocks finally decay and die." That therefore, to prevent the decay of woods, it is necessary "from time to time, to renew them by raising new stocks to supply the place of those which gradually wear out or are destroyed." But, that "besides the regular decay of age, to which all woods are liable, there are other injuries to which they are exposed, and which speedily and prematurely bring on their decay, unless prevented by proper means. One is the pernicious custom of suffering cattle to feed in woods, under an idea that, after they are of a certain age, as seven years, the shoots are grown out of the way, and cannot be hurt. In strong thriving woods, it is possible that cattle may do but little harm to the underwood, after it is seven or eight years old; but all the young plants, which either spring up spontaneously or are planted in them, must be liable to be cropped and kept down, and few of them can come to perfection. And in weak decaying woods, there is always a great deal of the underwood so low as never to get out of the reach of cattle, but constantly liable to be cropt and kept down by them, and the decay of the stocks consequently much hastened."

And that "another cause of the early decay of woods, is the want of draining such parts of them as are subject to be moist and damp; nothing being so prejudicial to wood as too much wet. This begins to be well understood in most draining districts, and has been practised with success." Further, that "a third cause of decay, is the custom of suffering woods to grow too old before cutting; whereby the strong shoots smother the weak ones, and, by their dropping, kill the stocks on which they grow. And to this may be added the practice of permitting the buyer to cut the wood, thereby making it his interest to destroy every sapling, and to cut the underwood as close to the stock as possible—which in old woods is highly prejudicial to the succeeding shoots—as well as the custom of not obliging the buyers to clear the woods early in the summer, so as to prevent the new shoots from being injured by their cattle, carriages, and other circumstances."

Where woods of the coppice or underwood kinds are to be raised or improved, it is necessary to pay great attention to the nature of the soil and the exposure of the land, adapting the trees and plants to the nature of these as much as it is possible, and at the same time taking into consideration the kinds of trees that are most useful and most in request in the particular district or vicinity, as from its bulky nature it is in general the most profitable when disposed of without the trouble of much carriage.

In speaking of plantations and the business of planting and keeping up woods, various sorts of trees adapted to particular soils and situations have been mentioned. But the excellent writer quoted above, thinks, that "taking the general demand of countries, and the peculiarities of different soils into consideration, there is no kind of wood so generally proper for planting in this way as ash. The value of ash poles being at least one-third more and frequently as much again per 100, as that of other poles (being applicable at all sizes to some useful purpose or other) the timber being always in request, and saleable at any age or size, at almost the price of oak; and the wood itself being as quick a grower as any, and quicker than most; and above all, there being but few soils, from the blackest and wettest bogs to the highest and most exposed mountains, where it will not grow; are reasons why ash is one of the most profitable woods to plant in such coppices as are favourable to its growth. But in soils and situations where ash does not grow kindly, let such other sorts of woods be planted as appear to thrive best in similar soils and situations in the same country. Spanish chesnut, though not so general a grower as ash, is a most excellent wood, either for timber or underwood, and wants only to be more known to be higher in estimation. It partakes much of the properties of oak, but excels it in two points, viz. that it grows faster, and that the sap part of the timber is firmer and less corruptible."

The same writer has likewise remarked, that "if it be profitable to plant new woods, it is unquestionably much more so to protect and preserve such as are already planted, to improve and fill them up where thin, and restore them when in a state of decline or decay. For the expense in this way is not only lessened by the saving of new fences, but the profit is greatly increased, by the rapid growth of the wood, when planted in situations that are sheltered by other trees and plants already in a state of growth. In such woods where saplings rise spontaneously in great numbers, their growth should be promoted and encouraged. And as, at the time of cutting the underwood, such saplings may, perhaps, be fourteen or fifteen years old, it might seem proper, after leaving for timber trees such as are straight and handsome, to cut off the rest for underwood; but a great part of the saplings at that age so cut off, will not, he thinks, be large enough to produce shoots sufficiently strong to get up as fast as the other underwood. Consequently

such shoots would suffer, and the stocks never come to perfection. It is therefore supposed in general, more advisable not to cut off such saplings as are intended for underwood, until the second cutting of the wood, when they may be probably near thirty years old, and when they throw out shoots strong enough to fight their way, and keep pace with the surrounding underwood. But where saplings do not spring up in abundance in this way, young trees must be planted; part of which may be preserved for timber, and the rest left to be stubbed off for underwood at a proper time, according to the particular circumstances of the cases.

In the view of filling up such woods as are "grown thin by age or neglect, the proper time is, Mr. Davis supposes, one year, or at the utmost two years, after the underwood is cut over. And that the young plants should be eight or ten feet high, and an inch and a half in diameter at the ground, and should be planted without cutting off. Where the soil is dry, no other preparation is required than that of barely digging the holes for the plants. But that where it is wet, deep drains should be opened to take off the superabundant water. And the earth dug out of these drains thrown on the lower side of them, the plants being planted out upon this new earth. Where land of this latter description is of the black and peaty kind, ash is peculiarly proper for it; and will, when planted on the earth thrown from the drains, make a most surprising progress. But where it is a stiff yellow clay, it is generally more favourable to the growth of oak than of ash. In such soils, oak for timber, with a mixture of willow, birch, alder, and Spanish chesnut for underwood, will, he conceives, perhaps be the most proper. He advises that all these kinds should stand one round of the underwood, and if still weak, two, before those are cut off which are intended for underwood. But that birch plants are an exception to this rule: they should always, he says, be cut off the first round of the underwood; for, if they are large when cut off, the stocks frequently decay and die. In all mixtures of different kinds of wood for coppices, those sorts should, he conceives, be used which are not unfriendly to each other, and which will come round fit to be cut together at the same periods; and such kinds should be allowed to stand for timber, and at such distances as to injure the underwood as little as possible. It is recommended, that the plants for filling up old decayed woods, should be the strongest and best of their kinds; that those which are weak at first will be drawn up by the surrounding underwood, and become from the increased height still weaker. Consequently, that at the next cutting of the underwood, they will be blown down; or, if cut off, the shoots will be too weak to grow up with the other underwood. He thinks, that oak, ash, and Spanish chesnut should be kept in a nursery for this purpose: alder and birch plants grow plentifully spontaneously in some countries, and may be taken up for use. Alder is sometimes propagated by taking up old roots and dividing them into several parts; and hazel may be raised in the same way. Willow is generally planted in cuttings; but a much better way, where there are any old willow stocks, is, he conceives, to plash down the shoots to fill up the vacant places round such old stocks."

It is a point in the management of woods, which has not yet been fully decided, and which can only be correctly ascertained by trials made upon a number of poles or stems of different sorts of wood at different growths, as seven, fourteen, and twenty-four years, whether the increase is in proportion to the length of growth. It is probable that by this means, and that of proper attention being paid to the nature of the soil by nice observation, in time an useful and exact estimate might be formed of the most advantageous periods of cutting woods.

The business of cutting wood over, differs in different districts, from seven or eight to twenty-five or thirty years; but the most common period is probably from twelve to fourteen or eighteen. A practice also prevails in some wood counties of leaving one or two stems upon each stool for a double growth, by which a portion of large wood may, it is supposed, be procured in each fall. And in this mode it is probable there may not be much less increase in the growth of the other parts of the wood, while the largeness of these stems may afford more profit, and admit of being applied more generally and to more important uses. Where there are causes that cannot be removed, so as to prevent cattle from injuring the early growth of woods, it would seem the most profitable method to defer the cutting to as late a period as possible, from the mischief being chiefly in the first few years. Besides, for many uses it is almost impossible to cut at the more early periods, except indeed on very good rich and soils. This is particularly the case with ash and oak, for hop-poles, and some other sorts. On the whole, it seems therefore probable, that the most profitable method may in general be to defer cutting till the later periods in most instances.

It is stated in the Survey of Essex, that "the management of underwood, particularly where the stubbs are young might, it is presumed, be improved by obliging the woodman to cut it even with, if not rather below the surface of the ground, by which means the stubbs would produce more plentiful shoots and afford a quicker growth, besides that the quantity cut would be considerably increased, as it is no uncommon thing to see the old stubbs left a foot or two high, after the wood is felled; and if more attention were paid to the draining of woodlands, the owners would find a good account in it when the wood next came in course for felling."

And it is added that "a considerable improvement has been made at Finchingfield, by forming walking paths through the wet woodlands: foot drains, or those cut one spit wide and deep, are then cut parallel to each other, and at the distance of from eighteen inches to two feet apart, between these drains the sods that are raised are laid; thus raising a pathway above the general level of the wood, and at the same time forming drains which effectually relieve the wood of its superabundant water: hence a more durable undergrowth is encouraged, and as oak timber is al-

ways found to flourish better in woods moderately moist than those that are wet, there is reason to believe that a due attention to this point in the wet heavy woodland counties, would prove highly beneficial, and much promote the growth and durability of oak and other valuable timber."

That on the rich lands of Woodside Green, and other parts of the forest "the growth of timber might be materially improved by inclosure, for the purpose of encouraging the growth of oak and other valuable timber."

"The undergrowth of the woodland is there cut once in eleven years, and produces 8*l.* 15*s.* per acre at the stubb.

The woods are well attended to; the quantity small; cut at twelve years growth, worth at the stubb about 8*l.* per acre, consisting of ash, sallow, hornbeam, hazel and thorn."

And that in the parish of Boreham, "the woodlands, which are generally kept in the hands of the proprietors, are for the most part cut at 15, 16, or 17 years, and are more or less valuable according to the quantity of hop-poles they produce, which is the chief article worth attention; as firewood is very cheap; owing to which considerable proportions of woodlands are cleared annually, and brought under the plough."

In the north riding of Yorkshire, it is stated as the management of the woods, that many of them "are under the course of what is called *spring-felling*, that is, felling the whole growth of the trees and underwood as near as possible to the ground, but so as not to injure the crown of the roots. Care being taken to leave the stool round and smooth, to prevent the lodgment of wet. By this management, a fresh and numerous succession soon arises from the old stool, and from the seed being scattered on the ground, which, after being occasionally thinned during the period of their growth, and having been well defended from cattle, in about thirty years are again ready for the axe. Oak, ash, and broad leaved elm, are equally capable of this re-production of timber from the old root. Spring wood, from its age, is of course small, but serves for many purposes of husbandry and country use."

And "that some, in going over their woods about every twenty years, raise a constant succession of timber, by leaving each time a certain number of the most likely young trees on each acre, and a certain number of every preceding thinning; so that at the same time that they leave a considerable number of trees of twenty years old, they leave also a certain number of twice, three times, four times, or upwards, of that age; fewer of each in proportion to their age. This method seems to raise the best trees, and greatest quantity of timber, because the wood, suffering little alteration, affords the most uniform and regular protection to the growth of the trees; and probably is the most profitable mode of managing woodlands. In these woods, some of the timber arrives at full maturity before it is cut down, and is fit for ship-building, or any large purposes. Several large woods are under this management."

It is observed, that "when woods are suffered to grow to their full size, it is the practice of some to have them weeded, that is, thinned of the smaller, and too numerous trees and underwood, as often as these acquire a size sufficient to make them useful for rails, stakes, or bindings for hedges, or other similar purposes, which is generally once in about seven years; at last the whole wood, when arrived at maturity, is cut down at the same time, and again trained in a similar manner for timber."

And that "woods under the best management practised in this part of the country, are held to pay very well on any soil; in many instances, from 12*s.* to 15*s.* per acre, where the land, though capable of cultivation, would not be worth as much if cultivated; and that rent will be produced on many of the steep and rocky hill sides in the Moorlands, which, if not covered with timber, would be of no value at all."

It is stated in a paper by Mr. Farey in the Agricultural Magazine, after noticing the backwardness of wood management, that "some gentlemen in the district of Kent from Foots Cray to Farningham let their woods on leases for twenty or twenty-one years, but the greater part of them retain their woods in hand, and at periods of ten to fifteen years, let or sell the standing underwood to wood-dealers or wood mongers, who cut and convert the same to a great variety of purposes for the London market."

And that "the sale of standing wood usually takes place in the winter, when what is denominated the fall is measured off and agreed for, at a certain price per statute acre; six to fifteen pounds have of late years been given, the average price being perhaps, about nine pounds ten shillings, or ten pounds per acre: half of the amount is sometimes paid down by the wood-dealer, and the remainder on or before the mid-summer following. The purchasers usually pay the tithe, and lay or make good such of the fences of the wood, as adjoin the fall: engaging to cut down all the wood before Lady-day, and to clear off all the produce by Midsummer. The timber is reserved by the owner of the wood, and herein lays, he says the principal difficulty of this mode of disposing of underwood; for unless a proper agreement is made in this respect, the fallers are properly looked after, and the agreement strictly enforced, the woods under this system of management are in time left almost without trees, of which some instances may in this district be seen, where from the thriving state of the few trees remaining, and the number in other near woods, upon similar soil, there cannot be a doubt but trees were once plentiful. Some gentlemen, who look principally to their underwood for profit, do not restrict the wood-dealer from cutting any thing below a certain girth, as four or five inches at four feet from the ground. Some proprietors of woods stipulate, that no oak stems shall be cut by the wood dealer, except such as grow upon old stools: others agree, for about eighteen black rinds, or such young oaks or tellers as have their bark cracked and turned black, and about sixteen white rinds, or young oaks whose bark is still white, and thirty to forty staddles, or young aspen, beech, birch, or maple stems or plants upon an acre. Ash is often classed with oak in these contracts, from its usefulness in hoops and wheeler's work, &c."

But "a different system is pursued by some gentlemen in this district, who commission a wood-factor to superintend and employ woodmen to cut down and convert their wood, for which they pay a certain commission on the value of the produce. The usual periods at which underwood is cut for wood-wares, as they are called, is, he says, from ten to fifteen years, according to the free-growing of the wood, or the impatience of the owner for a return; it being remarked by some whom he talked with, that those who cut their wood at the shorter period, seemed to be injuring the future growth thereby."

"Hoops for the cooper's uses, are among the most considerable articles of wood-wares, and are of several sorts, of which some are sold in the round, without cleaving, viz.

"Long can hoops, of hazel and the other sorts of underwood, except maple, six feet long, sixty in a bundle, tied with two withs, or bands; for cutting and making of which, threepence is paid to the men, and they sell at one shilling.

"Short can hoops, three feet and a quarter long, one hundred and twenty in a bundle; which sell at one shilling.

"The following sorts called smart hoops, are in other instances cleaved and shaved in the woods, four or six hoops of the four first sorts, being often made out of one of the larger staves or poles of underwood, each having when cleaved, a segment of the bark on it, and terminates with an edge at the pith of the staff; this edge or central part of the wood, the hoop-maker afterwards shaves off, with a drawing-knife, carefully preserving the bark, and a proper thickness of wood within it. The utmost care is requisite in trimming out hoop-staves, not to hack the bark or cut the knots too close, by which the hoops to be made out of them are spoiled. The sorts of hoops are,

Long middling smart hoops, 14 feet long, 60 in a bundle, tied with 5 bands, for making which (i. e. rending, shaving, and tying up) 18d. per bundle is paid. Delivered in London, there sell at 8l. per load of 30 bundles.

Short middlings, 13 feet long, 60 in a bundle, 5 bands; making 15d. or 16d. Price in London, 6l. 10s. or 7l. per load.

Long pipe, 12 feet long, 60 in a bundle, 4 bands; making 12d. or 13d. Price 5l. 10s. or 6l.

Short pipe, 10 feet long, 60 in a bundle, 3 bands; making 8d. Price 4l. 10s. or 5l.

Hogshead, 9 feet seven inches long, 90 in a bundle, 3 bands; making 8d. Price 4l. 10s. or 5l.

Barrel, 8½ feet long, 120 in a bundle, 3 bands; making 8d. Price 4l. 10s. to 5l.

Kilderkin, 7½ feet long, 120 in a bundle, 2 bands; making 8d. Price 3l. 10s. to 4l.

Firkin, 6½ feet long, 180 in a bundle, 2 bands; making 8d. Price 3l. 10s. to 4l.

Long pink, 5½ feet long, 240 in a bundle, 2 bands; making 8d. Price 3l. 10s. to 4l.

Short pink, 4½ feet long, 240 in a bundle, 2 bands; making 8d. Price 3l. 10s. to 4l.

Tumbler, 4 feet long, 240 in a bundle, 2 bands; making 8d. Price 3l. 10s. to 4l.

"Ash hoops are usually sorted out, and tied up separately from those of other wood, and so are those of Spanish chesnut, as being better than those of other wood. Here the hoop makers distinguish the nut-hazle into two sorts, the white and the red, which they know by the hue of the bark, and consider the white as much tougher and better for hoops than the red. A single stump of ash stems in these woods, has been known to produce a bundle and an half of hoops.

"*Hoop chips*, or the shavings of the hoops, are tied in bundles, 3 feet girth, for which 3s. per hundred is paid to the maker; these sell in London for lighting of fires, at 20s. per hundred.

"*Gate Hurdles* or wattles, these are made about seven feet and a half long and three feet high, consisting of ten vertical stakes, the two extreme ones of which are longer, and project both above and below the hurdle, the lower end is pointed for entering the ground a short way, and the upper is for receiving the shackle, to fasten up the hurdles when in use. The hurdles are so closely wattled with rods, that about twenty twists or turns round the end stakes may be counted, besides the ends of the rods: for making these gate-hurdles, the men are paid three shillings per dozen, and the hurdles sell at one shilling each in the wood.

"*Fold stakes*, these are cut seven feet and a half long, smaller at the lower end than the wrist, and are tied up in bundles of twelve and thirteen alternately, so that eight of these bundles make one hundred, which sell for four shillings. One of these stakes is pointed, and let into the ground by an iron pitcher or crow, between each of the gate-hurdles last mentioned, for forming sheep-folds and other temporary fences, and a copse or shackle of twisted rods, is put over it and the projecting heads of the adjoining hurdles, to hold the whole together. The soft nature of the soil in this district, admits of fastening the stakes, without driving, by which the stakes last much longer, than where the beetle is constantly in use.

"*Hop poles*, these are collected in three sorts, according to their lengths, viz. firsts, seconds, and thirds, and are from twenty-five to nine feet in length. From one shilling and sixpence to ten-pence per hundred, is paid for trimming and sorting these out, and they sell from twenty to twelve shillings per 100, according to their length and straightness. The oak poles are sometimes left standing till the stripping season, and are stripped of their bark when cut; and such do not sell the lower for hop-poles, on account of losing their bark, on which account this practice ought to be more general than it is.

"*Broom staves* or sticks, these are cut three feet long, and tied up fifty in a bundle; for the making of which, three-pence each is paid to the wood-cutter.

"*Birch cuttings*, these are tied up in bundles for the broom-makers, three feet in girt, and are near four feet long. The price of making is seven shillings and six-pence per hundred bundles.

"*Props*, these are poles left with three or four forks on them, and are cut from nine to six feet long; they are tied up in bundles of twelve and thirteen alternately, for each of which the wood cutters are paid

three-pence. These sell for propping up cloaths lines, &c. in and near London.

Sallow bundles, these are such pieces of clear sallow wood, four to seven feet in length and two to four inches in diameter, as are adapted to cleaving for the uses of basket-makers and sieve-bottomers. Each bundle should weigh about twenty-eight pounds, for making which three-pence is paid: these often sell at high prices in London.

"*Wharf fagots* or kiln bavins, these are about three feet and a half long, and thirty-two inches circumference at the band, weighing sixteen or seventeen pounds each; few of the sticks in these are thicker than the thumb: the middle, or guts as the wood-men call them, being filled with the refuse and brush of the other wares. For making these the men are paid three shillings per hundred. Delivered at the wharf, by the side of the Thames, they sell at sixteen shillings per hundred of five score.

"*Pimps* or brushes, these are very minute fagots made for lighting of fires in London and other places; they are fifteen or sixteen inches long, and twelve inches girt at the band, the making is one shilling and six-pence per hundred, and they sell at twenty-two to twenty-five shillings per thousand.

"*Withs* or bands; the longest of these are about eight feet and a half, and none of them thicker than the finger, they are tied with two bands, in bundles of one hundred each, the lower band being about three feet long; the making is three-pence, and they sell at seven-pence to nine-pence per bundle, for tying up fagots, &c. A much smaller sort of withs are made, called pimp-bands.

"*Hurdle-rods*, fencing-rods, or heathers, these are of a larger size than the gate-hurdle rods next to be mentioned; they are left of the whole length of the underwood, and are tied up by two bands, fifty in a bundle, which cost three-pence making, and sell at fifteen-pence each. With these rods, a neat and useful kind of open fence is made in this district, for guarding young quicks and other live fences; it is called hurdle-fence, or raddle-fencing, and consists of stakes of rather a smaller size than fold-stakes, set fast in the ground at equal distances, between and round which the rods are wattled, not close as in the gate-hurdles, but leaving some open spaces, so as to form a firm and continued line of fence, without breaks, except where gates or other openings are wanted. The labour of this kind of fence costs six-pence per rod of five yards and a half.

"*Gate-hurdle rods*, these are smaller than the last, are tied by two bands, into bundles of fifty each: they cost three-pence making, and sell at twelve or thirteen-pence per bundle.

"*Bushes*, these, when they run about five feet and a half long, are tied up with one band for hedging, in such quantity as to girt about three feet at the band; if the bushes run longer and good, they are made to girt less at the band, but more, if the bushes be shorter than above. Two shillings and six-pence is the price per hundred for making, and they usually sell at ten shillings and six-pence per hundred bundles.

Cord-wood, *Stack-wood*, or *Billets*, each cord of wood here, when first set up, should, in order to allow for shrinking, be made twelve feet and a quarter long, $3\frac{1}{2}$ feet high and $3\frac{1}{4}$ wide, supported by a strong stake driven in the ground at each end. The cutting and stacking of these cost 2s. 6d. per cord, and such sell from 18s. to 21s. and even 30s. according to the quality of the wood and the closeness with which it is stacked, which will much depend on the straightness of the wood.

It is observed that in cutting up cord-wood intended for charcoal making, which is here but little practised at present, it is of great importance to avoid haggling or splitting the ends of the wood, the coal from such, being apt to break into small pieces, on which account, a saw is sometimes used instead of the hatchet, in separating the billets for charcoal burning."

It is the practice in the large woods of Buckinghamshire, where the produce is chiefly of the beech kind, not to cut them over, till from twenty-five to thirty, or even thirty-five years, by which delay they consist almost wholly of successions of young trees. In the operation of cutting, the trees of a proper age are singled out annually and cut, without having recourse to regular falls, as in most other cases and districts. The extent of the cuttings is made so as to pay the proprietor from about fifteen to twenty shillings the acre, in proportion to the goodness of the growth. And the best are found to afford a clear profit of twenty shillings under this system. But in Worcestershire, where the goods are chiefly cut for the sake of the bark, they are felled at about forty years growth, a proper quantity of store woods of fourteen and twenty-eight years growth being left for the next fall. Also in the neighbouring district of Hereford it is sometimes the practice to fell at from eighteen to twenty years growth, and in others at from twelve to fourteen or fifteen. In the former the wood is chiefly oak; but in the latter, ash, sallows and alder; the whole being cut over, and such parts as are proper applied as hop-poles, with much profit. And the twenty years falls are stored and applied in the usual manner. But in the operation of cutting the wood one maiden standard is left to each lugg or forty-nine square yards. In this way coppice-wood will produce at from 2s. 6d. to 4s. 6d. a lugg, from twelve to twenty-two pounds the acre, at from twelve to fourteen years growth, which is a greater return than could be obtained in almost any other method in the soils and situations in which they are placed.

And it is remarked in the Survey of Gloucestershire, that "there are extensive and magnificent woods in Spring Park, and on the Frocester and Stanley hills, belonging to lord Ducie." And that "as these beech-woods re-produce themselves from seeds self sown, they generally come up so thick as to require to be constantly drawn for the first twenty or thirty years. The remaining trees then stand for timber, and are supposed to come to their perfection in seventy or eighty years. Woods of the best timber will then be worth from 80l. to 100l. per acre. They are sold to dealers, who convert the timber on the spot, into proper scantling for gun-stocks, saddle-trees, bedsteads, chairs, and other cabinet work; and of late years a considerable portion has been converted into

what is called, in the West Indies, lumber, or staves for sugar-hogsheads. These several articles, deprived of waste bulk, are carried on at a cheap rate to Birmingham and Bristol, for exportation; but the cost of carriage prevents the supply of them to a London market."

"That the waste and ordinary trees are either burnt into charcoal, or sold as billet-wood to the bakers, from 12s. to 15s. and in some situations, even 17s. per cord of eight feet eight inches long, four feet four inches high, and two feet two inches wide. At this price per cord, the timber brings from 5d. to 7d. per foot; whilst the good trees, sold separate, are worth from 10d. to 1s. per foot."

It is remarked in the Report of Staffordshire, that the Dillorn woods "form a chain of three or four miles in length, and consist of tall straight oaks and ash, which are in general so well filled up with underwood as to be cut in gradual falls at seven years' growth, and produce when well fenced six pounds per acre; for rods and staves, used for crates in the neighbouring pottery. Eighty-four acres of wood will admit of twelve acres being cut annually, and will produce seventy-two pounds; which is about seventeen shillings per acre per annum for the underwood, exclusive of the timber; while the bleak neighbouring hills, which remain unplanted, are not supposed worth more than three shillings per acre."

It is stated in the Gloucestershire Report, that "the management of coppice woods on the Cotswolds is the following, as practised by J. Raymond Barker, Esq. of Fairford. "The coppices are intersected by small cuts of six feet wide, and these divided in fourteen equal parts: one part is cut annually, so that the cuttings come regularly round in fourteen years growth. Wherever the ash roots are found to be dead at the time of cutting, and the wood becomes thin, it is planted the following year with young ash plants about an inch in diameter, cut down to the height of two feet, which is sufficiently high to preserve the young shoots from hares and rabbits. It is proved by experience, that ash is preferable for coppice to any underwood, except the black sallow (salix caprea) in moist places. As timber trees, by the spreading of their branches, necessarily injure the underwood, all the large branches are cut off at about eighteen inches from the body of the tree, which, from the experience of more than twelve years, has been found not at all to check the growth or hurt the timber: from this management the tree every fourteen years yields a considerable quantity of fagots, and the underwood flourishes near it."

"In some coppices, the small stuff, called drift-wood, is sold, if good, as high as 5s. the square perch. This is used for hedging; the poles are made into hurdles, which on the spot are worth 16s. per dozen."

And that "in the forest district, the coppices are also divided into portions, and cut every fourteenth or fifteenth year. The oak is found to have a quick growth for this purpose: being cut down near to the ground, it shoots up with several branches, and on stiff land is most useful for coppices. Ash, however, forms a considerable part, grows freely, and is useful for various purposes, such as making hoops, hurdles, hop-poles, &c. The oak, is of sufficient size, if split into laths, or sold for the use of the coal-pits, and a great deal of both is made into cord-wood, for the consumption of the iron furnaces, either in its natural state, or converted into charcoal.

"Birch, witch-elm, sycamore, lime, and others, are found in the coppices. The latter, provincially the "whitten or whitrod," (tilia cordata), though not recommended as the most profitable, is remarkable for its uses. Of the inner bark are made ropes for cyder-presses, draw-wells, and fishing-boats. To the latter purposes, they are excellently adapted, as not contracting or expanding from moisture or drought. The bark is stripped off about Midsummer, dried like hay in the sun, and is called "bast:" it is either manufactured on the spot, or removed to other places for the same purpose. Bast ropes are sold at a hundred yards length, in pairs, for 14*s.* per pair.

"The wood of the tree is remarkably white, and is sold to the toy-manufacturers in Bristol for 30*s.* per ton. The price of coppices here varies from 2*s.* to 4*s.* the square perch, or from 15*l.* to 30*l.* per acre."

But Mr. Davis has suggested, that "the periods of cutting underwood should be regulated by the luxuriance of its growth, the demand of the country, and the uses to which the wood is to be applied when cut. In the article of underwood, not only the interest of money, but the loss of the succeeding growth, tell, he says, against the value of standing wood after it is fit to cut, and make it doubly the advantage of the owner to cut his underwood as early as it is saleable. As soon therefore, as any kind of wood is fit for the uses of the country, it should then, says he, be cut, unless it can be made to appear that it will pay compound interest for standing longer, or, in other words, will pay not only the simple interest of the first value, but also the loss of so many years growth of the wood, as so far advanced towards another crop." He thinks that "wood merely for fuel can scarcely be cut too young. Hazel is usually fit for hurdles and dead hedges, from nine to twelve years old; ash for sheep cribs, at the same age; and ash and other woods, for hop poles, from eleven to fourteen years old: while ash for carpenters and other large uses, alder, birch, and willows for rafters, turner's uses, pattens, clogs, and coalpit uses, should stand from sixteen to twenty years before the poles are large enough for their respective purposes."

"It is usual for the business of cutting wood to commence in November, and to be carried on through the winter months till February or March; but to be completed before the beginning of April, except in cases where the wood is to be barked; in which the beginning of May may be the most proper, as it will then generally run better than at a more early period, from the sap being more up.

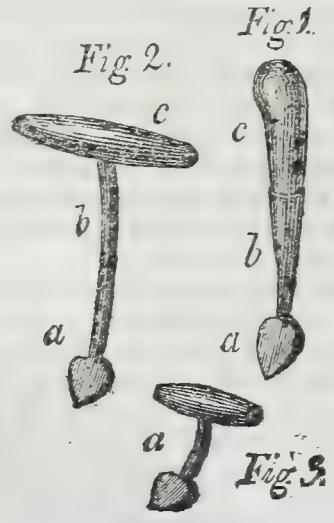
It is remarked by the above author, that "opinions have differed greatly respecting the most proper time of the year for cutting underwood; but there is one rule, which on the seller's part, is, he thinks, without exception, which is, that the older the wood is, the later in the spring it should be cut. When old wood is cut early in the winter, and a hard winter follows, the damage done to the stocks is, he conceives, very great; young flourishing wood will bear cutting at any proper season. But on the part of the buyer it is an

lowed that all woods are more durable, when cut in the most stagnant state of the sap; and in all uses where bending is required, such as hurdles, hoops, and even dead hedges the wood cannot, he supposes, be cut too early in the winter, being, if cut when the sap is rising, brittle, and unfit for those purposes. It is imagined that oak underwood, as bark sells at present, may pay well for standing till sap is up for barking, and that the stocks will seldom be much hurt by the practice.

In most districts the work of cutting is performed by measure, or what is often technically termed *tale*. And the wood is differently managed in different districts, as shewn above, being in some simply cut and laid in rows or drifts in order to be disposed off in that state by the rood, or some other measure. But in other cases it is regulated according to the uses for which it is intended.

It is remarked in the paper noticed above, that "in Kent those proprietors of woods, who let them to tenants, as well as those who sell the standing underwood to wood-workers, as noticed above, generally fall and strip the oak timber on their own account; but some sell it standing to dealers, who cleave the butts into spokes or pales, and convert the tops to gate-posts and other rough uses. Here the writer heard a remark which he begs to mention, viz. that the sap in oak pales, cleaved out directly after peeling, will last nearly as long as the heart, while pales that are cleaved from timber which has laid and dried after peeling, quickly decay in their sappy parts."

And he states that "it is not customary to pay the strippers, or *tan flayers* as they are there called, any thing per tree, for falling the oak spires in these woods, but they are paid eight-pence per yard of bark, or twenty shillings per load of thirty yards for stripping: and for converting the top and arms into wharf-bavins and cord-wood, they are paid the usual prices mentioned above. The strippers there seem, he says, to use but one kind of tool in peeling, which they call a *tan-spud*; on account of the great inferiority of this, to the tools which he has been accustomed to see used in Bedfordshire and other of the midland counties, he has represented them in the wooden cut below;



in which *a*, *fig.* 1, is the iron or operative part of the tool, by which the bark is wrenched off the tree, made flat on its front side, and is thickest in the middle on the other side, the edges being ground sharp; *b* is the socket of iron joined thereto, and made to receive a wooden handle *c*, which crooks forward at its upper end. The use of this spud seems, even in stripping the bodies of the trees, to which it is best adapted, to be very inferior to the barking-iron represented in *fig.* 2; where the iron *a*, similar in shape to that in *fig.* 1 is joined to a square iron rod, having its corners hammered down, whose upper end is flattened, to enable it to be inserted and rivetted into a cross handle *c;* exactly similar to that of a carpenter's augur. With this barking-iron, the peeler is enabled to thrust forwards by the operation of both his arms, in separating the strong bark of the bodies of trees, and he can occasionally lunge his body or thighs against the middle of the handle, to assist in the operation, while the transverse direction of the handle gives him an opportunity of turning or wrenching up the bark, in a very superior manner to the operation of the bark-spud, first described: but whose principal defect appears, in stripping the arms and boughs of the tree, from its weight and awkward length, when compared with the small bark-iron, *fig.* 3; which is of a size somewhat smaller than a carpenter's spike-borer, but shorter in the shank, is more crooked than the large iron, *fig.* 2, and with a smaller iron *a*."

It is added that "boys are soon taught to use this last tool in the midland counties, in peeling the boughs, after a man has chopped the bark round, at the proper intervals for the length of the rinds; each man has one of these small irons stuck in the string of his apron for immediate use, when a bough or small arm falls in his way while peeling. Some gangs of peelers have also, he says, a third tool, intermediate between *fig.* 2 and 3, both in size and crookedness, which they use generally with one hand, but occasionally both can be applied in peeling the arms, which tool has a surprising effect and dispatch, compared with the use of the clumsy Kentish bark spud which seems so ill adapted to the peeling of the boughs, that such are in a great measure left unpeeled, a circumstance which greatly surprised him when he saw it; and reflected, that the price of bark is now full three times as much as it was when he first undertook the care of woods in Bedfordshire, in the year 1792; although he then found it profitable to peel each bough, almost a yard higher than is now the practice, in the district alluded to. But in justice to the Kentish labourers he ought to add, that they do every thing which can be expected of them, under the absurd system by which they are paid for their labour: this, as already observed, is by the yard of bark, which is here thus ascertained: a pole of several yards in length is supported on forked sticks driven into the ground, at about 14 to 18 inches above the surface; against this pole a row of rinds of bark, from the arms and boughs of the trees, and from such knotty parts of the body as did not admit of stripping in yard lengths, are set up on each side; after which another set of rinds, cut to the length of three feet before stripping from the tree, are set up against the former on each side, and the setting is completed by lay in

three thicknesses of the larger rinds along the top, as a cap. Three feet in length of the bark thus set up is called a yard, and thirty such yards a load of rough bark; so called, to distinguish it from 45 cwt. of shaved bark, which is the load of bark." The price of which is regularly stated in the returns of different markets. See *Barking of Trees.*

He says that "it must be plain to every person, that all the smaller pieces of bark can be of no avail to the peelers, in this mode of ascertaining the quantity of their work; and it happened as he walked through one of the woods that he picked up several fine thick and fleshy pieces of bark of the size of his hand, and larger, which he shewed to the peelers who had finished the tree where they lay, had stacked its bark and were peeling another tree; remarking, that he wondered they did not pick up all such pieces of bark; their reply was, Sir, our master don't desire us to pick up any pieces of bark which wont set up, because he gets nothing for them from the tanner, any more than we do for stripping and picking them up. This waste of bark in the loss of numerous small pieces, and what is left on the boughs, is but one of the evils attendant on paying the strippers by the yard, rather than by the weight of bark which they collect: for in seasons unfavourable to the stripping, it is impossible to prevent the men from hammering the bark, in order to make it part from the tree, in such sized pieces as are necessary for setting; although every place thus hammered is as effectually spoiled as a keeping apple or pear is, by a bruise at the time of gathering."

In the timber woods of Yorkshire, it is the custom with Mr. Beaumont when a wood is ready to go down, to set out and leave as follows, viz.

Every 21 years

"Poles, supposed to be left for a future fall, being judged to be 20 years old, which, in 40 years more, it is supposed, would be timber trees;—left on an acre upon an average	180
Trees, supposed to be 40 years old, left on an average per acre - - - -	10
Timber trees, supposed to be 60 years old at the time they are ready to go down, judged to be taken down on an average per acre	10

The reasons why the underwood is not kept cut quite down, are, viz.

"The brush or underwood would not turn to any profit, except that it stands for 21 years, and then it is taken down along with the timber, for different uses; such as binding hedges, making riddles, burning for charcoal, and many other uses. The trees that are left are at such a distance from one another, that they do not prevent any thing from growing, but what will pay in twenty years time: but if the brush or underwood was kept quite cut down, it would neither be so well for the timber and younger wood; that method having been tried, it was found that neither the wood nor the bark made so much improvement, owing to its being starved in the bottom, when the underwood was not admitted to grow.

"A tree left for a future fall, is chiefly one that grows from its own stem, and what we call a lerding, and perhaps only forty years old, which, to stand twenty years more, in general pays better than to take it down at that age.

"It is supposed, when a fall of wood is ready to go down, that with the poles, underwood, &c. it is worth fifty-five pounds per acre, upon an average.

"The value of wood set out to stand for a future fall, is judged, at the time of its being left, to be, upon an average, worth eighteen pounds per acre.

"The woodlands in general, if they should be quite cleared of all the wood, underwood, &c. and put into cultivation, which would be at an enormous expence, it is supposed, would only, upon an average, be worth five shillings per acre.

"It remains to be added, as another reason for taking down wood in the manner we do, that by this method we have wood for all sorts of customers; and as such can dispose of it to more advantage and convenience. The small wood is used for laths, baskets, puncheons for coal pits, hedge-stakes, &c. the larger for husbandry implements of every description; the large timber for house-carpenters, ship-carpenters, coopers, &c. &c."

In a valuable paper on the management of the forests in France, translated by sir John Talbot Dillon, and inserted in the fourth volume of Communications to the Board of Agriculture, it is advised to "cut the underwoods at those periodical returns of years, when the stubs shoot luxuriantly and the standards are in a thriving condition.

And that "the ages for the falls should be settled from 20 to 40 years; by no means earlier than 20 years; that the coppices may have some degree of vigour to produce a good fall, with sandils reserved of a promising appearance; and not later than 40 years, as after that date they will decline or at least improve no farther.

Wood-*Bound*, a term signifying such land as is encumbered with tall woody hedge-rows, so as to hinder the free circulation of air, and admission of the sun, by which its natural fertility and strength cannot be fully exerted.

Wood-*Cock Soil*, a term applied to such ground as has the soil under the turf of the colour of a woodcock's breast, and which is not said to be of a good kind.

Wood-*Land*, ground covered with wood, or such land as has wood growing upon it, which in some districts is very extensive. It is also a term used by the farmers of many counties of England, for a sort of soil, which from its constant humidity and dark colour, resembles the soil in woods, which, of whatever nature it originally is, will always be made to appear thus from the continual dropping of trees, and the want of a free air and sun, together with the fall of the leaves, decomposed, destroyed, and washed down by the wet.

This sort of soil in the open countries has a considerable quantity of clay in it, and holds the water a long time which once falls upon it: in wet weather it sticks firmly to the plough-shares; and, in dry, is very apt to crack. In uncultivated places it usually produces rushes and rush grass. A moist and dripping year is extremely detrimental to this sort of land.

All the poor waste ground in different parts of the kingdom which cannot be profitably converted to the growth of grain may be in general very advantageously conducted under some system of wood management. See *Woods*, *Plantations*, and *Planting*.

Wood *Layer*, a word applied to the young oak plants or other young timber laid into hedges, among the white-thorn, &c.

Wood *Soot*, a substance which has been found highly beneficial as a manure for cold clayey or stiff loamy soils, either in the state of pasture or laid down in tillage for grain or other arable crops: it is of a black shining colour, emits a disagreeable odour, and has a nauseous acid taste.

The proportions per acre, according to Mr. Malcolm, are as follows:

		bushels.		bushels.
On Light Loams.	For Pasture from	22	to	24
	— Barley	33	—	34
	— Turnips	33	—	36
On Chalky Loams.	For Pasture from	23	to	26
	— Turnips	33	—	38
	— Barley	35	—	40
On Strong Loams	For Pasture from	22	to	26
	— Artificial grasses (or more correctly green crops) -	28	—	34

Wood-*Wash*, a name sometimes given to dyer's broom.

WOODEN *Horse Collars*. See *Collar*.

WOOL, the coat or covering of sheep. In most cases each fleece consists of wool of several qualities and degrees of fineness, which the dealers carefully separate for their different purposes.

It is obvious that the culture and improvement of wool must be intimately connected with that of bettering the state of husbandry, and the sheep stock which it supports, as well as the advancement of the arts to which it is applicable, whether by the invention of machinery, the institution of new articles of manufacture, or the improvements in the processes by which they are brought to the condition of being exposed for sale. In this last way the improvements in the arts of dying have had a considerable effect.

But independently of these there are various causes which operate immediately upon the fleece as connected with the sheep. It has been remarked by a late intelligent writer, who is himself engaged as a dealer in the article of wool, that "the naturalist has commonly classed the tribe of sheep by their fleece, the colour of the face and legs, by the structure of the ears, the horns, the tail and the rump. The grazier classes them precisely in the same manner, but instead of using the term species, he considers each class as a distinct "breed;" and in order to distinguish the varieties which he perceives, he calls them "cross breeds." The term, it must be confessed, arises naturally from his peculiar pursuits, and is by no means improper. The wool stapler on the other hand, whose attention is confined chiefly to the fleece, has his peculiar arrangement; he distinguishes the hairy sheep, that which yields wool mingled with hair, and the pure wool-bearing animal. The first of these classes is evidently unconnected with his profession. In the coats of the two last, he observes numberless dissimilarities, and arranges them according to the colour of the pile, the length of the staple, the soil upon which the fleece was produced, and the country where it was shorn. These are the principal points to which he attends. The last is of no consequence, except so far as it is connected with his knowledge of the district. It then serves to give him a general idea of the wool which happens to be the subject of discourse. Hence he mostly connects with his description of the fleece, the name of the kingdom, or the county where it was grown. He speaks of the wool of Spain, of Portugal, or of Germany, of the fleeces of Sussex, of Norfolk, of Shropshire, of Northumberland, or of Scotland, and conveys to the ear of another stapler, by the epithet which he uses, an idea of the properties of the wool as correct as the graziers do of sheep, when they speak to each other of the Norfolk, the Ryeland, the Cheviot or the Dishley breeds."

And that "the division of fleeces into distinct classes which the wool-stapler so constantly adopts and finds so useful in his business, is intimately connected with a fact in natural history, which has been long since established beyond all possibility of doubt; that the sheep is so constituted as to yield a fleece peculiarly appropriated to its distinct breed; and that at every annual return of the season for shearing, the same animal under the same circumstances will afford a similar kind of wool. If therefore the colour of the pile was once white, it will be found so again; if the staple was long, it will return in the same form; if it was coarse and hairy it will be so still. A temporary and partial alteration may be produced in the fleece by certain circumstances, but there is no reason to suppose that in any case the constitution of the animal is so changed as to yield a kind of wool permanently different from that which it once afforded. The operation of slighter causes upon wool is constantly visible, and their effects have been noticed with some degree of precision, but the consequences which some of the more violent ones produced, such as affect very suddenly the temperature to which sheep are exposed, their nourishment and their health have been suffered to pass unrecorded and perhaps too often unobserved. The degree of information we at present possess, induces us, he says, to attribute the slight variation, which we perceive in the fleeces of the same flock, at different seasons of shearing them, not to the constitution of the animal, or to any change which takes place in its characteristic peculiarities, but to the influence of external circumstances which are perpetually varying, and seldom if ever change in a similar manner throughout two succeeding years. If the fact, that the fleeces which the sheep produces are similar to each other, be well established, and if it be not in the power of the less violent causes to produce a material difference in them; then nothing can more strongly evince how important it is for the wool grower to mark well the peculiarities of his flock, to place no dependance upon accidental and external circumstances for the production

of good fleeces, but to rely entirely and with confidence upon the properties with which nature has endowed his sheep. See *Sheep*.

The same writer likewise adds that "the improvement of wool, it should ever be recollected, consists in rendering it better adapted to manufactures. Alterations which fail of this grand purpose, if produced by design, are trifling and contemptible. If they render it less susceptible of an application to useful purposes they and the abettors of them deserve the severest reprehension of an enlightened agriculturist, who declares that "the debasement of the fleece is an act of treason against the state." But manufactures are so very changeable, and their demand for the raw material has been so uncertain past ages, that the grazier ought to observe with in the keen eye of a statesman, the public and the domestic occurrences of the moment, if he would produce from the backs of his sheep a commodity which shall possess the highest intrinsic value, and be most assiduously sought after."

The causes which produce the great varieties in the wool of sheep, so as to fit it for so many different uses are extremely numerous, as the breed of sheep which affects the pile or filament, the particular form of which may probably depend upon the nature of the pore of the skin, through which it passes. It being in some families of these animals perfectly round and even, while in others it is uniformly flat and smooth. This diversity of arrangement demands more regard than it has yet met with. The quantity of yolk has also considerable influence on the properties of the wool. The nature of the climate in regard to heat as well as moisture and dryness, likewise greatly affects the nature and quality of wool; the state of the pasture, and the nature of the herbage have further influence on the nature of the wool which is afforded by sheep. And the properties of the soil, as well as the care which is bestowed on the animals, are not less important in the effects which they have on the quality of wool.

In regard to the essential qualities of wool, it is observed by Mr. Luccock, that that is evidently most distinguished for good qualities, which may be fabricated into a valuable article, by means of the implements in common use, in the most perfect manner and with the smallest degree of labour and expence.

And that "when the fleeces are separated from the backs of the sheep, they are universally found to contain a variety of different kinds of wool very frequently suitable to the fabrication of articles very dissimilar in their nature, and adapted to processes in the manufacture of a description totally different from each other. The chief business of the stapler is to separate the portions of this mingled mass, to distribute them in their proper order, and to supply the manufacturers with the peculiar kind of wool required by the goods which each of them makes

This occupation constitutes him the agent of the manufacturer, or rather in his hands, wool passes through the first stage of the process, and [illegible] render it useful, and it becomes his business [illegible] interest to watch the state of trade, to notice the changes in the demand for different articles to remark the nature and the qualities of wool, and to point out to the grower, the properties of the fleece which are successively of superior or of smaller importance. The art of sorting wool, almost unknown a few centuries ago, has been very considerably improved during the last hundred years, and as the division of labour in most other branches of manufacture contributed to their advancement, so in the fabrication of woollens it has produced very essential benefits."

In Spain they are less nice in this business than in this country, merely tearing the fleece across the loins, taking off the skirts and dividing the remainder into three parts without much discrimination. But here it is the interest of the workman to be more scrupulous in the separation of the pile having introduced a much greater number of sections into his method of breaking the fleece. There are here three general kind of fleeces, each of them being sorted in a manner different from the others. "The finest includes all those adapted to the fabrication of woollen articles, and comprehends by far the larger proportion of the wool of the island; the second comprehends the longer pile, that which is suitable to worsted goods, and the other is confined to wool of a medium length that which is used in the hose trade. The number of sorts into which the fleeces of each class are divided, is always arbitrary; but custom has introduced an imperfect kind of system to which most staplers conform. The number of sections adopted in the hose trade is generally about six or seven, and the names applied to them only two, *drawing* and *matching*, but distinguished in the inferior divisions by the epithets common, fine, blue, brown and super. The fleeces suitable to worsted goods, when considered upon a scale comprehending most of that kind of wool produced in the kingdom, admit of about sixteen sorts, half of them obtained from the wool of sheep which have been shorn more than once, and the others from hog fleeces.

"Those who break the shorter wools, sometimes make about seventeen different divisions in a pile of fleeces, and very few staplers, even those who purchase the inferior parcels of this description, reckon fewer than nine sorts, but manufacturers sometimes content themselves with three or four distinctions. The names which in the east of the kingdom are commonly applied to the sorts broken out of small fleeces, furnish a curious illustration of the increasing fineness of the pile, since the art of sorting was made a distinct occupation, and likewise of the growing skill of the workmen who has almost constantly endeavoured to discriminate the size of the hair with greater exactness." That of the lowest sort or

"No. 1. Is *Short-coarse*; and very descriptive of its character.

2. *Livery* } Old sorts into which the fleece
3. *Abb* } was formerly divided.

4. *Second*. Probably a second or better abb, and the first alteration in the mode of sorting, which arose either from the

improvement of fleeces or in the art of breaking them. This and all the subsequent names seem to have been in their regular succession at the top of the list.

5. *Downrights.* Perhaps intended to convey the idea of superlative perfection.

6. *Head*, or chief.

7. *Super Head.* An advance upon the preceding sort.

8. *Picked Lock.* First made perhaps in small quantities.

9. *Choice Lock.* Still more excellent.

10. *Prime Lock.* The last sort introduced into the list, and in one instance called *Pic Nic*, alluding to the celebrated society of that name."

And the names of the others are borrowed from these, it is supposed, the sorts which they represent being introduced into such parts of the scale as had the largest divisions to admit them. They are mentioned as *Better Livery.*

Small Abb.

Best Second, with other titles of a similar kind.

And this catalogue of sorts advances in proportion to the hair or the fineness of the pile, being calculated to receive that part of the fleece which is suited to cloths of the lighter colours; and that what is suitable to the stronger tints may only be received, a list of sorts usually termed *Greys* is run parallel to it; as the *first*, *second*, and *third.*

The sorting of wool by means of a micrometer is advised by D'Aubenton for the manufacturers of France. And Mr. Luccock finds the pile of his own sort to arrange itself thus, when examined by a lens applied to a graduated scale.

The *Breech* or short coarse receiving all the short and very inferior locks, and the *Livery* those of the finer kind, but with great latitude of hair. And the diameters of the pile in all the others will be shown, if an inch be divided, being considered as unity, by the number annexed to each of the names.

Thus:

Better Livery	by	six hundred.
Fine Grey	—	seven hundred and twenty.
Seconds	—	eight hundred.
Downrights	—	nine hundred and twenty.
Head	—	one thousand.
Super	—	eleven hundred and sixty.
Picked Lock	—	twelve hundred and eighty.
Choice	—	Fourteen hundred.

It is remarked that these numbers are the average of repeated measurements, and considered as a sort of standard of the sorts to the names of which they are affixed.

It is therefore the object of the wool-stapler to have at a given price as large a proportion as he possibly can of the superior sorts; the fineness of the pile being the primary consideration. Thinness of hair can very seldom be considered a detriment to the fleece, while coarseness frequently unfits it for many different purposes. Length of staple in the present state of the woollen manufacture is an object of great moment, as it is this which destines the fleece to be wrought into fabrics, which are very different in their nature, and produced by implements of very different kinds.

The principal qualities which are requisite in carding wool, are a shortness of pile, and a disposition in the fibres of the hair to be put in a crumpled, shrivelling, or spring-like form, a disposition which has not been found capable of being communicated to wool where it does not originally exist.

While in respect to the combing wool, it is highly necessary that it possess a sufficient length as well as a degree of curvature or disposition to contract the length of pile, though this property should not too much prevail. The length of pile suited to this purpose is usually more than five inches, and some uses, as those of the hose trade require it from four to eight inches in length.

There are also many other properties highly essential to wool for different uses, such as pliability, toughness, the property of felting, softness, colour, relative weight, smell, trueness of hair, and various others.

The following table drawn up by Mr. Luccock will, however, afford a more correct idea of the nature of different wools:

TABLE.

The quality of English wool, arranged in classes according to the fineness of its pile.

CLASS.

No. 1.	*Packs.*
York, West Riding	6678
—— East ditto	6380
—— North ditto	5939
Westmoreland	3262
Cumberland	5915
Lincoln	2833
	31007

No. 2.	
Cambridge	1128
Hunts	2000
Beds	4450
Kent	7000
Hants	7257
Devon	7280
Cornwall	3382
Berkshire	4151
Oxford	5303
Bucks	2787
Herts	5297
Middlesex	750
Stafford	1526
Warwick	2287
Leicester	291
Nottingham	4112
Derby	4530
Chester	926
Carry forward	64,357

	Packs.
Brought forward	64357
Lancaster	4522
Durham	3320
Northumberland	12333
North Wales	5692
South-ditto	3570
	93694

	Packs.
Brought forward	38448
Monmouth	1431
Worcester	4820
Shropshire	4397
	53486

No. 3.

Essex	6486
Surry	3540
Wilts	8144
Dorset	9880
Somerset	9388
Gloucester	5400
Carried forward	38448

No. 4.

Norfolk	5697
Suffolk	5176
Sussex	9477
Hereford	4200
	24550

THE AVERAGE QUALITY

Of short wool is 1 inch divided by	871,	value	£15
——— Fleeces	885,		
Of Long wool	600		£13

TOTAL VALUE OF ENGLISH WOOL.

245,290 Packs of short wool at	15l.		£3,679,350
137,228 ——— Long ———	13		1,783,964
10,718 ——— Lamb's ——	10		107,180
		Total	£5,570,494

The slaughter of short wooled sheep is	4,221,748	per ann.
—— Carrion of ditto	211,087	
—— Slaughter of long wooled sheep	1,180,413	
—— Carrion of ditto	59,020	
—— Slaughter of lambs	1,400,560	
—— Carrion of ditto	70,028	
	7,142,856	

The number of lambs yeaned per annum, is	7,002,802
Annual decrease	140,054
	7,142,856

In describing the fleeces of this country, Mr. Luccock arranges them in two classes which are distinguished from each other both by the length of the staple and the mode of manufacturing them, the one adapted to the fabrication of woollen goods, and the other to that of worsteds. "The sheep from which these different kinds of staple are obtained, do not always he says run promiscuously in the same flock, or graze upon the same pastures; each being most commonly found upon its appropriate soil, and under a peculiar management. Sometimes the line which separates them is boldly drawn, at others the pastures are so mingled or the qualities of the land so gradually change, from those which are suitable to the heavier

sheep as to give the stock a sort of mongrel appearance, and the fleece an uncertain character. But human genius always fertile in expedients has rendered even this defect of the fleece advantageous to the interests of society, and has adapted it to the manufacture of stockings.

Thus though "long wool is found in many detached parts of England, but much more commonly on the eastern than western side, and often nearer to the coast than the middle of the kingdom. Among the larger ranges of long wooled sheep, the first to be noticed and the most northern, is situated near to the mouth of the Tees, a river separating the bishopric of Durham from the county of York. The second which may properly be denominated the Lincoln district, comprehends the south-eastern point of Yorkshire, nearly the whole of Lincolnshire, and the fen lands of Huntingdon, Cambridge, and Norfolk. This kind of wool is also found in the smaller marshes of Essex and of Kent, which surround the inlets of the sea, but is much more abundant in those of Romney and of Guildford. We meet with it in the counties of Dorset, Devon, and Cornwall, upon the Cotswold hills, in some detached parts of Lancashire, Oxford, Bedford and Stafford, through the whole of Leicester, Rutland, Northampton, and Huntingdon, and along the banks of the larger rivers."

But it is remarked that "the short wools of the kingdom do not arrange themselves so distinctly in districts as those of the longer staple do, but fill up the whole space besides that which has been noticed as the pasture of the heavier breeds of sheep. Those families which produce a fleece suitable to the card, though originally possessing features much more strongly characteristic than are found in the other kind, are sometimes so mingled with each other and with the sheep of the larger fleece, as to render it difficult to determine what particular race many of the individuals belong to. Yet it is convenient to describe them in classes, and to proceed from that county where the species appears most pure, to those where its blood becomes intimately mingled with that of another variety. Though the period when any of these sheep were introduced into the country is not known, nor whence they were procured, there remain at present in England and Wales six different kinds, viz. the Norfolk, the South Down, the Wiltshire, the Ryeland, the Heath sheep, and the Mountaineer; beside some small collections of different varieties which seem to have descended from families now almost extinct."

In the districts which produce these different sorts of wool, much variety is found in the nature of the sheep as well as the wool which they produce; and an equal diversity exists in regard to the methods or customs of disposing of it.

In regard to the manner of disposing of wool, Mr. Luccock states, "that in a small portion of Staffordshire, it is common to sell wool by the tod of 30lb. while in almost every other part of the Leicester and Lincoln districts, which he has noticed, the tod of 28lb. is used, and in order to accommodate the seller, a pair of seven pounds weights is conveyed by the stapler to the place where the wool is to be weighed. They are usually cast in a flat form, with the arms of his majesty upon them, and adjusted by the Tower standard. For the convenience of carrying them on horseback they are united by a thong of leather, which sometimes weighs from five to sixteen ounces. This some farmers allow to be balanced with the weights in order to make up the tod, and actually produce a weight for their wool which varies from 28lb. 10oz. to 30lb. The practice of using the strap, and of balancing it is commonly defended upon the ground of old acts of parliament which are said to allow such extra weight as a counterpoise to the moisture and the dirt which the fleeces contain; but at present, he believes, it rests entirely upon custom, being sanctioned by no law whatsoever. When the practice of using Tower weights was first adopted, the design was, he thinks, an admirable one, for it prevented those endless disputes which must have constantly arisen when the farmer sold his wool by handsell, a practice now entirely laid aside in Britain. But instead of promoting justice it has sometimes been made the means of fraud; for unless a specific bargain was made for the weight of the tod, as well as for the price of the wool, the quantity sold for a given sum of money was only nominal, and was to be determined by the conscience or the policy of the buyer. In many cases the increase of the tod to 30lb. did not more than compensate for the trash which was often found in the fleece; the manner of winding wool was shamefully unjust, for the bundles contained besides dirt of different kinds a quantity of *dag-locks* of wool from dead sheep, and that which had been shorn before the staple had attained its full length, of which the antient technical terms are now almost forgotten, even among staplers themselves. False-winding or the enwrapping of any wool or other substance in a fleece, which does not naturally belong to it, is still cognizable by the law, and punishable with a very heavy fine, to be recovered by an easy process. But farmers, at least the enlightened part of them, are guided in their commercial transactions by better principles than penal statutes afford, and the dishonest ones are soon known sufficiently to prevent any disadvantage accruing to them from practices which bring the whole body into disrepute among persons who indulge in general censure when irritated by the crimes of individuals. Buyers of wool, he is persuaded, would consult their own interest if they laid aside all local customs, and weighed wool from the farmers upon the same broad principles that are adopted among themselves. Indeed farmers are now so much better acquainted with the principles of commerce than they were formerly, as to see the advantages resulting from an universal weight as well as a regulated measure, and from exchanging local customs for more general manners, and he is acquainted with wool-staplers who rejoice when their weights, the badges and test of honesty, are found to be useless."

And it is further stated "that in the district

which in some measure may be denominated that of the Norfolk sheep, wool is often sold by the pound; in some parts of it by the tod of 28lb. and in others of 29lb.; but there seems through the whole a disposition to lay aside local customs, and to adopt those of a more general nature. The use of the strap is not always dispensed with; but many farmers complain of it, and are disposed to adopt a new method of weighing their wool, one which is calculated to destroy all ambiguity in the tod which they make use of."

And it is stated in addition by the same able writer, in speaking of the practice of Herefordshire in respect to wool, "that no other part of the country takes so much pains to render its fleece marketable as this. Here the old custom of employing sworn winders is, he says, diligently adhered to, and they are engaged to strip off the coarse part of the fleece and to wind up only the better kind of wool; to tie about half a dozen fleeces together and to ticket the weight of each bundle, or as it is there called trendle. In this county the bundle does not resemble that of Norfolk as sometimes supposed, for in Herefordshire the fleeces are wrapped up separately, very hard and commonly in the shape of a nine-pin, and of these the bundle is composed; but in Norfolk the unwound fleeces are spread upon each other, and when a sufficient number are thus disposed, all of them are rolled up in one general mass, and there also called a bundle. This latter is certainly the easiest and quickest mode of securing the fleeces, but it obliges the farmer to conceal the best of his wool, and the buyer to purchase it rather from recollection of the sorts which the parcel produced in former years, than from any opinion formed of the value of those particular fleeces which are offered to his notice. The parcel of a certain person, he knows, was last year either good or bad, and he supposes that its quality will not be greatly altered in this. But where every fleece is wrapped up singly, there is evidently much more room for the exercise of skill in estimating the value of a quantity of wool, and a more solid basis whereon to found a definite opinion. In Herefordshire fleeces are sold in public fairs by a stone of twelve pounds and an half."

These form the most material customs respecting the disposal of wool.

The tables introduced below which have been taken from the writer just mentioned, exhibit at one view the produce of our long and short wools, as arising in the different districts.

TABLE.

The Produce of English Long Wool.

District.	County.	Number of acres.	Proportionate Stock per acre.	Number of Sheep.	Weight of fleece.	Number of packs.
Teeswater	Durham	100,800	$\frac{2}{3}$	67,200	9*lb.*	2,520
	Yorkshire	61,250		14,310	8	477
Lincoln	Holderness	127,680	$\frac{25}{107}$	84,000	8	2,800
	Lincoln R. Land	413,875	$\frac{3}{1}$	1,241,625	9	46,561
	——— Marshes	175,000	$\frac{1}{2}$	87,500	8	2,916
	——— Misc Land	758,485	$\frac{2}{3}$	505,657	8	16,855
	Norfolk	55,428	$\frac{3}{7}$	38,500	7	1,123
	Cambridge	187,600	$\frac{1}{3}$	41,688	8	1,390
	Huntingdon	87,500	$\frac{1}{1}$	87,500	7	2,552
Leicester	Leicester	398,650	$\frac{2}{2}\frac{1}{7}$	380,528	7	11,100
	Northampton	560,000	$\frac{8}{7}$	640,000	6	16,000
	Rutland	117,000	—	114,000	5	2,370
	Warwick	182,875	$\frac{7}{8}$	160,000	5	3,333
	Stafford	14,000	$\frac{7}{25}$	3,720	7	113
Kent	Romney Marsh	46,920	$\frac{2}{4}\frac{1}{4}$	185,000	7	5,400
	Other marshes	65,000	$\frac{5}{3}$	108,330	7	3,160
Devonshire	South Hams	387,500	$\frac{1}{2}$	193,750	8	6,458
Cottswold	Gloucester	200,000	$\frac{1}{1}$	200,000	8	6,666
	Total	3,939,563		4,158,308		131,794

Slaughter 1,176,770 sheep.

196,128 producing long skin wool 5,720

carrion wool 286

——— 5,434

Neat total 137,228

And the following table gives the statements in respect to the quantity of short wool.

TABLE.

The Produce of English Short Wool.

District.	County.	Number of acres.	Proportionate Stock per acre.	Number of Sheep.	Weight of fleece.	Number of Packs.
Norfolk	Norfolk	1,260 572	$\frac{32}{59}$	683,701	2lb.	5,097
	Suffolk	817,000	$\frac{138}{227}$	497,000	$2\frac{1}{2}$	5,176
	Cambridge	187,600	$\frac{1}{4}$	67,744	4	1,128
	Huntingdon	141,000	$\frac{3}{4}$	108,000	$4\frac{1}{2}$	2,000
	Bedford	268,800	$\frac{92}{97}$	204,000	5	4,250
	Essex	778,400	$\frac{2}{3}$	519,000	3	6,486
South Down	Sussex Downs	211,200	$\frac{3}{2}$	316,800	2	2,640
	—— Low Land	623,840	$\frac{1145}{1305}$	547,000	3	6,837
	Kent	728,000	$\frac{405}{562}$	524,175	$3\frac{1}{4}$	7,000
	Hampshire	774,900	$\frac{2}{3}$	516,600	3	6,457
	Isle of Wight	87,500	$\frac{2}{3}$	61,000	$3\frac{1}{4}$	800
	Surrey	327,600	$\frac{5}{6}$	283,000	3	3,540
Wiltshire	Wilts Downs	437,000	$\frac{4}{3}$	583,500	$2\frac{3}{4}$	6,684
	—— Pasture	235,000	$\frac{1}{2}$	117,500	3	1,460
	Berkshire	408,800	$\frac{3}{4}$	306,600	$3\frac{1}{4}$	4,151
	Oxford	380,730	$\frac{4}{5}$	304,584	various	5,303
	Bucks	408,800	$\frac{6}{11}$	222,968	3	2,787
	Herts	369,600	$\frac{3}{4}$	277,000	$4\frac{1}{2}$	5,297
	Middlesex	76,000	$\frac{19}{32}$	45,000	4	750
Western	Dorset	700,000	$\frac{28}{31}$	632,240	$3\frac{3}{4}$	9,880
	Devon	873,700	$\frac{1}{2}$	436,850	4	7,280
	Cornwall	812,000	$\frac{1}{4}$	203,000	4	3,382
	Somerset	851,200	$\frac{10}{17}$	500,700	$4\frac{1}{2}$	9,388
	Gloucester	528,000	various	355,000	various	5,400
Hereford	Hereford	672,000	$\frac{3}{4}$	500,000	2	4,200
	Monmouth	322,625	various	177,619	various	1,431
	Worcester	369,600	$\frac{778}{870}$	330,504	$3\frac{1}{4}$	4,820
Heath	Shropshire	739,200	$\frac{373}{303}$	422,034	$2\frac{1}{2}$	4,397
	Stafford	549,360	$\frac{1}{3}$	183,120	2	1,526
	Warwick	365,925	$\frac{1}{2}$	182,967	3	2,287
	Leicester	59,000	$\frac{2}{5}$	20,000	$3\frac{1}{2}$	291
	Lincoln	309,120	$\frac{2}{5}$	123,648	$5\frac{1}{2}$	2,833
	Nottingham	435,680	$\frac{543}{926}$	255,147	various	4,112
	Derby	553,280	various	362,400	3	4,530
	Chester	588,000	various	65,000	various	926
	Lancaster	952,000	$\frac{263}{623}$	310,000	$3\frac{1}{2}$	4,522
	York, W. Riding	1,429,250	various	383,122	various	6,678
	—— E. Riding	454,720	$\frac{33}{49}$	306,240	5	6,380
	—— N. Riding	1,200,000	various	365,326	various	5,939
	Westmoreland	431,200	various	223,725	$3\frac{1}{2}$	3,262
	Cumberland	856,800	various	378,400	$3\frac{3}{4}$	5,915
	Durham	414,400	$\frac{5}{13}$	159,385	5	3,320
	Northumberland	1,108,800	various	538,162	$5\frac{1}{2}$	12,333
Welch	N. Wales	2,035,200	various	683,040	2	5,692
	S. Wales	2,284,800	$\frac{1}{4}$	571,200	$1\frac{1}{2}$	3,570
	Isle of Man	——	——	——	——	——
	Total	28,412,202		14,854,299		202,737

		Brought forward (short wool)		202,737
		Packs.		
Slaughtered 4,221,748 sheep — $\frac{3,25}{2}$ —		28,580	skin wool.	
Carrion	211,087	1,429	*Packs.*	
Slaughter of long wool sheep	980,642	3 12,258		
Carrion of ditto brought forward		286		
				42,553
		Total of short wool		245,290
		Ditto long ditto		137,228
		Packs.		
Wool from lambs slaughtered		2,918		
Ditto shorn - -		7,800		
				10,718
		Grand total		393,236

	lb.	*oz.*	
N. B. The average fleece of England nearly	4	8	
Do. - short wool	3	4	
Do. - - long wool	7	10	
Do. - stock per acre in England			$\frac{14}{3\frac{1}{2}}$ sheep
Do. - long wool			$\frac{20}{14}$ ditto
Do. - short ditto			$\frac{9}{2\frac{1}{2}}$ ditto
Do. - produce per acre long fleece wool	8	0	
Do. - - short ditto	1	5	
Do. - long skin wool	0	5	
Do. - short ditto	0	4	
Do. - - skin wool of the kingdom nearly	0	5	

It is stated on the whole, that "the several quantities of wool which are obtained from the larger and the smaller sorts of sheep collected when living, and from their pelts when dead, and when to these are added, that which is procured from lambs under a year old" that "the grand total of this substance produced in England and Wales, amounts to more than 393,000 packs. It is procured from more than twenty-six millions of wool-bearing quadrupeds, and from thirty-two millions three hundred and fifty-two thousand acres of ground."

It is observed, however, from the general view which has been given that "the English fleece appears susceptible of very great improvement. There are but few tracts, says Mr. Luccock of land, and these comparatively small ones, on which it has attained a moderate degree of perfection. Long wool, though not possessed of all the excellent qualities which ought to be communicated to it, is in general well adapted to those inferior worsted goods in the manufacture of which it is used, and also to those coarser kinds of woollen articles, which require a long knap and are calculated to produce an extraordinary degree of warmth. But a very small quantity only of this pile is applicable to superior articles, a more attenuated one might be produced, and would be found of great value. It must be observed with regret, he says, that during the last hundred years, the manufacture of worsted goods has greatly declined. If it be desirable to revive it, care must be employed to render them more thin, flexible, and soft; to give them a greater similitude to the fabrics of cotton, or of silk, to qualify them to endure the rivalry of the first of these articles both at home and abroad."

And that the short wool of England, is also still in a wretched state, for although some noble efforts to improve it have excited emulation and activity, yet when compared with what remains to be accomplished, but little has been already effected. When looking over the preceding table, says Mr. Luccock, we are surprised at the number of sheep in every district, which might be exchanged for a better stock, and with respect to their coats no wool-stapler, he is persuaded, who has any general acquaintance with the English fleece, will think him extravagant when he conjectures, "that of fifteen millions of short stapled ones, which the kingdom produces, there are not 500,000 which even border upon perfection. The southern districts where most has been done to improve both the carcase and the coat of the sheep, contain at present but few flocks which pretend to superior excellency. The wool of Norfolk, although greatly improved, in general is far inferior, not only to the best piles, but also to many samples which have been produced even by the native sheep. The best cultivated fleece of Sussex has not yet been obtained from every flock that grazes upon the downs, pastures most fit for the culture of wool. Nor has the Ryeland race of sheep, notwithstanding the superiority of its fleece, been allowed to retain possession of its ancient pastures. And though a few spi-

fited individuals have combined with various English breeds, the blood of the Spanish race, and by that means obtained a staple hitherto unequalled among English wools, yet those flocks are small, widely dispersed, have not at present descended to the hands of common farmers, and their wools compared with the whole produce of our soil, bears no greater proportion to it than the parks of our nobility do to the extended fields occupied by untitled farmers. The whole race of heath sheep must be banished from the northern counties, where they greatly abound or must change the nature of their staple, before the wools of England can be pronounced only moderately good. Where they range the fleece is positively a disgrace to the flocks, its shaggy staple is most fitted to the goat, to the ages of barbarism, and to countries where wool is of no estimation. Such animals are permitted to roam over the wide extended commons in these mountainous districts, merely because their constitutions are hardy and their mutton delicate. But, he asks, are there no sheep to be procured with a constitution equally strong, with flesh as well marbled and juices quite as palatable, whose fleeces are far superior? Did not the *old breed* of Scotland bear better wool, and was it unsuited to the pasture? Do not the mountains of Wales, as much exposed to moisture as those of Cumberland produce a finer wool? And is not the shorter and fuller fleece of the Penistone moors and of the Cheviot hills obtained from sheep which graze upon the very pastures of the black faced shaggy-coated breed? But if the carcases of these hairy animals do really possess qualities which in goodness counterpoise the egregious defects of their fleeces, let farmers tolerate them still; yet, let them show by judicious experiments, such as ought to convince the world, but especially those who are most interested in the improvement of flocks, that the excellences attributed to the mountain breed, are real, not imaginary, that they are peculiar, not common to any other race of sheep; that the execrable coat cannot be exchanged for a finer pile without substantial injury: let them do this, lest strangers noticing defective fleeces should upbraid the shepherds, and deem the produce of their flocks a proof of ignorance or prejudice."

These are powerful arguments in favour of the introduction of better breeds of sheep in so far as wool is concerned.

The writer has however, stated, that "only two modes of improving fleeces have yet been adopted. One consists in selecting those lambs for slaughter, which have the least valuable coat, the other in bringing into the flock male sheep, of the most approved breeds, in order that their progeny may perpetuate their best peculiarities. But that flocks might be amended much more rapidly if in addition to these common methods, a kind of barter in lambs were adopted between two districts situated near to each other, one of them possessing a superior, and the other a less valuable sheep. From the best flocks a great number of lambs are yearly slaughtered, without any regard to their good qualities, while perhaps, at only a short distance, a multitude of others are preserved without any attention to the badness of their coats. If these could be exchanged in such a manner that only the good ones should be preserved, and the inferior kinds alone should be sent to the shambles, the flocks of Britain would become every year more valuable, a few seasons would be sufficient to dispossess the least cultivated breeds of their present pastures. It were easy, he says, to point out parts of the kingdom where within the distance of a few miles, the fleeces differ in value full 50 per cent. where the pastures upon which the worst are produced, are equally well suited to a more valuable kind; and where the quantity of the inferior pile afforded by a single sheep by no means counterbalances the difference in price. Some persons perhaps may think this idea of transferring the best lambs of one district to the pastures of another, and the worst of this latter region to serve as a supply for the shambles of the first, more than chimerical. They perhaps may represent in forcible language the difficulty of inducing butchers to purchase only those lambs for slaughter which have the worst coats, of convincing the wool growers, that it is their interest to provide young stock from a distance, rather than to rear it for themselves; to give for it a greater price than can be obtained for their own lambs, and to judge of the value of these animals, as well by their fleece as their form and their flesh. These objections, however, would, says he, vanish from before the example of the wool growers of property, influence, and spirit; and the measure which he recommends is nothing more than adopting, with respect to wool, a principle upon which graziers have long acted in reference to the carcase."

It is supposed, that the willingness of the people in this country to purchase the manufactured article, whatever the prices, should act powerfully upon the wool-grower and compel him to cultivate a superior pile. It is an unpopular theme, says Mr. Luccock but after calm and deliberate thought he confesses it appears to him desirable that the growth of superfine wool, should be encouraged at home, that it should be encouraged even by imposts upon the article of foreign production, not indeed so heavy as to check the importation, but considerable enough to operate favourably upon the British fleece. See *Sheep*.

In this view of the nature of wool, many circumstances have been passed over as of little consequence to the sheep farmer, and others as being wholly connected with the manufacture of the article. And in speaking of sheep many points which are of great interest to the grazier and wool dealer have been brought to the notice of the reader which it is unnecessary to reconsider in this place. See *Sheep*.

A more full idea of the causes upon which the improvement of wool depends, and of its application to different useful purposes may be obtained by the perusal of the work mentioned so frequently above, the Annals of Agriculture, and other writings upon the subject.

Wool *Pack*, a certain quantity of wool packed up together; in London two hundred and forty two pounds constitute the pack; but in the country it is two hundred and forty-four pounds.

WOOLLEN-*Rags*, the rags formed by all sorts of woollen articles of the cloth kind. These when cut or chopped small are found excellent as a manure both turned under and applied upon the surface as a top-dressing. See *Manures* and *Top-dressing*.

WOOLLED-*Cord*, a term applied in some districts to the woollen yarn by which the bunches of weld are tied up.

WORK, a term signifying the labour performed by the farm servant or other person employed in agricultural business, either by the day, year, or piece.

The price of all descriptions of farm work has had a rapid advance in the last fifteen or twenty years. It is evident, however, that the general advancement of husbandry must in a great measure depend upon the price of all sorts of farm work being kept down as much as possible, as it is impossible to cultivate land in the most perfect or improved manner, where the price of labour is very high. See *Labour*, *Labourer*, *Servant*, and *Wages*.

In the county of Middlesex, the average price of day labour may at present be from 2s. to 2s. 6d. per day, but a great deal of the farm work is done by the piece.

In Hertfordshire the average price of labour varies from 10s. to 12s. the week at present, according to the report of that district.

The price of work in the county of Suffolk, is less variable than in many other districts; according to the Survey of the county, "it may be stated generally (beer included) at 1s. 4d. in winter, 1s. 6d. in summer, and 2s. 10d. in harvest. Call winter twenty-nine weeks, harvest five, and summer eighteen; this will make the year's earnings 23l. 18s. A woman earns six-pence, a day, and the wages of men servants rise from 5l. to 10l."

But "these are prices by the day; however the great mass of work in this county is done by the piece, in which earnings are usually much higher. With a clay cart, which goes on through winter, the earnings are pretty generally 10s. a week; and but little work is taken, at that season, for less than 9s. In summer, the rates are higher. In regard to the rise in labour, it is considerable. In the writer's own vicinity, he remembers it to have risen in twenty to twenty five years, from 1s. in winter, to 1s. 4d. a day; and in harvest from 10s. to 12s. and of late to 14s. a week. There are however parts of the county where the rise has not been equally great.

"Some rates of labour as communicated by correspondents, are: at Brome, from Lady-day to Michaelmas, 1s. 4d. and pint of beer; the other half year 1s. 2d. and ditto; at Hopton, 1s. 6d. summer, 1s. 4d. winter; at Fornham St. Martin, 1s. 5d. no beer; at Lackford, 9s. a week, and small beer.

In Norfolk where farm work is performed with a dispatch which deserves attention in other districts, the average price of labour is in summer 1s. 11d. per day, and in winter 1s. 8d. The general average for harvest work, is stated in the Report at 2l. 8s. 3d. per month with board.

In Gloucestershire the price of work is in winter per day, per man 1s. 6d. women 10d. in summer 2s. and 1s.

The following statements also shew the advance of it in different parts of Norfolk.

	1770.	1803.
Runcton,	Harvest, 2l. 2s. and board.	2l. 12s. 6d. and board.
	Hay, 1s. 6d. and beer.	2s. and beer.
	Winter, 1s. 2d. and beer.	1s. 9d. and beer.
	Reaping wheat, 4s. to 6s.	7s. to 8s.
	Reaping oats, 4s.	5s.
	Mowing barley, 1s. 6d.	2s.
	Mowing grass, 2s.	3s.
	Hoeing turnips, 4s. and 2s.	4s. 6d. and 2s. 6d.
	Threshing wheat, 2s. a quarter.	3s.
	Threshing barley, 1s.	1s. 6d.
	Threshing oats, 8d.	1s.
	Head man, 12l.	12l.
	Next ditto, 9l.	9l.
	Lad, 5l.	6l.
	Dairy maid, 4l. 10s.	4l. 10s.
	Others, 3l.	3l.
At Snettisham.	Five weeks harvest and board, 45s. to 50s.	2l. 12s. 6d.
	In hay time, a day, 1s. 6d. to 2s.	2s. 6d.
	In winter, 1s. 2d.	1s. 9d.
	Reaping, 5s. per acre.	12s.
	Mowing barley, 1s.	2s.
	Mowing grass, artificial, 1s. to 2s.	2s.
	——— natural	4s. 6d.
	Hoeing turnips, 4s. and 2s.	7s.
	Filling and spreading marle, 25s. per 120 loads.	28s. to 30s.
	Threshing wheat, per quarter, 1s. 2d. to 1s. 4d.	1s. 8d. to 2s.
	Threshing barley and oats, 8d.	8d. to 10d.
	Threshing pease, 8d. to 10d.	1s. 3d.
	Head man's wages, 10l. to 12l.	11l. to 15l.
	Next ditto, 9l.	7l. to 10l.
	Lad, 4l. to 7l.	4l. to 7l.
	Dairy maid, 5l.	5l.
	Other ditto, 3l. to 4l.	3l. to 5l.
	Women, in harvest, 1s. and board.	1s.
	in hay, 9d. and beer.	1s. No beer.
	in winter, 6d.	8d. No beer.

And in Essex, the difference in the rate of day labour from 1790 to 1804, is shewn in the following table:

DAY WORK.

	Price in Winter 1790.		Price in Winter 1804.		Price in Summer 1790.		Price in Summer 1804.		Price in Harvest 1790.		Price in Harvest 1804.	
	per week.		per week.		per week.		per week.		per week.		per week.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
	8	0	12	0	0	0	0	0	15	0	22	6
	8	0	12	0	9	0	15	0	15	0	21	0
	6	0	9	0	6	0	9	0	12	0	21	0
	7	0	9	0	7	0	9	0	18	0	31	6
	7	0	9	0	7	0	9	0	18	0	30	0
	9	0	10	0	10	0	12	0	21	0	31	6
	9	0	12	0	9	0	12	0	21	0	26	3
	7	6	12	0	10	0	15	0	21	0	30	0
	8	0	10	0	9	0	12	0	15	0	21	0
	7	0	9	0	7	0	9	0	8	0	10	6
Average	7	11	10	$5\frac{1}{4}$	8	$2\frac{1}{2}$	11	4	16	6	24	$6\frac{3}{4}$
Per cent		$42\frac{35}{65}$				$38\frac{14}{107}$				$48\frac{19}{22}$		

Work of most sorts is probably better performed by the piece than any other way, as the men work with more satisfaction and cheerfulness. See *Piece Work.*

Piece Work. In Middlesex the prices are these in performing work by the piece:

	s.		*s.*	
Mowing grass for hay from	2	to	6	per acre
Mowing, making, stacking, and thatching teams, and straw included,	20		30	Do.
Mowing clover first crop	-		3	Do.
Do. second crop	-		2 6	Do.
Mowing barley and oats	2 6		3 6	Do.
Stocking peas -	3 0		5 0	Do.
Mowing tares -	-		5 0	Do.
Reaping oats -	-		8 0	Do.
Bagging wheat and rye	10		18	Do.
Do. beans -	8		9	Do.

And in Gloucestershire it is thus stated by Mr. Rudge:

Breast-ploughing on saintfoin leys, burning and spreading, 1*l.* per acre: on Vale grass lands, 25*s.*

Breast-ploughing on pea stubble, or bean ditto, in the Vale, 7*s.*

Setting beans by line, 1*s.* 8*d.* without line, 1*s.* 6*d.* per bushel.

Hoeing ditto, 6*s.* per acre. Hoeing wheat, twice doing, 7*s.* 6*d.*

Cutting beans with a cradle scythe, 7*s.* Reaping wheat, 6*s.* to 8*s.* 6*d.* including binding, and stacking.

Mowing barley, 2*s.*

Threshing wheat, 2*s.* 6*d.* per quarter.

Threshing barley, 2*s.* per quarter.

Hoeing peas, 3*s.* 6*d.* per acre.

Threshing beans, 1*s.* 4*d.* per quarter. Oats, 1*s.* 3*d.* ditto.

Mowing grass, from 2*s.* 8*d.* to 3*s.* per acre; or mowing and making at 10*s.* 6*d.*

Making split hurdles, 5*s.* 6*d.* per dozen.

Making hogshead hoops per bundle of thirty-six, 3*s.* 6*d.* Cleaving lath, from 2*s.* 6*d.* to 3*s.* per thousand. Making fagots per hundred, 2*s.* 6*d.*

Fences. Planting quick hedge, digging ditch, double fencing, with rended oak posts and three rails mortised, 13*s.* per lug or perch.

Walling on the Cotswolds, 4 feet 8 inches high, covered at top with broad stones, without mortar, 8*d.* per yard.

Thorns for dry or dead hedging on the spot, 1*l.* 1*s.* per load.

Stakes, from 5*s.* to 7*s.* per hundred. Withy sets, for planting in the fences, 4*s.* per dozen.

Oak gates with five bars, from 18*s.* to 1*l.* 1*s.*

Elm ditto, from 13*s.* to 15*s.*

Hurdles of sawed stuff, Elm rails, and Oak heads, 9*s.* a piece.

Ditto of split Ash, 1*l.* 1*s.* per dozen. Wattled ditto, 8*s.* per dozen.

Draught Work. Hire of a team (waggon, four horses, man and boy) per day, 1*l.* 1*s.*

Ploughing per acre, with four horses, 15*s.*

Harrowing per acre, 4*s.*

In the northern districts the prices of ditching and forming stone dikes are for "the first (of which a man will commonly make one and one-fourth fall in a day), from 1*s.* to 1*s.* 2*d.* the fall, of six ells; and the other from 4*s.* to 6*s.* according to the convenience of stones; and from four to five feet high. A fall (or six ells) of four and a half feet dike, will take about 15 carts of stone: a good hand, with good stones, will build two and a half falls of it in a day; and a cart, travelling only at the rate of 16 miles a day, will bring 32 loads, or more than will build two falls, from a distance of a quarter of a mile.

Various tables shewing the rise of the prices of different sorts of farm work, also of that of artizans of different kinds from 1790 to 1803 and 1804, may be seen in the Reports of Essex and Norfolk.

WORK-SHOPS, places properly fitted up for performing different sorts of farm work in. In all cases where farms are extensive, places of this sort are extremely useful and convenient, for making and repairing different kinds of tools, as well as for preserving materials ready seasoned and prepared, for the purpose of constructing or mending ploughs, harrows, carts, wheels, and other implements of husbandry. By this means the farmer is sure of having his timber in proper condition, and always ready to his hand. These shops should always be provided with a good set of carpenters' tools, a bench to work upon, a lathe for turning different things, and a convenient grind-stone; and a blacksmith may often be necessary on farms of very considerable extent. And it would be likewise of advantage to have a place for timber and a saw pit near at hand. The latter might be made under the same roof with the work-shop, if convenient. In the former all sorts of wood or timber, and the broken and worn out implements should be deposited.

WORKING-HORSES, such as labour in the teams, as ploughs, carts, &c. See *Horse* and *Team*.

WORKING-OXEN, such as work in the teams. See *Oxen* and *Team*.

WORM, an animal which has much variety, and which is often very destructive to the roots of young corn, and other crops.

It has been observed that there are various kinds of worms that are more or less destructive to crops, as the red-worm, which has many feet, the small red-worm with no feet, the white worm which has a yellow head and many feet, and a white worm which has the appearance of a maggot. It is found that this eats the corn while in the ground before it rises above the surface, but that the other sorts eat the roots of the grain and turnips after they are in blade. These worms are all produced by a fly, and are not of any long continuance in the earth, merely harbouring in the ground when it is in a light, loose, porous state, proper for affording nourishment to their eggs, and bringing them to perfection.

It is remarked by Mr. Middleton, that "grubs may be very much reduced by ploughing, harrowing, scarifying, and rolling arable land during the months of March, April, and May; for as the eggs of the fly called *father long-legs*, and some others, are hatched in February, they continue in a state of grub till the beginning of June; then in *crysalis* a few weeks; and before the beginning of August, the flies come out, and immediately set about copulation and depositing their eggs." But that liming land is not destructive to earth-worms and grubs, or capable of protecting crops from their depredation: if it did, such insects would, he thinks, be unknown in all limestone and chalky soils. Thorough culture, and clearing the land from every vegetable for such a length of time as to destroy them by the ploughs and harrows, exposing them to be picked up by rooks and other birds, and by starving the rest to death for want of vegetables for them to eat, seems, he thinks, to be the only methods which promise success. On the breaking up of grass lands of every description, paring and burning is, he supposes, the first step, and most effectual for destroying the eggs of grubs, and many of the worms, and reducing the number sufficiently for a few years. When they have increased again, so as to threaten their doing much harm, the land should be thoroughly tilled and freed from such vegetables as can in any manner contribute to their support. And it seems, he says, by some experiments which have been lately made, that a solution of soot and water showered over land when grubs and worms are destroying the corn, will put a stop to their depredations; and that soot, sown on the land, will have the same effect on being dissolved by the dews or rain." And that when applied in a large proportion it would have the power of destroying them in a great degree. See *Grub*, *Red-Worm*, and *Wire-Worm*.

WORM, *Red*, the name of a worm which often makes great havoc in grain and other sorts of crops. In the vicinity of Watton and Hinghan in Norfolk, this as well as the cockchaffer grub has been found highly destructive in grass lands: but they have encouraged rooks every where, with some effect: and sea-gulls fortunately resort very much to lay their eggs on an island in Scoulton Meer, and rear great numbers of young, undisturbed, as they are known to feed only on worms and grubs, no seed having been found in their crops. They come at the end of March, and migrate in July." See *Red-Worm*.

WORM, *Wire*, a most mischievous worm, which attacks the roots of grain crops, and produces great injury to them in the winter and early spring months. See *Wire-worm*.

WORMING, in *Farriery*, an operation performed on puppies, under an ignorant supposition that it prevents their going mad; but in reality to cure them, as it generally does, of the disposition to gnaw every thing in their way. It consists in the removal of a small worm-like ligament, situated beneath the tongue; and the part being afterwards sore for some days, the animal is thus weaned of his mischievous habits.

WORMS, in *Farriery*, a troublesome sort of vermin found in the intestines of horses and other animals.

"There is nothing," says Mr. Denny, "so destructive to the health and appearance of the horse as worms. When they have obtained a settlement in the intestines, neither the labour of the groom, nor the liberality of the master, will prove of any avail towards improving the animal's condition: for as fast as the chyle is formed from the aliment, which ought to be converted into blood, these numerous guests first satiate their craving appetites, and leave but a scanty supply for the exhausted system of the horse: so that a double allowance of corn would not preserve a healthy state; because the digestive organs cannot exert an extraordinary power for any length of time, without producing such a state of debility as to render them incapable of performing afterwards their proper office."

In these animals the most common kinds are the following: 1, botts, which many young horses are subject to in the spring: 2, those that resemble earth-worms, and which, by physicians, are called teretes or rotundi: 3, those that are about the size of the largest sewing-needles, with flat heads, called asca-

rides: 4, that species of worm called *tænia*, or tape-worm. Whatever variety be observable in these different kinds, except the last, it consists chiefly in the difference of their size and colour, which are only accidental. We shall speak of these in their order. The botts, that are found in the stomachs of horses, and are sometimes the cause of convulsions, appear to be of the same kind with those in the rectum, being only somewhat larger and of a deeper red colour. They are exactly the same in shape and figure, both having little sharp prickly feet along the sides of their bellies, like the feet of hog-lice, which seem to be of use to fasten them more securely to the part where they are found, and from whence they draw their nourishment till they come to maturity.

And the teretes are of the same kind with those we often see voided by children. They resemble common earth-worms in many respects, only that they are sharper at both ends, are more callous towards the middle, and do not so easily contract or dilate themselves. In children, and in grown persons too, they seldom exceed six inches in length; but Gibson says, he has known them to be passed by horses of a size larger than a man's finger, and about eighteen inches long, and some of them, when slit open, full of eggs. These, notwithstanding, are seldom hurtful to horses, further than as they hinder them from thriving and appearing in condition.

And the small worms like needles resemble those in the human body called ascarides; some of them are white and some of an azure colour, with flattish heads. These are very troublesome and hard to be expelled, and they expose horses, more than any of the other kinds, to gripes, and other uneasy affections of the intestines.

With respect to the cause of worms in horses, it is imagined that, as in the human subject, some constitutions are more inclinable to breed worms than others. Gibson says, the most usual cause of worms is foul or high feeding, which occasion crudities and slimy indigested matter in the stomach and bowels (especially in horses that have been pampered for sale), forming a proper nidus for worms. This indeed may be the case, but the primary cause of worms is that which occasions these crudities, to wit, a want of energy in the functions of the stomach and bowels, as worms are never found in animals perfectly healthy in these respects.

According to Gibson, "the signs of worms in horses," are various, according to their different kinds. The botts that many horses are troubled with in the beginning of summer are always found sticking to the rectum, and are often thrust out with the dung, along with a yellowish coloured matter like melted sulphur. They are no way dangerous there, but they are apt to make a horse restless and uneasy, and rub his breech against the posts. The season of their coming is usually in the months of May and June, after which they are seldom to be seen, and rarely continue in any one horse above a fortnight or three weeks. Those that take possession of the membranous portion of the stomach, are extremely dangerous in causing convulsions, and are seldom discovered by any previous signs before they bring a horse into violent agonies." See *Botts*.

But the *teretes* or earth-worms give little disturbance to a horse, and would hardly be discovered, unless they were seen now and then to come away with the dung. Frequently horses void one or two, and no more; and sometimes they will void pretty large quantities of the young brood, not much larger than the ascarides, only of a red colour, and not white, as the latter generally are. They are most usual in autumn, or the beginning of winter, though a horse may now and then void one or two of these at other times of the year.

However the *ascarides*, or small needle-like worms, are very troublesome to horses, breed at all times of the year, and often when one breed is destroyed another succeeds. These are not at all dangerous, yet when a horse is pestered in this sort of way, though he will go through his business tolerably well, and sometimes feed heartily, yet he always looks lean and jaded; his hair stares as if he was sickly, and nothing that he eats makes him thrive. That he feels pain too is plain, for he often strikes his hind foot against his belly, which shows where his grievance lies, and is sometimes griped, but yet without the very violent symptoms that attend a colic or strangury. He never rolls or tumbles, but only shews uneasiness, and generally lays himself down quietly on his belly for a little while, and then gets up, and begins to feed; but the surest sign is, when a horse voids these worms with his dung.

In regard to the cure, if a horse be troubled with botts, Gibson says, he may be relieved without much expense or trouble, only by giving him a spoonful of savin, cut very small, once or twice every day, in oats or bran moistened; and if three or four cloves of chopped garlick be mixed with the savin, it will do better, for garlick is of great service in these complaints. Horses that are troubled with botts ought to be purged with calomel and aloetic purges before the weather grows too hot; and if they be kept to a clean diet after this, it will be a great chance if ever they are troubled with them any more. As the botts generally happen about the grass season, those horses that are turned out to grass often get rid of them there, by the first fortnight's purging; and therefore those that have the convenience of a good pasture for their horses need not be very solicitous about giving them medicines.

And the earth-worms, which some writers call *teretes*, *rotundi*, or *lumbrici*, are also best conquered by calomel and occasional aloetic purges, for worms often come away in purging, when, till then, it has not been known that the horse was troubled with them; and it has been observed, after these have been voided, that the animal has thriven better, grown more lively, and shewn more alertness at his business. There can scarcely be a better plan of treatment than is supplied in the following formulæ recommended by Mr. Denny in his useful work.

Take of Calomel, one drachm;
Aniseeds, in powder, half an ounce;
Treacle, enough to make a ball.

He advises, this is to be given in the evening; and the next morning the following:

Take of Succotrine aloes, in powder, one ounce;
Ginger, in powder, two drachms;
Treacle, enough to make a ball.

And the above bolus and purgative ball must be repeated, with an interval of nine days, until the horse has taken three doses. Then he advises to give the following alterative powder, daily for about a month. This process does not require any change of diet, or involve any hazard from the effects of cold:

Take of Ethiops mineral,
Crude antimony, prepared,
Aniseeds in powder, half an ounce.
Mix them.

The management of the horse during this course of worm medicines is that in common cases of physic. But some prefer giving Barbadoes aloes for the removal of worms, thinking it the more efficacious because its operation is very rough. And Gibson thinks, it may be given to hackneys, and other horses of small value; but he never found it more efficacious than the succotrine, at the same time that it exposes a horse more to gripes and other dangerous disorders, unless it be properly managed. The following he gives as a cheap well corrected purge of this kind:

Take of Barbadoes aloes, one ounce;
Salt of tartar, two drachms;
Ginger, grated, a drachm and a half;
Oil of amber, a middling spoonful;
Syrup of buckthorn, sufficient to make a ball.

The only objection to this is, the quantity of aloes, which would be too considerable even if of a milder sort.

It may be observed that the sort of worms called ascarides sometimes come away from a horse in great numbers, with the help of a purge, and some get quite clear of them with purges only. But this does not very often happen, for the horses that breed ascarides, above all others, are subject to slime and foulness in their intestines. In the human body ascarides are thought to be bred in the rectum, near to the fundament, but in horses no other kind than botts usually adhere to that gut. On the contrary, these worms in them seem to be lodged about the beginning of the small intestines near the stomach, where they feed on the alimentary parts of the chyle. The botts, in a horse, are often seen sticking near the sphincter ani, and are continually dropping away with the dung. But the ascarides are seldom seen there, except when the animal has had a purge given him, or when he falls into a natural purging, which often happens from the irritation of the bowels, and then they come away in very great numbers, accompanied with much slime and mucus. Botts seldom alter a horse's looks, but these not only make a horse grow lean, and look emaciated, but on opening his mouth one may perceive a more than ordinary languid whiteness, and a sickly smell instead of that liveliness of colour that is always perceivable in the mouth of a sound and vigorous horse. So that, whatever be the primary cause, these worms seem in a great measure to proceed from a vitiated appetite and a weak digestion, which renders them the more difficult to be removed; for which purpose recourse must be first had to the foregoing remedies, and after them, such medicines as are proper to strengthen the stomach, promote digestion, and give tone to the solids.

The treatment advised by Gibson for these worms is chiefly the following:

Take of Calomel, prepared, two drachms;
Diapente, half an ounce;
Make these into a ball, with a sufficient quantity of conserve of roses, and give it in the morning, keeping the horse from meat an hour or two before and after the dose.

And next morning administer a moderate aloetic purge, taking great care to keep the horse from wet or from any thing that may expose him to take cold. The above calomel ball, and the purge may be repeated in six or eight days, and again in six or eight days more. Or the following mercurial purge may be given, which will be less troublesome though not less efficacious;

Take of Crude quicksilver, two drachms;
Venice turpentine, half an ounce.
Rub the quicksilver with the turpentine in a mortar till no particle of the former appear; then add,
Oil of savin, thirty or forty drops;
Succotrine aloes, in powder, half an ounce,
Ginger, grated, one drachm;
Syrup of buckthorn, enough to make it up into a ball.

One of these mercurial purges may be given in the foregoing manner, viz. one in six or eight days, with all the same precautions. It will work mildly, and with little or no griping or sickness. And another mercurial purge, which is proper to destroy worms and to cleanse the first passages is this;

Take of Diagridium,
Calx of antimony,
Calomel, of each two drachms;
Succotrine aloes, six drachms;
Ginger, grated, one drachm;
Oil of savin, cloves, or aniseeds, thirty or forty drops;
Syrup of buckthorn, enough to form the ball.
To be given as the preceding.

When a horse has gone through a course of these mercurial purges, some advise the following drink to be given two or three times a-week, or till the horse begins to thrive and look healthy;

Take of Rue,
Chamomile flowers,
Horehound, of each a handful;
Galangals, bruised in a mortar three drachms;
Liquorice root, sliced, an ounce.
Boil these in a quart or three pints of forge-water fifteen or sixteen minutes, in a covered

vessel, and keep it covered till cold, then strain it through a piece of coarse canvas, and give it in the morning upon an empty stomach.

Powdered tin has likewise been advised with the intention of destroying worms. And also most of the preparations of antimony; sulphur is also good in all such cases; and even crude antimony in fine powder, given with equal parts of sulphur, often succeeds in the proportion of an ounce in the morning and another at night.

There is also a kind of worms which are frequently fatal to the gallinaceous birds, of which a curious account has been given by Mr. Weinsenthal in the Medical and Physical Journal. The inconvenience produced by these creatures is at first but slight: however, it gradually becomes more and more oppressive, until it ultimately destroys. Very few indeed recover; they languish, grow dispirited, droop, and die. It is found, on dissection, that these symptoms are occasioned by worms in the trachea. The writer has seen the whole of it completely filled with these worms, and has been astonished at the animal's being capable of respiration at all under such circumstances.

They are of a reddish colour, and at first view resemble the human *lumbricus;* but when examined, are materially different. When exposed to the microscope, they are found to have an orifice or mouth at one end, formed for suction; the other end, as far as it can be ascertained, is imperforated. The intestinal tube, is much convoluted, like that of the lumbricus.

It does not appear that any effectual remedy has been yet discovered, for removing these most destructive animals. They have been drawn out of the trachea by means of a feather, stripped from near its end, which is passed into the larynx and twisted round till it engages one or two of the worms, which are extracted, but without any relief to the animal after the operation has been performed.

WOTEHAT, provincially applied to an orchard.

WOTS, provincially oats.

WOULD, a term applied in some districts to signify the same as wold. See *Wold.*

Would-*Land*, that sort which remains in the state of wold. Much land of this description, both in Yorkshire, Gloucestershire, and other counties, have been lately much improved by inclosing and cultivation. See *Waste Land.*

WOULDS, a term applied by some writers on husbandry to crops of the woad kind. See *Woad.*

WOUND, in *Farriery*, a solution of continuity in the soft parts of an animal body, made by a hard or sharp instrument. It may however be noticed that obtuse instruments wound, and sharp ones cut into the bones. Horses and other cattle are exposed to various accidents of this kind, from many different causes.

In all such wounds as are superficial, when cleaned from the blood, &c. as they are perceptible to the sight nothing is necessary in the way of examination, but when they are too deep to be seen into, it is requisite to examine them either with the finger or with a blunt probe. Where the wound is too small for the finger, a bougie is supposed by some to be better than a metal probe, on account of its flexibility, especially where the wound takes a winding direction. In examining a wound, it is of advantage to know the situation the animal was in when it received it, the kind of weapon, how far it penetrated, how it was directed, with what force the blow was given, &c. and it should be noticed, what kind of fluid is discharged from the wound. The knowledge of these circumstances with that of the animal frame, the use, &c. of each part, enables the farrier to judge rightly of the nature of the wound, its consequences, and method of cure which will be necessary.

It may be observed that the danger from a wound will be in proportion to the size of the vessels that are divided, and the importance of the injured part with respect to life. The nearer the wound is to a vital part, the more dangerous it is. Wounds in the joints are healed with difficulty; so are those that are situated in any part subject to constant motion, as in the lungs or belly. The attending symptoms render a wound more or less dangerous. Dividing a principal artery in a limb, endangers mortification; a principal nerve, insensibility, and an atrophy. Separation of a tendon destroys as much motion as depends on the muscle connected with it. A wound in the spinal marrow causes death, or a mortification in the lower parts. And an immoderate suppuration in a deep wound, by absorption, may cause a hectic disposition in the animal.

The different progressive states of a wound may be considered under those of digestion, or the discharge of matter; incarnation, or filling up with new flesh; and cicatrization, skinning over or healing.

In the treatment of wounds, the following particulars should be attended to. When the extraneous bodies are extracted, the hæmorrhage suppressed, if it can be done prudently, all morbid tensions in the wounded part removed, and the lips of the wound, where this is required, brought properly together, the dressings may be pledgets of soft lint covered with one of tow, spread with some digestive ointment, and large enough to cover the whole; these may be secured by means of such bandages as the situation of the wound best admits of: the first dressings usually remain three or four days, or until the discharge of matter renders the separation of them easy. After the first are removed, the dressing may be repeated every twelve or twenty-four hours, according as the discharge is more or less abundant or acrid. If after the first dressing a warm digestive is found requisite, add to the yellow basilicon, a little oil of turpentine or balsam of caprivi. These applications need not be warmed, except when very cold; after spreading the pledget, its surface may be just warmed by holding it before the fire; each time that the surface of the wound is cleansed, it should be performed by dabbing it gently with soft lint, and not wiping it, lest the tender granulations should be destroyed. The surface of the wound should not be made quite dry, but be left somewhat moist, as the digestion is less interrupted in this case and the healing forwarded,

It has been commonly observed that the principal interruption to the healing of a wound, made with a sharp instrument, is the fungus. This, however, may be suppressed by dry tow or lint and a proper compress upon it: or if it advance above the surface of the skin, the edges need only be touched with some escharotic, as blue vitriol. But it sometimes happens that an obstruction to healing is the flabbiness of a wound, which is generally removed by dabbing, at each dressing, with lime-water and tincture of myrrh, or with a solution of corrosive sublimate. Thus, if an ill constitution or bad habit of the animal is no impediment, wounds on the exterior parts are generally soon healed.

After the wound is filled up with flesh, dusting the surface with prepared lapis calaminaris will usually effect the last intention of cure, or that of the cicatrising of the wound, and thus finish the healing process.

Besides these there are many accidents which occasionally are attendant on wounds in one stage or other, such as fever, inflammation, &c. the management of which will be learned from what is observed under the different heads to which they belong.

In case a small artery be wounded, if it be quite divided it retracts, and the hæmorrhage is soon spontaneously restrained; if it is punctured or partially divided, if it can conveniently be come at, it may be wholly divided, or the wound enlarged, and then the artery may be tied, if proper pressure proves ineffectual. When a large artery is punctured or divided, it must be taken up and secured with a needle and ligature.

As wounds sometimes penetrate the cavity of the breast and belly, and sometimes injure one or more of the viscera; the first are known by the probe, the latter by the discharge that issues from them; if the symptoms attending a wound that penetrates into the cavity of the breast or belly are favourable, and there is no discharge from any of the viscera, it may be concluded that the viscera are unhurt; in which case, after excluding the air that may have rushed into these cavities, they may be treated as simple wounds. If any of the viscera have protruded and are unhurt, they should be returned with all speed; but if wounded, use the glover's future, leaving three or four inches of the ligature out of the wound. If the protruded viscera have been exposed to the air, it may be necessary, before the return of them, to use a fomentation of warm milk and water, or some thin starch. In all these cases flannel is the best bandage, because it gives way and retreats as the breath requires.

And wounds in the principal internal blood-vessels are all deemed mortal; but blood is sometimes discharged from smaller vessels into the cavity of the breast or of the belly; if this happens in the breast, it occasions great difficulty of breathing. To discharge this blood, if the wound be in the lower part of the breast, the lungs may be pushed back with a probe, that the blood may pass out; if the wound is in the upper part of the breast, an opening must be made at the most depending part, allowing the other to close. But, until the hæmorrhage appears to have ceased, which may be judged of by the strength and equality of the pulse, and the warmth of the animal's extremities, any operation will be useless. When the opening is made, the expulsion of the matter is assisted by the efforts of respiration. In these cases the animal must be kept still, and opium given if a cough attends. If blood is poured into the belly, there will soon be laborious breathing, anxiety, and intermitting pulse, &c. If the discharge of blood is small, the animal sometimes recovers, but, if considerable, it general proves fatal to it.

In cases where a nerve is wounded, a variety of alarming symptoms come on in proportion to the tenseness of the part it is attached to, and the peculiar irritability of the constitution. When the pain is extreme, it sometimes is relieved only by dividing the nerve. This accident is soon discovered by the sharp ichor which distils from the part, and its excoriating the circumjacent parts. When a tendon is wounded, the same symptoms do not follow as when a nerve is injured. Swelling occurs, though not suddenly, advancing gradually with the inflammation. The most common applications to wounded nerves and tendons have been of the spirituous sort, such as the oil of turpentine, &c. but they are productive of the worst symptoms. Instead of these, put the limb into the easiest position, keep the wounded part free from cold air, avoid spirituous and hot applications, and in their stead apply warm poultices, having first covered the wound with lint; or instead of the poultice, cloths may be applied after dipping them in warm brandy and vinegar mixed in equal parts. Fomentations may be used before the application of the poultice, if inflammation attends, or seems to be approaching; or if the case admits of it, the part may be soaked in warm water.

Such wounds as penetrate the joints, when they are inflicted with cutting instruments, or with heavy weapons falling on them, are attended with danger. Though the wound is small, its consequences are often grievous, from irritation, from the admission of the air, from the loss of synovia, &c. Much depends on the habit. From a large wound in the joint, caused by a fracture, nothing remarkable has followed; yet fatal consequences have been the result of a small one in other instances. However favourable appearances may be, a guarded prognostic should always be given. Penetrating wounds of the joints are almost always dangerous. And a mere incised wound into a joint from letting in air and injuring the ligamentous parts, has often proved fatal. The two great consequences to be avoided in wounds of the joints are inflammation and pain; the first is to be attempted by bleeding, and pursuing the antiphlogistic or debilitating plan; the latter, by the position of the limb and by opiates. The most relaxed position of the limb is the best. If no tumefaction comes on, emollient applications are not wanted; but if tumefaction tension, &c. appear, immediately apply emollients. There is a symptomatic fever generally attendant, exclusive of any other circumstances, and this is sometimes attended with such a discharge as to reduce the patient greatly, in a very short time.

It has been remarked by Gibson, "when horses happen to be wounded on the joints, especially when

they break their knees by falling down, or when they cut or over reach; in all such cases a pledget laid over the wound, spread with common digestive, and bound on with a roller of broad tape or list, will seldom fail of a speedy cure, unless a horse also have the grease, and then the case must be treated as such. If any small abscesses be formed under the skin, these may be opened by incision, in order that no lodgment may be left for the matter. But in the knee, and all the other joints, care must be taken to prevent inflammation, or to abate it if already begun, by the use of proper fomentations or poultices. These effects, however, are more frequent in punctured wounds, that have been caused by thorns or small splinters than in wounds that are larger. Horses are sometimes in very great pain with punctures on their knees, hocks, or pasterns, and sometimes with contused wounds that have been apparently inconsiderable, and without the least sign of inflammation. But these, though in themselves somewhat dangerous, are generally relieved by the timely use of emollient fomentations and astringent remedies."

In common simple wounds of horses it is stated in the valuable Survey of Essex that Mr. Wood of Ingatestone, has had much success in their cure by restricting them from water. It is, says the writer, remarkable, "that when any horse has a wound, the only chance of a cure, if it be a bad one, is keeping him from water. He has had some cases so bad, that cures were despaired of; but by an absolute prohibition of water till the wound runs good matter, he has effected several surprising cures."

A case is stated which deserves attention. "He had a horse wounded by a kick, and by very bad management of a farrier, was after a fortnight returned much worse than he was sent, with an enormous load of proud flesh on the wound." From having read of the great effect of a solution of common salt in water, in reducing an inveterate wen on the human body, when often applied; "it struck him that the same application might be used to reduce proud flesh on his horse; and accordingly he tried fomentations of hot beef brine five times a day: the success was rapid and complete; the horse was cured, and has now been posting for four years past."

In regard to the treatment of gun-shot wounds, some peculiarity of management is necessary; these, when they take place in horses, require a treatment almost exactly similar to the same kind of wounds in the human subject, since there can exist no other difference than what arises from the stronger powers of restoration in the former. And they can be considered in no other light than contused wounds. In those made by a musket or pistol ball, the most immediate considerations are to extract the ball, or any other extraneous body which may have lodged in the wounded part, and to stop the hæmorrhage, if there be an effusion of blood from the rupture of some considerable artery. In doing which it is frequently necessary to enlarge the wound, in order to extract the ball; and if it has gone quite through (provided the situation of the part wounded will admit of its being done with safety), the wound is to be laid freely open through its whole length; by which means any extraneous body will be more readily removed, and the cure facilitated. And in order to get at the ball, or any other foreign matter, probing is to be used as sparingly as possible; and this must evidently appear to any one who will only consider the nature of the symptoms attendant on penetrating wounds of the breast or the belly, either from a bullet or sharp instrument; the thrusting in a probe to parts under such circumstances being unavoidably a fresh stab on every repetition of such practice. If probing be necessary, the finger should be preferred as the best and truest probe where it can be used; where it cannot, a bougie may answer the purpose. Where a ball, or any other foreign body, happens to be lodged near the orifice, or can be perceived by the finger to lie under the skin, though at some distance from the mouth of the wound, we should cut down to it, and take it out; but when it is sunk deep, and lies absolutely beyond the reach of the finger, it must appear evident, upon the least reflection, that thrusting first a long probe in quest of the bullet, and then, as has been practised likewise, a longer pair of forceps, either with or without teeth, into a wound of that kind, though with a sort of certainty to extract it, must either contuse, or irritate, and inflame, the parts to a greater degree; and, consequently, do as much or more mischief than the ball did at first by forcing its passage such a length of way. And should they, at the same time, lay hold of any considerable artery or nerve along with the ball (which can scarce fail of being the case), what hurtful consequences would attend such a proceeding! Nor would attempts of this sort be less injurious, in case a bullet should happen to be lodged in the cavity of the belly or breast. Such attempts are the less necessary, because a greater number of instances have occurred, where balls have quietly lodged in several parts of the body, till, after many years they have worked themselves a passage towards the surface, and were very easily extracted, and many where balls have been entirely left behind without any ill consequence being experienced from them.

But in case the wound be occasioned by a musket, or pistol shot, and of course but small, it will be deemed necessary to *dilate it* without delay, provided the nature of the part will admit of this with safety, for in wounds near a joint, or in very membranous or tendinous parts, the knife as well as forceps, should be put under some restraint; nor should any more opening be made than what is absolutely requisite for the free discharge of the matter lodged within the part.

And in the general treatment "where the wounded animal has not suffered any great loss of blood (and this is generally the case), it will be adviseable to open a vein immediately, and take from the same a larger quantity; and to repeat the bleeding, as circumstances may require, the second and even the third day. Repeated bleedings in the beginning draw after them many advantages; they prevent a good deal of pain and inflammation, lessen any feverish assaults, forward the digestion, and seldom fail to obviate imposthumations, and a long train of com-

plicated symptoms, which are wont otherwise to interrupt the cure, miserably harrass the poor animal, and too often endanger his life. Even where the feverish symptoms run high, and there is almost a certainty that matter is forming, bleeding, in that state is very frequently of great advantage and benefit.

In cases where a gun-shot wound has penetrated any of the large joints, and in passing through them, fractured the ends of the bonds, it will then be found for the most part impossible, let the skill or abilities of the farrier be ever so great, to preserve both the life and limb of the animal. The reason of this is, that the access of air to the cavity of the joint excites such a violent inflammation as must certainly end in gangrene; and therefore, for the most part, it will be proper, as soon as possible to destroy the horse or other animal.

It has been well suggested by Gibson, that "in dressing gun-shot wounds, it is necessary to avoid all unctuous applications, which encourage the growth of fungous flesh. He advises to dress the wound with turpentine, mixed with honey or the yolks of eggs, or with honey and turpentine. He has, always, he says, observed this method to be the most safe and efficacious in the gun shot wounds of horses; and if fungous flesh arise, to which some constitutions are more liable than others, the part may be strewed with a little red precipitate, finely powdered, or dressed with lint dipped in vitriol-water, and squeezed dry; or precipitate may be mixed with the digestive, and this in a suitable proportion to the luxuriancy of the granulations. When a bullet chances to enter the cavity of the body, and to be lost there, if it happen to slide on the principal viscera without wounding them, especially those of the abdomen, there will scarcely be any thing further necessary than to cure the external wound." But that where a symptomatic fever arises, which often happens in gun-shot wounds, bleeding is proper, with laxative clysters, and the diet should be chiefly scalded or moistened bran, with water gruel. Sometimes nitre, cream of tartar, and such-like opening and cooling remedies, may also be given: and if the wound become an ulcer, which frequently happens in gun-shot accidents near the joints and membranous parts, it must be treated according to the directions laid down for the cure of ulcers in general." See *Ulcer*.

In scalds or burns from gunpowder, or any other cause, when the skin remains entire, the part should be bathed well, and kept soaked with rags dipped in camphorated spirit of wine; salt bound thick on the part has been found very effectual for this purpose: and indeed all saline and spirituous applications excel others while the skin is yet unbroken; but when it is separated, the part should be anointed and kept constantly supple with linseed or sallad oil, and a plaster spread with bees wax and oil; if the skin be so scorched, that sloughs must be digested out, it should be dressed with the wound ointment and oil of turpentine, and the cure finished with any drying ointment. Should the horse be feverish from the pain, he should be bled and have cooling clysters.

The fire supposed to be left in the part after injuries of this kind is nothing more than the inflammation, which is the natural effect of such causes.

In the cure of wounds in the feet from nails, gravel, &c. which are very common, and sometimes for want of early care, prove of bad consequence: for the parts being naturally tender, are very susceptible of inflammation, and when matter is once formed, if a free discharge is not procured, the bone which is spongy soon becomes affected, and the whole foot is then in danger. Of course, when any extraneous bodies, such as nails, stubs, thorns, &c. have passed into the horse's foot, they should be removed as soon as possible, and after washing the part with oil of turpentine, the hole should be dressed with lint dipped in the same, melted down with a little tar; the foot may be stopped up with bran and hogs lard heated together, or put into the turnip, or any soft poultice; this method is generally successful, when the nail, &c. is not entirely removed; but if any portion should remain behind, which may be suspected by the degree of pain, and discharge of matter, after paring away the sole as thin as possible, the puncture should be enlarged, that it may be drawn out by a small pair of forceps, or brought away by digestion; if this method should not succeed, but the lameness continues, with a discharge of a thin bloody, or stinking matter, the wound should be laid open immediately with a drawing knife to the bottom, and then dressed as directed above.

WRACK, a name sometimes given to a marine plant, which is of great utility as a manure. With this plant surgeons sometimes make a cataplasm, by bruising a quantity of it, and applying it in cases of scrofula, or white-swelling, but more particularly glandular tumours. Where this cannot be got, sea-water and oatmeal formed into a poultice have supplied its place. There is no reason why the tumours and ill-conditioned sores of brute animals should not be benefited by similar applications.

It is frequently termed *Sea-Wrack*, *Sea Tares*, *or Tangle and Sea oak*. See *Sea-Weed*.

WRETWEED, a name sometimes given to wartweed or sun spurge, a troublesome weed in fields.

WRECK, a term signifying the weeds thrown up by the floods upon the sea shores; also the dead indigested roots and stems of grass, and other plants in ploughed lands.

WRENCH, in *Farriery*. See *Strain*.

WRINGLE-*Tail*, a name given by the people of several parts of England to the *curvicauda*, a species of bee-fly, very much resembling the bee in shape, but having only two wings and no sting. It is very troublesome to horses, but does not suck their blood, but only lays its eggs in their skins; it is called in other countries the *whame* and the *barrel-fly*.

WRONGS, a term applied to the crooked arms or large boughs of trees, when the fagot wood is cut off from them.

WUMBLE, the provincial name of an auger. It is sometimes written wummle and wimble.

WUNT, a term provincially applied to the mole.

WUNT-*Hillock*, a word signifying a mole-hill.

X

XAN

XANTHIUM, a term under which the lesser burdock is sometimes known by botanical writers, and which is a very troublesome weed in some arable lands, especially those of the more moist sorts. It is a very difficult sort of weed to extirpate,and can perhaps be only well got quit of by deep and frequent ploughing the ground.

XERASIA, in *Farriery*, a term signifying a species of disease consisting in a dryness of the hairs for want of due nourishment, whence they fall off. It is met with in animals which are only fed or kept on poorfood.

XER

XERODES, in *Farriery*, a term which expresses any tumour attended with the property of dryness or exsiccation.

Y

YAR

YARD, a fold or inclosed portion of ground in which domestic animals are kept for feeding, fattening, or any other purpose. See *Farm Yard.*

YARD *Dung*, that sort of manure which is raised in the farm yard.

It is remarked by Mr. Young, in his Survey of Norfolk, that " through every part of West Norfolk, from Brandon and Thetford, to Snettisham and Holkham, the farm-yard dung, after foddering is over, is turned up in heaps in the yard, or carted on to heaps in the fields, where it is turned over for mixing : Mr. Denton, of Brandon, has, however, he says, made an observation on this point, which has a tendency to a change of system. It seems from the general practice, that the gentlemen and farmers (for all are in the same husbandry), do not conceive that the sun and wind have any power of extracting those volatile particles which contribute to the food of plants; and the common way of leaving the heaps when carted on to the land for some time before spreading, and again, when spread, before ploughing in, shew that this is the case. Here, however, he must, he says, make an exception of Mr. Coke, whose teams he saw so proportioned, that the dung was turned in as fast as carried out, and very completely buried; but it was short."

YAR

It is added that "the observation alluded to is this—Mr. Denton on shewing him his beautifully improved warren farm at Feltwell, he remarked, how much better one half of a layer of seeds was than the other; occasioned by one part being manured with long dung, and the other with old turned-over short dung. The soil, quite a sand: the writer observed the different appearance clearly,the best was that which was covered with the long manure." And he adds that " 30 years ago they reckoned near Holkham, that the wheat stubble ploughed in, was as good as a light coat of dung.

The practice of the farmers in this district in regard to the use of long or short dung is, however much divided; but Mr. Young says that " though in the common method of the county short dung is preferred, there is enough said upon the merit of that which is used in a long state, to prove that the inquiry deserves more attention than it has hitherto met with."

That "the result of the above experiment is remarkable, and the practice of many farmers much in support of it." But that " comparative experiments are

wanting to ascertain the point, which is unquestionably of great importance, and these might be made without much difficulty."

It is, he adds, a prevailing idea in the above district "that long dung is best for strong land, and short for light soils;" but the general practice that of spreading *short* in all cases. The soil on which Mr. Denton's trial was made was that of a sand.

And "there is another question which is of equal consequence to the farmer to have decided, which is that of the superior advantage of consuming the straw by animals, or of having it trodden into dung in the yards. Many of the most enlightened farmers in this county are against the former practice, though a large part of them is in the custom of it. They have recourse to the method of buying oil cake even often at a loss, in order that their straw may be trodden into dung by fattening beasts, which is an excellent management." See *Dung*, *Manure* and *Compost*.

It is remarked by the same writer that "there is a singular practice at Yarmouth, which has been common time out of mind, of littering all stock, such as horses, cows, &c. with sea-sand. A number of Yarmouth one horse or one-ass carts, are employed to bring sand from the shore for this purpose; and it is done the more largely, that the quantity of muck to sell to the farmers may be the greater." That" Mr. Thurtell manures all his turnips with this dung, and it is excellent. The sand ought to be ten days or a fortnight under the horses and cows, being gradually drawn back with hoes, and fresh supplied: many thousand loads are thus made annually; and great quantities are taken into the country by the sailing barges called *keels*. Ten large cart-loads per acre are a good dressing, as much as three horses can draw. It sells at 4s. a waggon-load in the town, and six of these loads do an acre." The above farmer "brings it all winter long. He observes, however, that it is not durable; the chief force of it is exhausted in the turnips and following barley."

It is added that "Mr Everit, of Caistor, manured a field with part yard-muck for turnips, but falling short two acres, he finished that part with Yarmouth sand-muck: the turnips were equally good, but the barley on those two acres inferior to the rest of the field, and that Mr. Ferrier's horses at Hemsly are all littered with sand, and the manure is very good."

In many situations this practice may be adopted with advantage.

YARD, in *Horsemanship*, the common name for the penis of animals.

YARD, a measure consisting of three feet or thirty six inches.

YARD-*Fallen*, in *Farriery*, a vulgar term for a supposed malady in a horse, which, from want of strength in the muscles of the part, cannot draw his penis within the sheath, so that it hangs down between his legs. This is merely the effect of erection, and not a disease.

YARD *of Land*, a quantity of land which in some counties signifies fifteen acres, in some twenty, and in others, twenty-four, thirty, and thirty-four acres.

YARD *Sheep*. See *Sheep Yard*.

Cow-YARD, the yard in which the cows stand to be milked, fed, &c.

Stable-YARD, the yard which belongs to the stable or place where the horses are kept.

Stack-YARD, the yard that encloses, or contains the stacks.

Straw-YARD, the place in which the straw is contained. It also signifies the place in which animals are kept or fed upon straw, &c.

YARROW, a plant of the grass kind, the (achillea millefolium): this is a common but valuable plant, which has been long ago noticed by Dr. Anderson, and which is found to succeed on moist loams, almost equally with dry burning gravels, sands, and chalks. It possesses the singular quality of resisting drought on the most dry acrid soils, so that if a green spot appears in a burnt up, close fed pasture it may be almost certainly concluded to be covered with this plant. 5s. per bushel are given for gathering its seeds in October. Yarrow is found in the best bullock pastures, where it is highly grateful to every description of cattle, particularly of sheep which bite it as fast as it grows: so that on tolerably well stocked pastures it is rarely suffered to come into flower. It is adapted in its nature to almost every sort of soil, flowering in June and July, and is a plant which seems to deserve the attention of the farmer in a higher degree than has hitherto been the case.

YEAN, a term signifying to bring forth young, when spoken of sheep. The polled lambs are yeaned with the greatest facility.

YEANLING, the young of sheep. See *Lamb*.

YEAST. A well known ferment used for ale. It is observed by Dr. Thomson in his excellent System of Chemistry, that "considerable exertions have been made by chemists of late, to ascertain the nature of the substance in yeast, which produces this striking effect upon wort; and to discover it if possible in other substances, Westrumb examined the yeast of beer; from 15360 parts of it he obtained the following substances:

Potash - -	13
Carbonic acid -	15
Acetic acid - -	10
Malic acid - -	45
Lime - - -	69
Alcohol - -	240
Extractive - -	120
Mucilage - -	240
Saccharine matter -	315
Gluten - -	480
Water - -	13595
	15142

"Besides some traces of phosphoric acid, and of silecia. But it is obvious, that all these ingredients are not essential. From the experiments of Westrumb it appears, that when the yeast is filtered, a matter remains upon the filter, which possesses the properties of gluten, that when this substance is separated, the yeast loses the property of exciting fermentation, but recovers it again when the gluten is added, hence it follows, that this glutinous matter is the essential

constituent of yeast. When yeast is kept for some time in cylindrical glass vessels, a white substance not unlike curd separates, and swims upon the surface. If this substance be removed, the yeast loses the property of exciting fermentation.

"This substance possesses many of the properties of gluten, though it differs from it in others. Its colour is much whiter; it has not the same elasticity; and its particles do not adhere with the same force. It dissolves more readily in acid. He has little doubt that this is the part of yeast which is the real ferment. It may be considered as gluten somewhat altered, and much more disposed to decomposition. It existed no doubt in the raw grain, but underwent considerable modifications during the process of malting, and probably others, during the fermentation of the beer, from which it is separated.

"That a substance analogous to gluten, is the real ferment, appears also from the experiments of Fabroni, who published a Treatise on Wine-making in 1785, which gained the prize proposed by the Florence academy. By heating the juice of grapes, and passing it through a filter, he separated an adhesive matter, which possessed the properties of gluten. The juice deprived of this substance, refused to ferment, but it fermented as usual, when the glutinous matter was again added. The observations of Thenard confirmed those of Fabroni, and which, according to him, is absolutely the same with pure yeast. This substance is insipid, does not change vegetable blues, is insoluble in water, loses three-fourths of its weight when dried, and is decomposed like animal substances. When eight parts of it were distilled, they left 283 of charcoal, and yield 161 of water, 131 of oil, and a quantity of ammonia, which when saturated with muriatic acid, formed 146 of sal ammoniac; the gas obtained weighed 0,33, and consisted of $\frac{1}{5}$th carbonic acid, and $\frac{4}{7}$ths of carbonated hydrogen, requiring $1\frac{1}{2}$ times its bulk of oxygen to consume it. Nitric acid, even when diluted, converts it into a species of tallow. With potash it forms a soap while ammonia is disengaged, and a vinous liquor formed. By this action, the ferment loses the whole of its azote, and becomes incapable of exciting fermentation, when mixed with a new portion of sugar.

"The essential constituent of yeast, then may be considered as a species of gluten, differing in several respects from the gluten of wheat. When mixed with the wort, this substance acts upon the saccharine matter, the temperature rises, carbonic acid is disengaged, and the saccharine matter is converted into *ale*. The yeast soon collects on the top of the liquid, but the brewer occasionally mixes it again to continue the fermentation. The quantity of yeast employed being small, the saccharine matter is but imperfectly decomposed.

The following is a process that has been much recommendedfor th e making of yeast. "Boil potatoes (the mealy kind the best) one pound for every quart to yeast you wish to make. When boiled, skin and mash them. Mix as much of the water in which they were boiled as will reduce them to the consistency of yeast. Then, for every quart of yeast, put in two ounces of the coarsest brown sugar, and when in a lukewarm state, two or three table spo nfuls of good new beer yeast for each pound of potatoes. Keep it stirring and warm for 24 hours, or till it has done fermenting, when it will be fit for use; but if older the better. It will keep in bottles for several months."

YELLOW *Meat*, a property in some sorts of animals, of both the sheep and cattle kinds, to afford meat which has a yellow cast or appearance.

It has been remarked by Mr. Middleton, that "the colour of the fat of a sheep, may easily be known by making an incision of about two inches in length, through the skin and fat of the tail of the living animals, and by spreading the wound with the side of the knife at the time of cutting it, which will shew the natural colour of the fat, whether it be fair or yellow." And that "lambs and calves should always be tried in this manner, and such as should prove on trial to be of an unpromising colour should not be kept for breeding. If this method was always pursued, the grazier might, he thinks, be able to warrant his stock to die of a fair colour.

It is observed, that "cattle whose fat is yellow, fatten as kindly as those whose fat is a fair colour, and they are said to be less subject to the rot. And, that "the yellow colour extends through every part of the fat, but it is not, on that account disliked by the tallow-chandler. The flavour of the meat, whose fat is not of the fairest colour, cannot be distinguished from that whose fat is of the fairest colour, and yet it is sold for three-half pence or two pence per lb. less, and is, therefore, mostly put off by candle light."

It is suggested, that this defect must be hereditary; as no pasture or particular food can either produce or remove it, as sheep which have been tried in the manner here described, and found yellow have been sent to the Thames marshes, kept there a year, and when slaughtered have proved as yellow as gold. It may probably depend upon some physiological principle, which mere examination after death has not yet shown. These remarks are equally applicable to beef as mutton, in the opinion of the above writer.

YELLOW-*Oat-Grass*, a sort of grass which thrives in meadows and pasture, and on hills in calcareous soils where it flowers in June and July: It is a coarse grass, and though tolerably sweet, is much inferior to the meadow and fescue grasses; and Withering has asserted that it is not relished by cattle, but Swayne thinks it one of the best grasses of this sort for the use of the farmer. See *Avena*.

YELLOWS, in *Farriery*, a disease incident to horse and other cattle, commonly called the jaundice. In this disease some advise to have first recourse to bleeding, clysters and purges.

The last intention may be answered by the following:

"Take of Indian rhubarb powdered, one ounce and a half;
Saffron, two drachms;

Succotrine aloes, six drachms;
Syrup of buckthorn, as much as is sufficient to make a ball."

If the rhubarb be thought too costly, omit it, and add the same quantity of cream of tartar, and half an ounce of castile soap, with four drams more of aloes. This may be repeated two or three times, giving intermediately the following balls and drink.

"Take of Ethiop's mineral, half an ounce;
Castile soap, one ounce;
Make them into a ball, and give one every day, and wash down with a pint of the following decoction:
Take of Madder root and turmeric root of each four ounces;
Burdock root, sliced, half a pound;
Monk's rhubarb, four ounces;
Liquorice sliced, two ounces;
Boil them in one gallon of forge water to three quarts; then strain off the liquor and sweeten it with honey."

Balls of Castile soap and turmeric may be given also for this purpose to the quantity of three or four ounces a day, and will succeed in most recent cases of this nature.

By these means the distemper generally abates in a week, which may be known by an alteration in the horse's eyes and mouth, but the medicine must be continued till the yellowness is entirely removed. Should the distemper prove obstinate, and not submit to this treatment, recourse must be had to more potent remedies, viz. mercurial physic, repeated two or three times at proper intervals, and then the following balls:

"Take Salt of tartar, two ounces;
Cinnabar of antimony, four ounces;
Filings of steel, three ounces;
Saffron, half an ounce;
Castile or Venice soap, half a pound;
Make them into balls the size of a pullet's egg with honey, and give one night and morning, with a pint of the above drink."

It will be proper, on his recovery, to give the horse two or three mild purges, and, if a fat horse, to put in a rowel. And the salt marshes have likewise been found very efficacious in the cure of this disorder, and, if taken in time, rarely fail in restoring the animal.

YEOMAN, a term applied to the first or highest degree of plebeians in this country. The yeomen are properly freeholders, and such as cultivate their own lands. This useful and important class of society has been within these few years considerably lessened.

YERK, in *Horsemanship*, a term signifying to strike out backwards. A horse is said to yerk, or strike, with the hind legs, when he flings and kicks with his whole hind quarters, striking out the two hinder legs near together, and even to their full extent. Horses of this sort are very dangerous, and should be got quit of as soon as possible.

YEW-TREE, the name of a well known evergreen tree; the timber of which is much esteemed for various uses.

These trees may be easily propagated by sowing their berries when divested of the pulp, in autumn, as soon as they are ripe, upon a bed of fresh undunged soil, either over the whole or in drills covering them over about half an inch thick with the same earth. But the latter is the better mode.

In the spring, the bed must be carefully cleared from weeds, and if the season prove dry, it will be proper to refresh the bed with water now and then, which will promote the growth of the seeds; many of which will come up the same spring, but others will remain in the ground until autumn or spring following; but when the seeds are preserved above ground till spring before they are sown, the plants never come up till the year after, so that by sowing the seeds as soon as they are ripe, there is often a whole year saved.

The plants, when they come up, should be kept constantly well cleared from weeds, which, if permitted to grow amongst them, would cause their bottoms to be naked, and frequently destroy the plants when they continue long undisturbed.

In this bed the plants may remain two years; after which in autumn, there should be a spot of fresh undunged soil prepared, into which they should be removed about the beginning of October, planting them in beds about four or five feet wide, in rows about a foot asunder, and six inches distant from each other in the rows, observing to lay a little mulch upon the surface of the ground about their roots, as also to water them in dry weather until they have taken root; after which they will require no farther care, but to keep them clear from weeds in summer, and to train them according to the purpose for which they are designed.

In these beds they may remain two or three years, according as they have grown, when they should again be removed into a nursery, placing them in rows at three feet distance, and the plants eighteen inches asunder in the rows, observing to do it in autumn, as before directed, and continue to trim them in the summer, for what they are intended; after they have continued three or four years in this nursery, they may be transplanted where they are to remain, always observing to remove them in autumn where the ground is very dry; but on cold moist land it is better in the spring.

These trees are very slow in growing, but there are many very large trees upon some barren cold soils.

It is observed in the Gloucestershire Report that "the yew-tree should not be suffered to grow in or near cow pastures. The leaves are poisonous to horned cattle and horses, though the berries are esteemed inoffensive. In January 1805, in consequence of some fences being broken down by a violent wind during the night, a pack of cows belonging to a farmer in Sandhurst entered an inclosed shrubbery where there were many yew trees growing, and continued in it till the morning. Soon after they were driven out, all of them were seized more or less with a kind of madness, or such acute pains as made them run about in a very furious manner, sometimes leaping to a considerable height, then beating their heads against whatever opposed them, and at last falling instantly dead.

Oils of different sorts were poured down their throats, as there was an opportunity of securing them, which seemed to produce a good effect on some; but notwithstanding every effort nine out of 30 died in a few hours after they were discovered. On their being opened, it appeared that the whole quantity they had eaten put together would not have filled a peck.

"An opinion prevails that the leaves are not poisonous in the summer: this, however, is probably erroneous: at least it is not confirmed sufficiently by fact to justify the farmer in subjecting his cattle to the experiment. If cattle come within reach of the yew tree at that time of the year, they may perhaps reject it altogether, giving the preference to other green food, more palatable, and in plenty around them."

These trees should therefore be carefully kept out of hedge-rows, and all other places where cattle are pastured.

YIELD, a term signifying the quantity or supply of any sort of produce, as of grain at harvest, &c.

YIELD, in *Horsemanship*, signifies to slack the hand, which is toslack the bridle, and give the horse head.

YOKE, a frame of wood fixed with bows over the necks of oxen, whereby they are coupled together, and harnessed to the plough. It is sometimes written Yoak.

In the business of harnessing oxen for the purpose of draught, different methods have been followed by different farmers.

And the modes of harnessing and yoking oxen are even different in different counties and districts of the same county. The most common practice in the southern parts of this kingdom, is that of working them in harness in the manner of horses while in the northern countries the yoke and bows are still much employed. On the continent, as in France, Portugal, &c. the head is the part to which the draught is chiefly attached.

In the first case the shoulder is made the principal point of draught. But in the second method the neck and shoulder conjointly have the weight of the draught, and in the last mode the principle of draught, are in one case the head, and in the other, the joint power of the neck and base of the horn, which lord Somerville has considered a purchase as great perhaps as can be given to the animal." It is "effected by a long leathern strap wrapped round the base or bottom of the horns, and again fastened to the yoke." It has been observed by a writer in the ninth volume of the Agricultural Magazine that with respect to the second method which has been noticed above, the "usual form of the yoke is a frame of wood fitted over the necks of the oxen, whereby they are coupled, and harnessed to the plough. It consists of several parts, as the yoke properly so called, which is a thick piece of wood, lying over the neck; the bow, which compasses the neck about; the stitchings and wreathings, which hold the bow fast in the yoke, and the yoke-ring and ox chain," which it is supposed "a method, which is evidently founded on a total mistake in the anatomy of the ox."

And that in the first we have "imitated the gear used with the horse, without considering that the strength and agility of the ox is placed by nature in a different situation. The neck of the ox is a tower of strength; if the soil resist, he projects this part of his form with that prodigious muscular force with which she has provided him for his own defence, but without attending to her operations, we impose a load of timber on his withers, we lacerate his flesh, and press him down to the earth."

The third or French mode of yoking is thus described in the words of Mr. Hughes. The labourer "passes a piece of wood, of about one sixth of the weight of the English yoke across the forehead of his cattle, having previously neatly hollowed out the extremities of it to fit the mould of the head, and lined those hollows with a piece of woolly sheep-skin, to answer the purpose of a soft pad, or cushion. This light and easy yoke, he braces to the horns with a small thong of leather, attaches the beam of his plough to the middle part of it, and the animal is completely equipped for his labour."

It has been observed by lord Somerville in his System of the Board that oxen "whether worked in harness, or in the yoke and bow, as in England, by the joint power of the yoke and horn, as in Portugal, or by the head as in France, they cannot fail to benefit their employer. As, however, the yoke and bow has prevailed for a considerable length of time, it is probable, that the practice may still prevail, in which case the Portuguese mode of draught will apply with the utmost ease and success to our yoke and bow, so as gradually and imperceptibly to cheat oxen into its use. This in itself is an obvious advantage, because it gives two points of draught instead of one, and thereby relieving each, admits of a lighter yoke which in this country, has ever been far too heavy and oppressive; and if hereafter the French method should be preferred, for which there are not wanting advocates, it is the best preparatory step to its introduction. It would be almost superfluous to remark that the strong points of an ox are in his head and neck. It is ordained by nature, that where the strength of an animal lies, there he will resort for defence, the horse to his heels, the man to his arms, and the ox to his head; and in cases of the greatest exertion, the beast ever puts his nose close to the ground."

In objection to the harnessing of oxen it has been observed in the paper noticed above, that "the article of gear is an oppressive annual charge, from the perishable nature of the commodity employed. The tackle there recommended for twelve oxen would not amount to six and thirty shillings, whereas the leathern harness for the same number of animals, according to the new method, would cost six and thirty pounds, and the annual expence of repairs, would exceed thrice the original cost of the former." And that "by the French mode of yoking, at least one third more of the power of the animal is obtained. In the common way, the shoulder being bruised by the unyielding bow, no vigour is exerted, excepting what is imparted by the goad; and the sinews of the neck, are not brought into employment: hence the sublime and gigantic

force with which he is endowed, is not rendered subservient in the important duties he has to perform for the supply of human subsistence. The cattle proceed in the French team bold and erect: no pain oppresses them, and they chew the cud chearfully as they pace along the furrow. On the contrary, in this country the painful pressure obstructs the progress of the animals, they lean against each other scarcely capable of supporting their own weight, and the fine intelligent eye which nature has given them to express the generosity of their temper, is clouded with anxiety."

That "the trial of this method has at least two recommendations; it may be made at very little expence, and under the fair expectation of success." See *Team*.

The methods of yoking cattle in ploughs, are also different in different places, but the only circumstances worthy of being considered is, whether the cattle should be yoked in pairs, or in a line before each other. It may therefore, be useful to consider the advantages and disadvantages attending each mode, and to compare them.

The most common way of yoking cattle in ploughs is in pairs. There are some disadvantages attending this way that are obvious. In ploughing the furrows betwixt ridges, the land-cattle go upon the ploughed land, and tread it down with their feet: this, especially if the land be wet, poaches and hurts it very much. And there is another disadvantage which is very obvious. When there is but as much of the ridge unploughed as to allow the land cattle to go upon it with difficulty, they are frequently either going into the opposite furrow, and thereby giving the plough too much land, or, which is worse, they are jostling the furrow-cattle upon the ploughed land.

In order to remove these inconveniences which attend the ploughing with cattle yoked in pairs, some yoke them in a line before each other. It is obvious, that cattle yoked in this manner, going always in the furrow neither tread upon the ploughed land, nor jostle one another. In these respects the yoking the cattle in a line before each other, seems to have the advantage. It is to be observed, however, that this method is not quite free from inconveniences. When examined it may, perhaps, be found attended with as great inconvenience as the other. Where cattle are yoked in a line, they go all in the furrow. This makes it necessary to give the plough more land than ordinary either by the sock or the muzzle; for if this be not done the head and sock being in the same direction with the beam, and the cattle yoked to the middle of it, the plough will directly follow the cattle, without taking any thing off from the land. Now it is inconvenient to be obliged to give the plough land either by the sock or muzzle; for when the sock is turned out of the plane of the beam it makes the plough heavy to draw; and when the muzzle puts the draught too much to one side of the beam, it prevents the plough from going upright. The yoking the cattle in pairs is attended with none of these inconveniences; for, in this case, the quantity of land, which the plough has naturally, when right made, is sufficient to make it take off a proper furrow.

There is another inconveniency that attends yoking cattle in a line, arising from the nature of the animals, which is, that as they like their ease, they are disposed to throw the burden upon their fellows. This they have a better opportunity of doing when yoked in a line before each other, than when yoked in pairs. When yoked in a line, each pulls by the traces of the one behind him; and therefore, though it may be known when the foremost neglects his work, by the slackening of his traces, it cannot be known when any of the rest neglect their work; for though one of them does this, yet by the pulling of the one before him his traces may be fully stretched. But this is easily discovered, when the cattle are yoked in pairs; for then every one of them has a separate draught.

There is still another inconveniency that attends the common way of yoking cattle in a line before each other. When the fore cattle are all yoked to the traces of the hindmost, it is obvious, that as the beam to which the draught is fixed, is much lower than his shoulders, by which the rest pull, such a weight must be laid upon his back or shoulder, as must render him incapable of giving any assistance. Besides, as the whole force is applied in the direction of the traces of the hindmost, it cannot have such influence on the plough, as when a part of it is in a direction more horizontal. When a body is to be moved forward in any direction, the nearer that the direction of the force applied approaches to the direction of the body, it acts with greater influence. And therefore, as the plough moves horizontally, and as the direction of the united draught of a plough with the cattle yoked two abreast, is more horizontal than the direction of the draught in a plough with cattle yoked in a line, the same force applied will have greater influence.

When these two different ways of yoking cattle in ploughs are thus considered and compared together, it is difficult to determine which ought to be preferred. Each of the two seems preferable to the other in a certain situation. When the land is stiff and the labour severe, the yoking the cattle in pairs seems preferable, as it is certainly the strongest draught; and when the land is wet, and in danger of being much hurt by the treading of the cattle, the yoking them in a line before each other seems preferable; as thereby they are confined to the bottom of the furrow, which is the firmest part of the land, and prevented from doing harm.

YOKE *of land*, the quantity of land which a yoke of oxen can plough in a day.

YOKING, the operation of putting the animals into the yoke or team. It also signifies the quantity of land ploughed at once going out with the team.

YOLK, the peculiar munctuous secretion which exudes through the skins of sheep, and which by intermingling with the pile of the wool, renders it soft, pliable, and in proper condition. It has somewhat the same effect on it, which oil has upon a thong of leather, when kept in and perfectly saturated, with it. The disposirion to the production of this sub-

stance in sheep is favourable to the valuable properties of the wool, and should be attended to by the sheep farmer in fixing his stock.

YORKSHIRE-*White*, a perennial grass, flourishing well in most situations, and growing very generally on all except on the most barren and dry soils. It flowers in June and July, but is chiefly calculated for sheep, and has answered uncommonly well when closely fed. It is not much relished by other cattle, and is said to be very injurious to horses, which become affected with a profuse discharge of urine and general weakness. Should any hay made from this grass, be accidentally given to these animals, an immediate change of food will prevent any farther ill effects. Its foliage is soft and woolly. See *Holcus lanatus*.

Z

ZEA ZEA

ZAIN, in *Horsemanship*, a termed used by the French to signify a horse of a dark colour, neither grey nor white, and without any white spot or mark upon him in any part.

ZEA, a term signifying maize or Indian corn. It is stated by Mr. Parkinson in his Experienced Farmer, that he has planted a small quantity of this sort of grain in his garden, and it turned out superior to his expectations. And that he is of opinion that this crop may be raised to advantage on some light soils, particularly the poor sands of Norfolk and Suffolk; or on any hot burning lands; as the countries where it grows naturally, are light hot soils, See *Maize*.

And he adds that, that he prefers the drill method in this country; as the small hillocks in planting the seeds separately, make the land unsightly and improper for other crops. But to raise the greatest produce in corn, the hills are, he conceives, the best way, however if the crop is intended chiefly for fodder, then drills are best. The seed is to be put about an inch deep in the ground.

And that when the corn first appears above the surface, the hillocks or drills must be examined, to see whether it all come up properly, and if it has not, there must be fresh seeds put into the vacant places to prevent a loss in the crop. And as soon as the plants take root in the ground, the crop should be examined again to see whether any have died away, or the birds have taken the seed. The plants must also be thinned to two on a hill, and good plants substituted for weak ones.

In the after-management in the hill-way, the hoe must be used at every operation to the plants, and earth be given to them, as the land cannot be made too light for this crop, but when in drills, the corn must be held in the same manner as garden peas.

He also further observes, that when the corn gets out of the milk, the blades below must be all pulled off while green: tie them up in small bunches, about the size of a birch-broom, and hang them on the top of the stalks of the corn: for at the same time that the blades are pulled the tops must be cut off, and set up in round bunches to dry, and tied round the topmost part to keep them from falling; when these are dry, they must be harvested. The blades are generally ready in four or five days, but the tops take

longer, when these blades and tops are properly harvested, they are excellent food. And it is suggested that as these processes will be finished about the end of August, the land might be ploughed and then sown with rye. If seeds were required, he is of opinion, it would be very proper to sow the seeds, at that time on this poor hot land; as the warm season would be over, and the seeds would have sufficient time to take root before winter. If only rye was wanted, he would eat it with sheep in the spring or during the winter. But the stalks must, he says, stand for the corn to ripen after the rye is sown: and the corn ought to hang on the stalk till it is hard. In America, it is often December before the white corn can be pulled, or September for the yellow corn: if it is pulled before it is hard, and the *cob* is perfectly dry, it will mould and spoil, and the corn will be apt to rot, therefore great care should be taken not to pull it too soon.

This sort of corn is, he says, given to horses, cattle, and hogs, without shelling, and only husked in the ear, but when given to fowls or intended for sale it is rubbed off by burning a *cob* in the fire till hard, and then rubbing the corn with it. It is a sort of grain which is sometimes given to pigs, but more frequently when ground to fowls. Count Rumford has shown in his Essay on Food, that this is perhaps the most nutritious grain, except wheat, either as human sustenance, or as provender for brute animals.

ZEOLITE, a sort of stony material, or a particular kind of fluor which dissolves very slowly in acids, and without any effervescence. It prevails much in some districts.

ZERNA, in *Farriery*, an ulcerated impetiginous affection or a sort of leprous disorder, which some times shows itself on the skins of some animals.

ZEST, the woody, thick skin quartering the kernel of a walnut.

FINIS.

W. Flint, Printer,
Old Bailey.

Plan of Floor

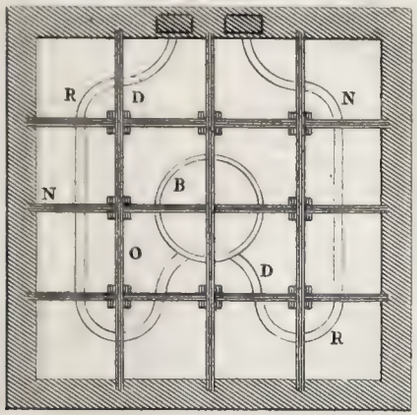


Fig. 4.

Section

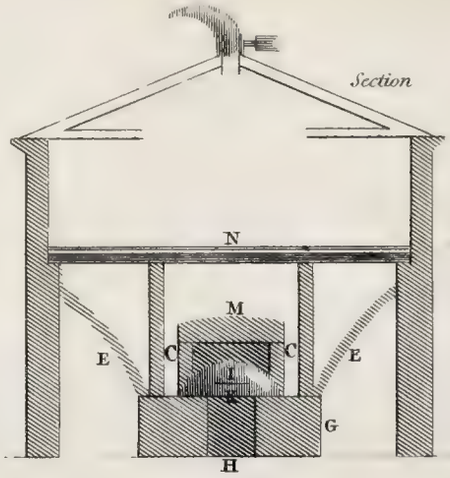
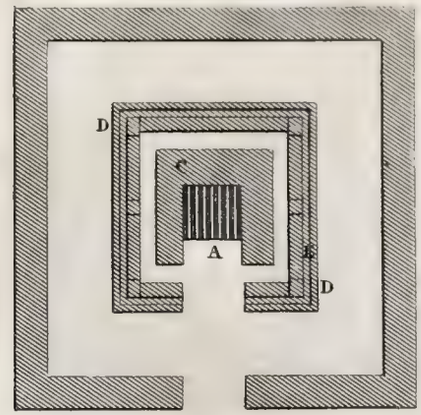


Fig. 3.

Ground Floor



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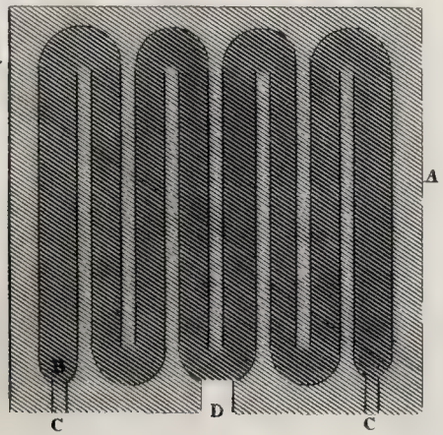

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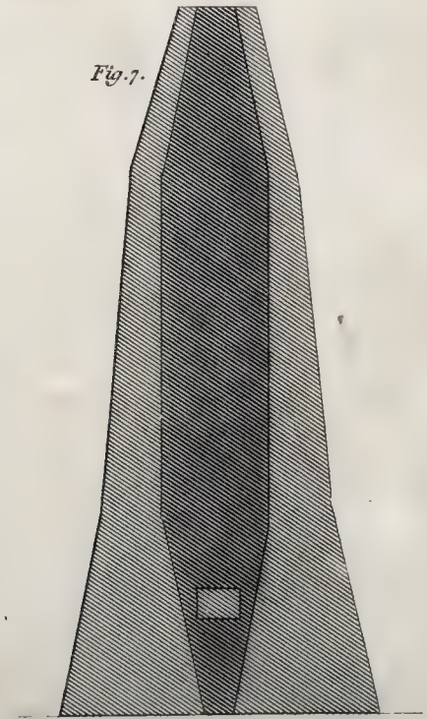


Fig. 7.

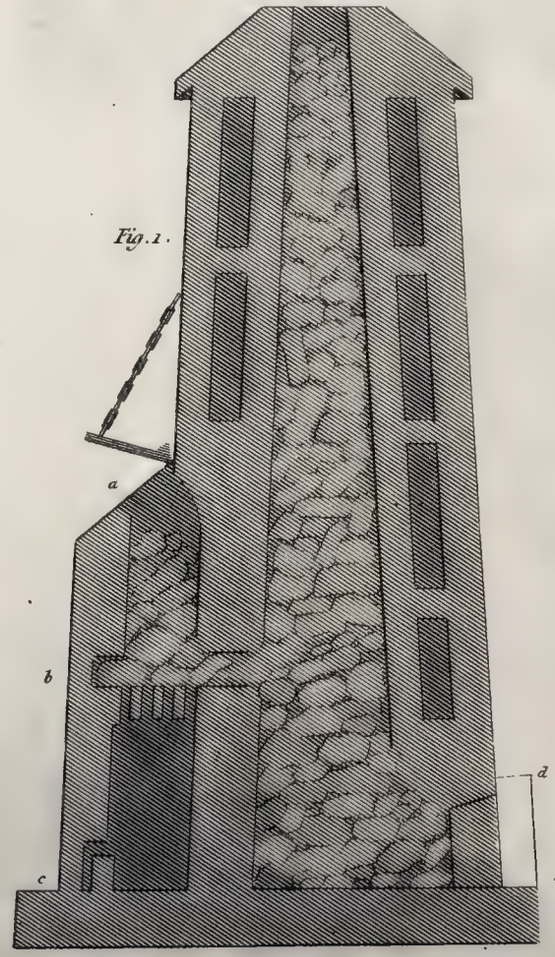


Fig. 1.

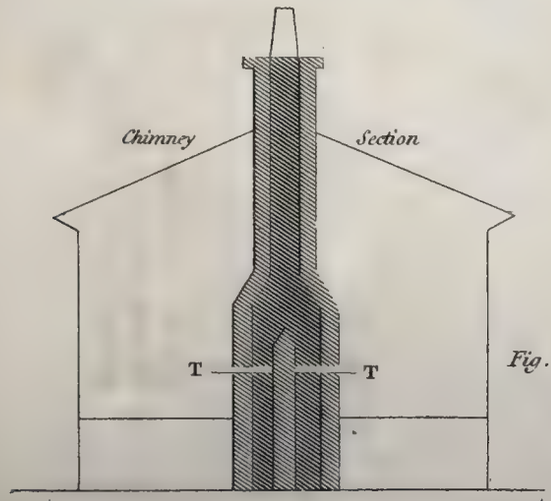


Fig. 5.

Published as the Act directs June 1st 1807, by Longman Hurst, Rees & Orme Paternoster Row.

Blunt del et sculp.

DISEASED HORSES LEGS.

Fig. 1.

Fig. 2.

Fig. 4.

Fig. 3.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

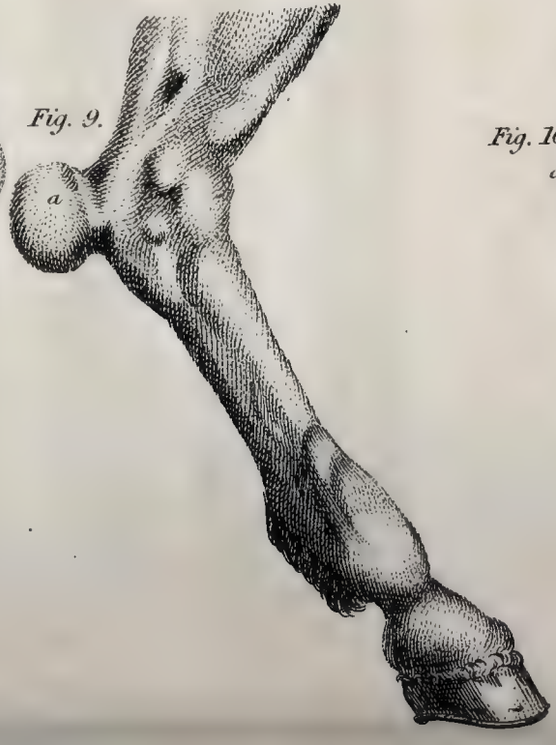


Fig. 10.

Fig. 11.

Fig. 12.

LACTOMETER.

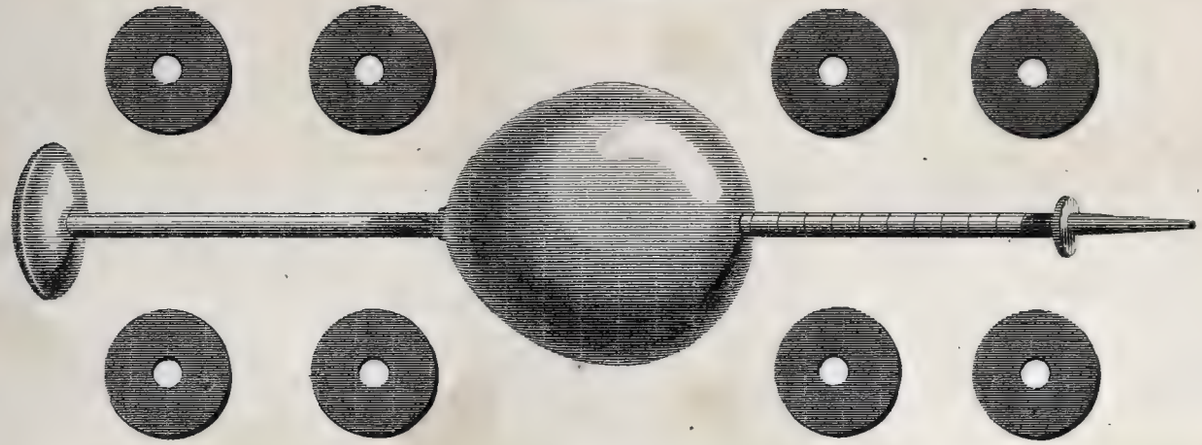
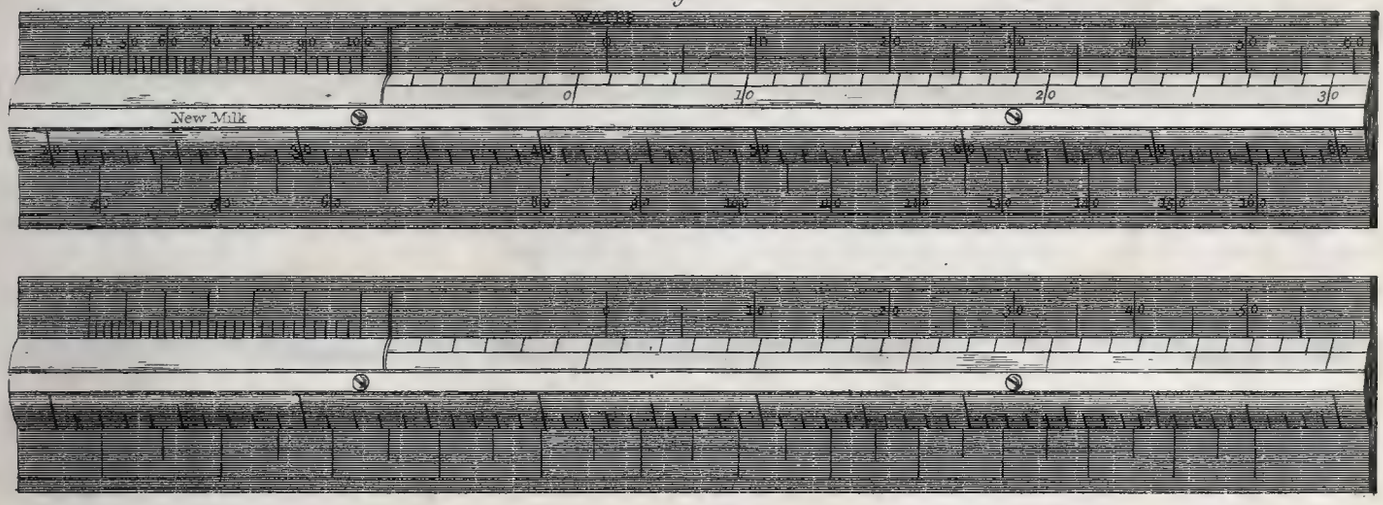


Fig. 1.



Lime stone pounding Machine.

Fig. 2.

Publish'd as the Act directs March 1. 1806, by Longman, Rees, Hurst & Orme, Paternoster Row.

Drawn & Engraved by J. Blunt

Levelling Instruments

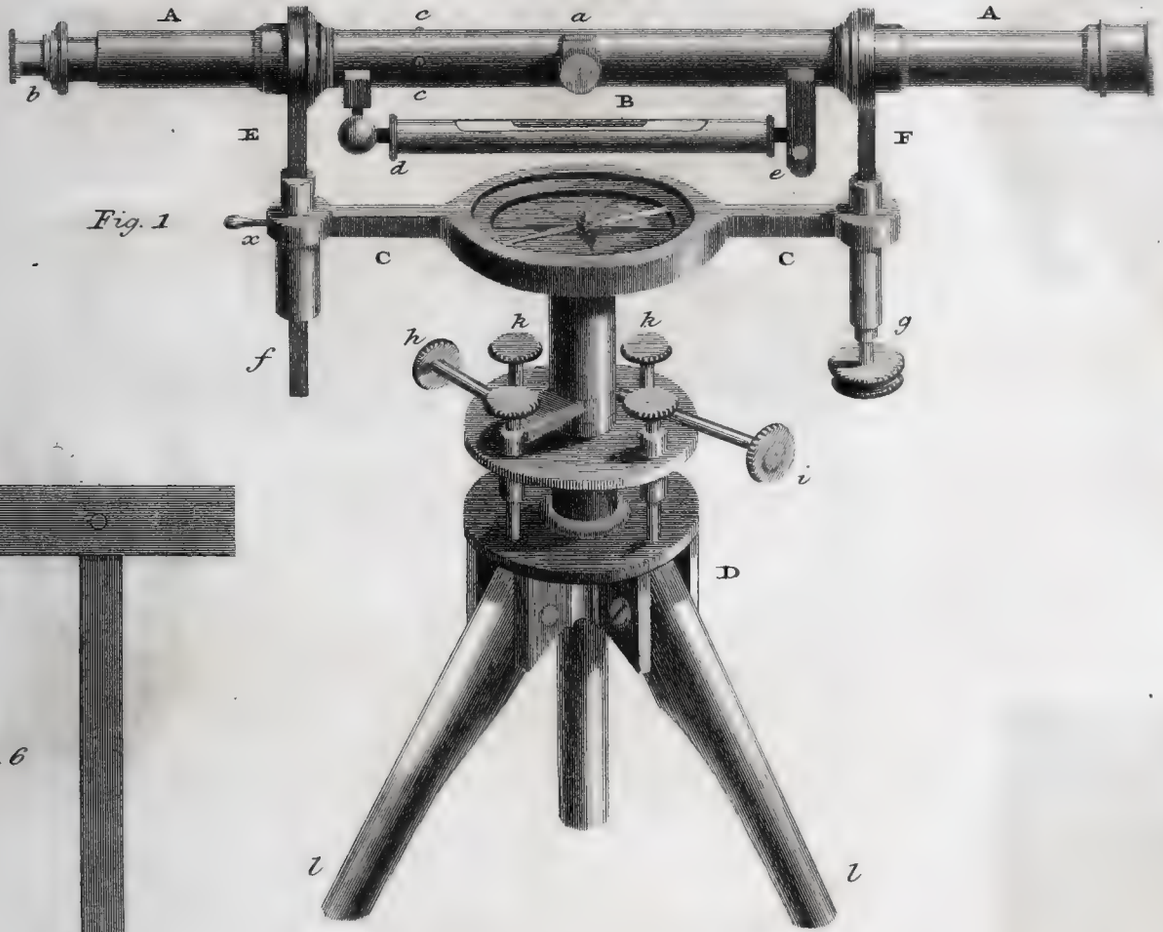


Fig. 1

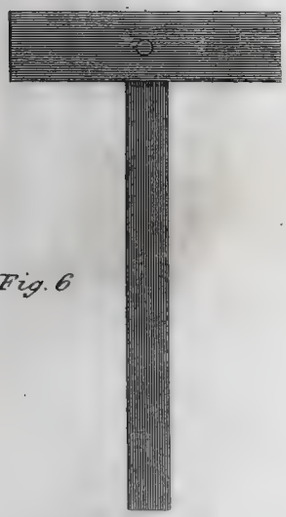


Fig. 6

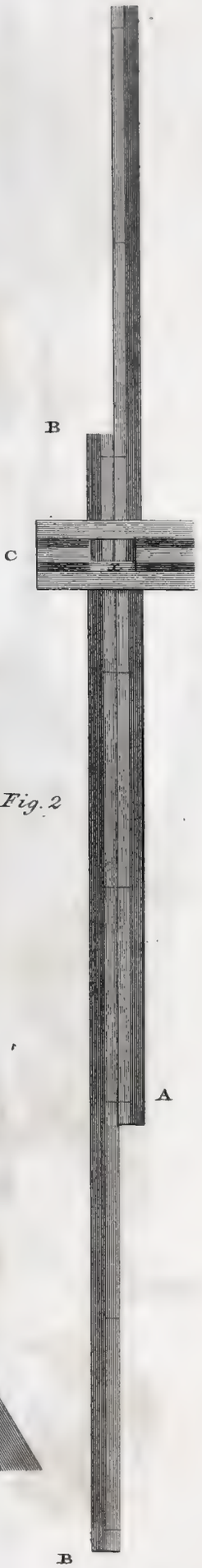


Fig. 2

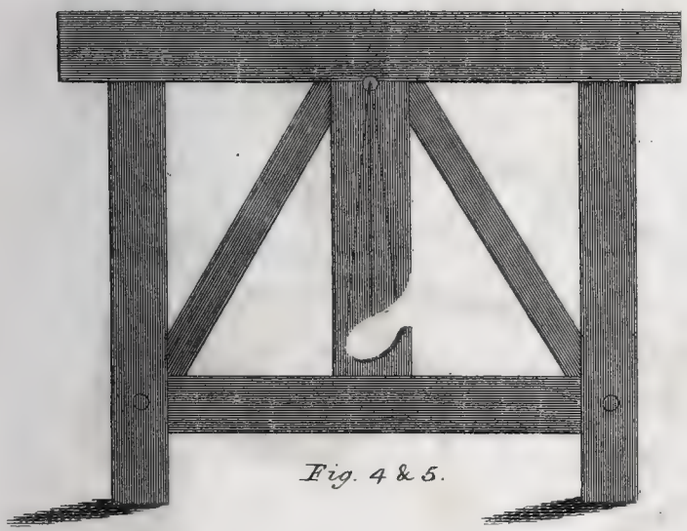
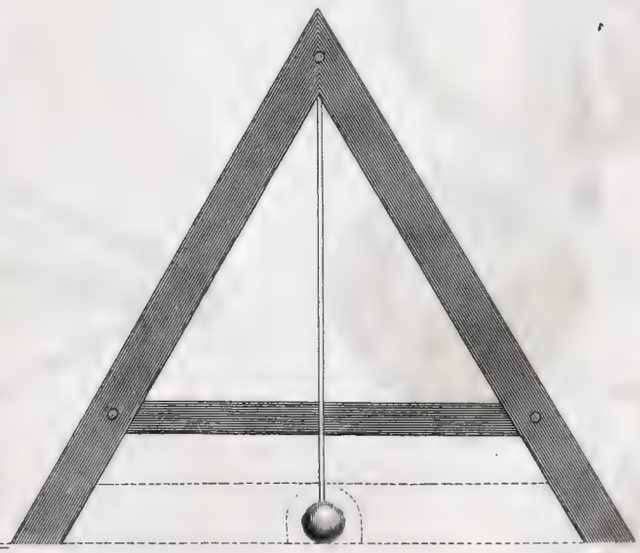


Fig. 4 & 5.

Fig. 3



Published as the Act directs Sept.r 1.1806 by Longman Hurst Rees & Orme Paternoster Row.

Blunt del. et sculp.

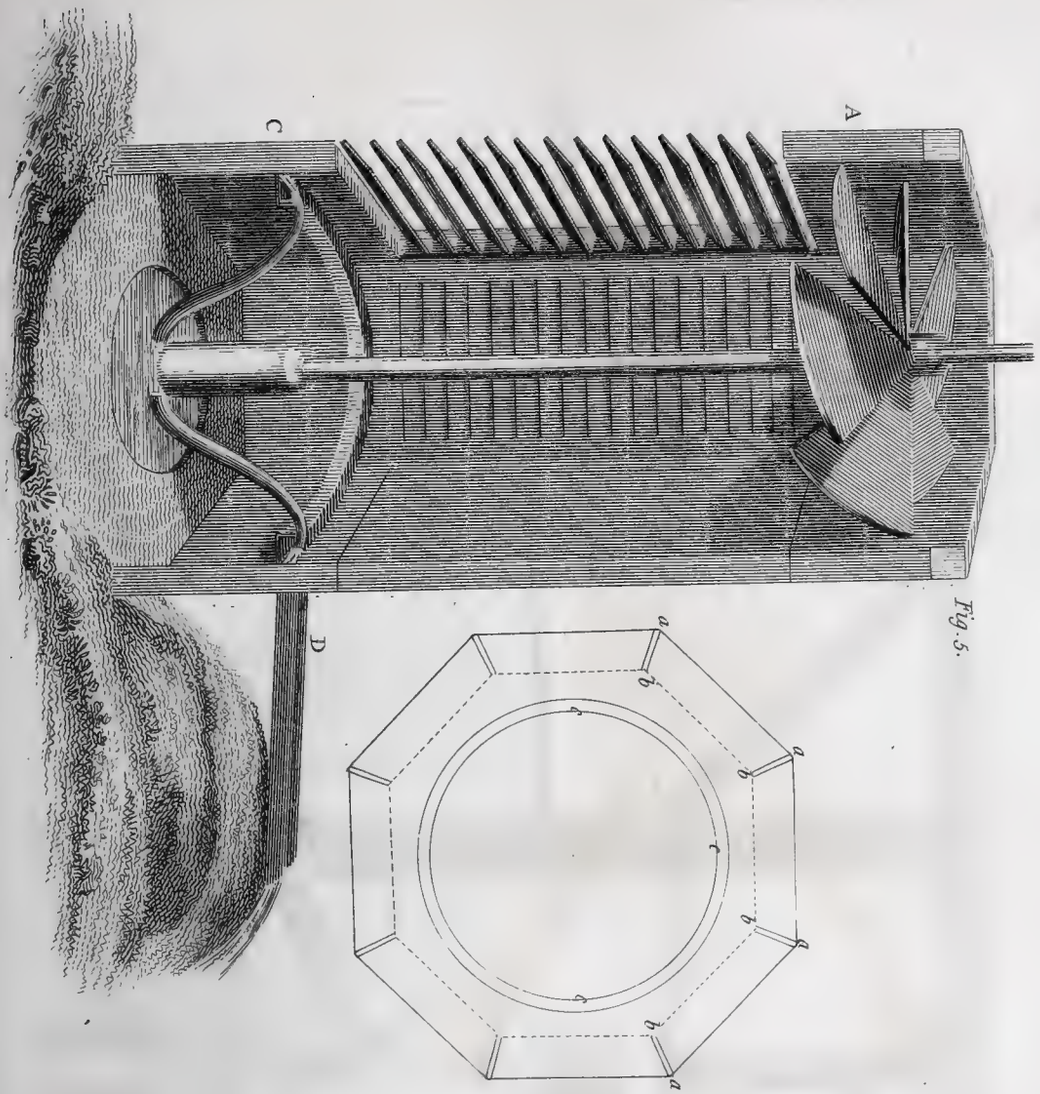


Fig. 5.

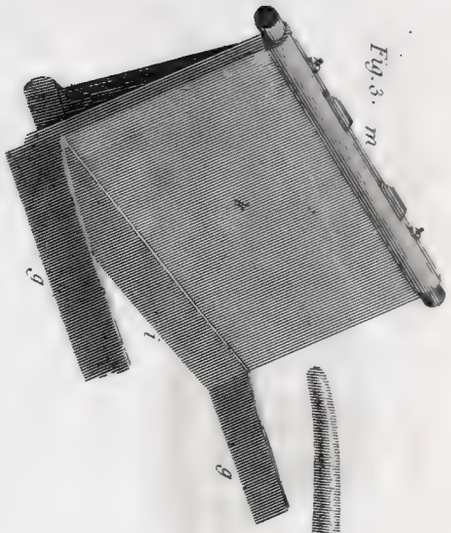


Fig. 3.

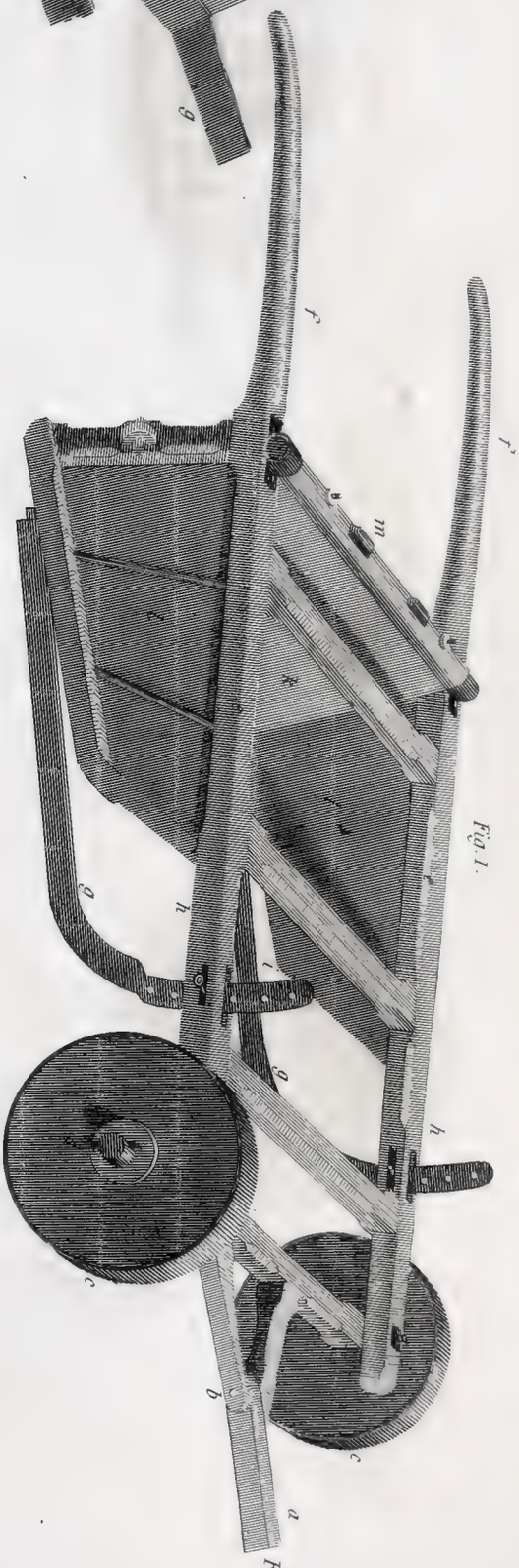


Fig. 1.

Fig. 2.

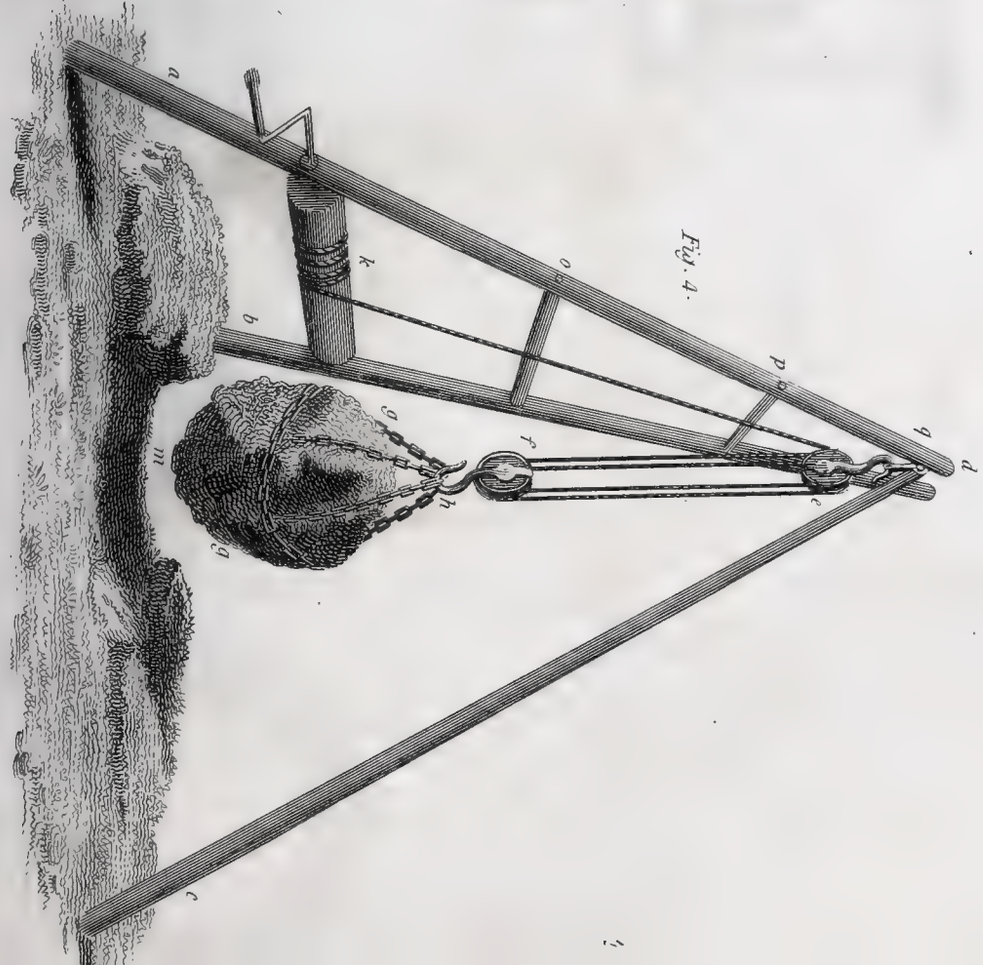


Fig. 4.

WATER RAISING MACHINE.

Fig. 3.

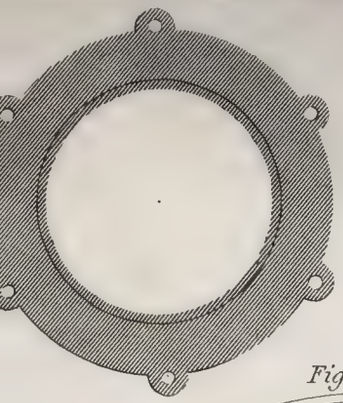


Fig. 4.

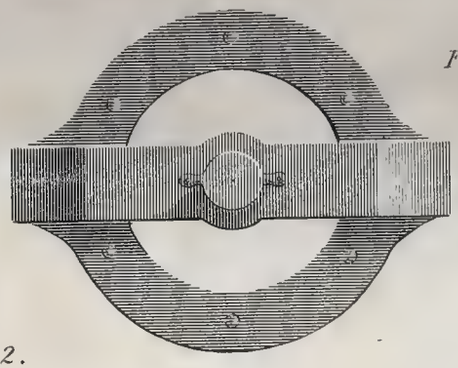


Fig. 5.

Fig. 6.

Fig. 2.

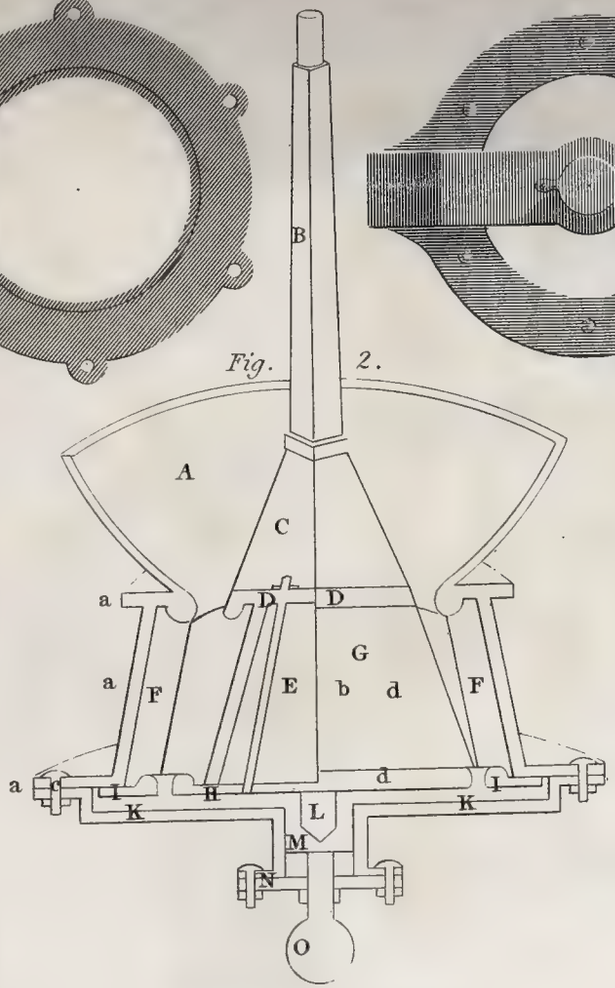
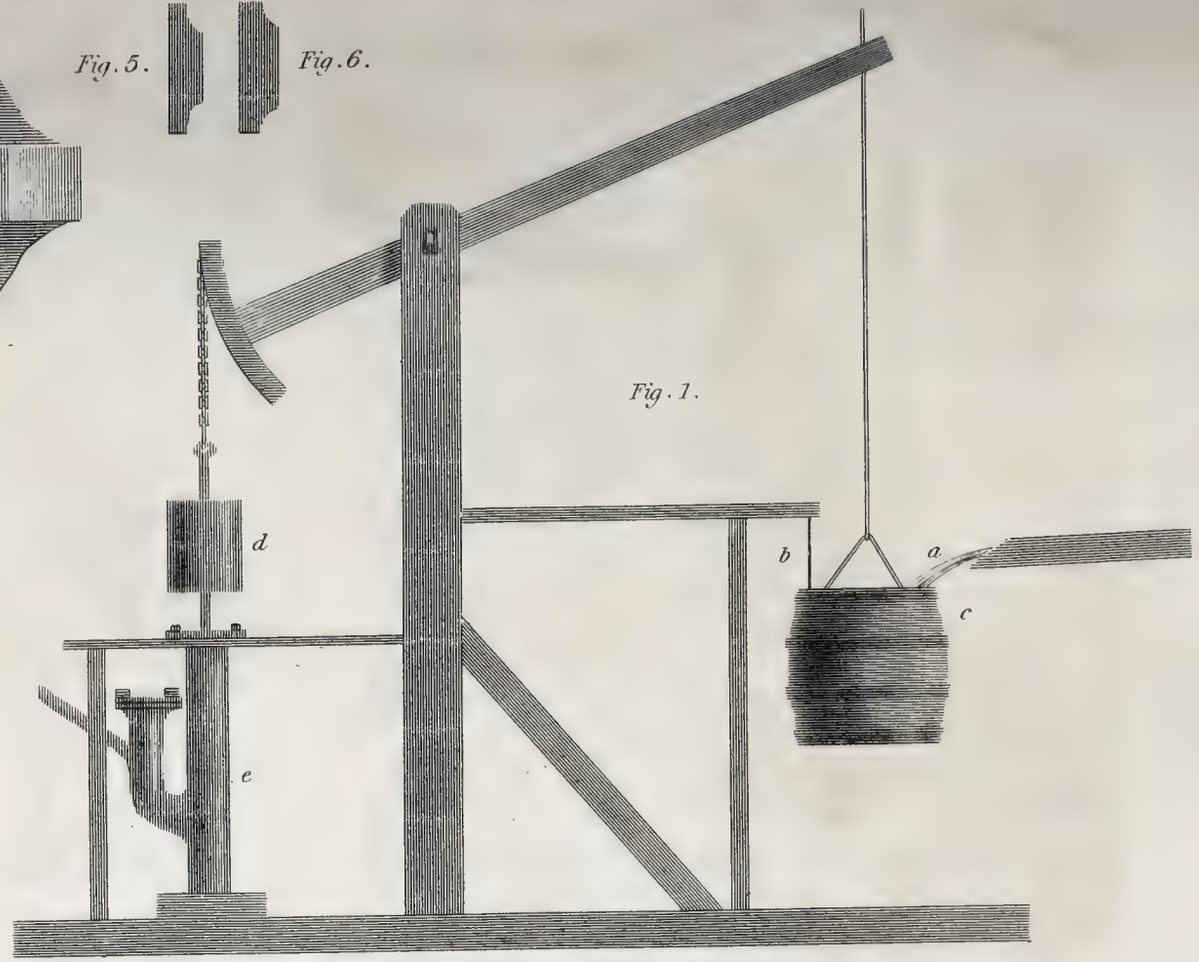


Fig. 1.



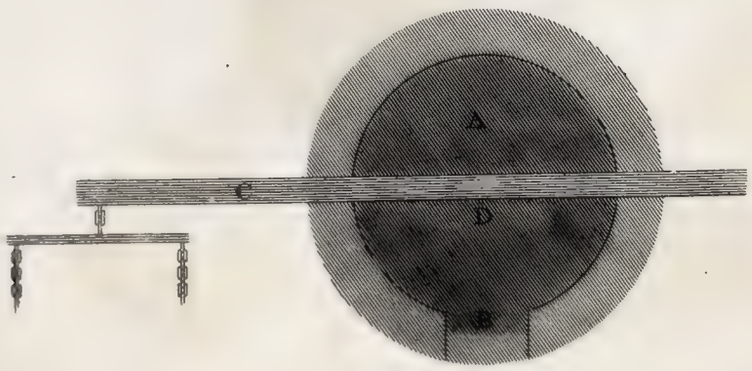
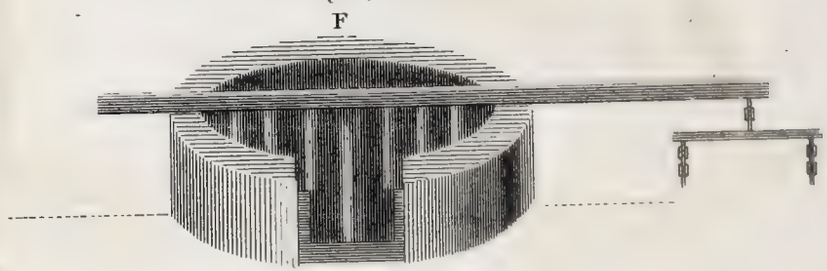
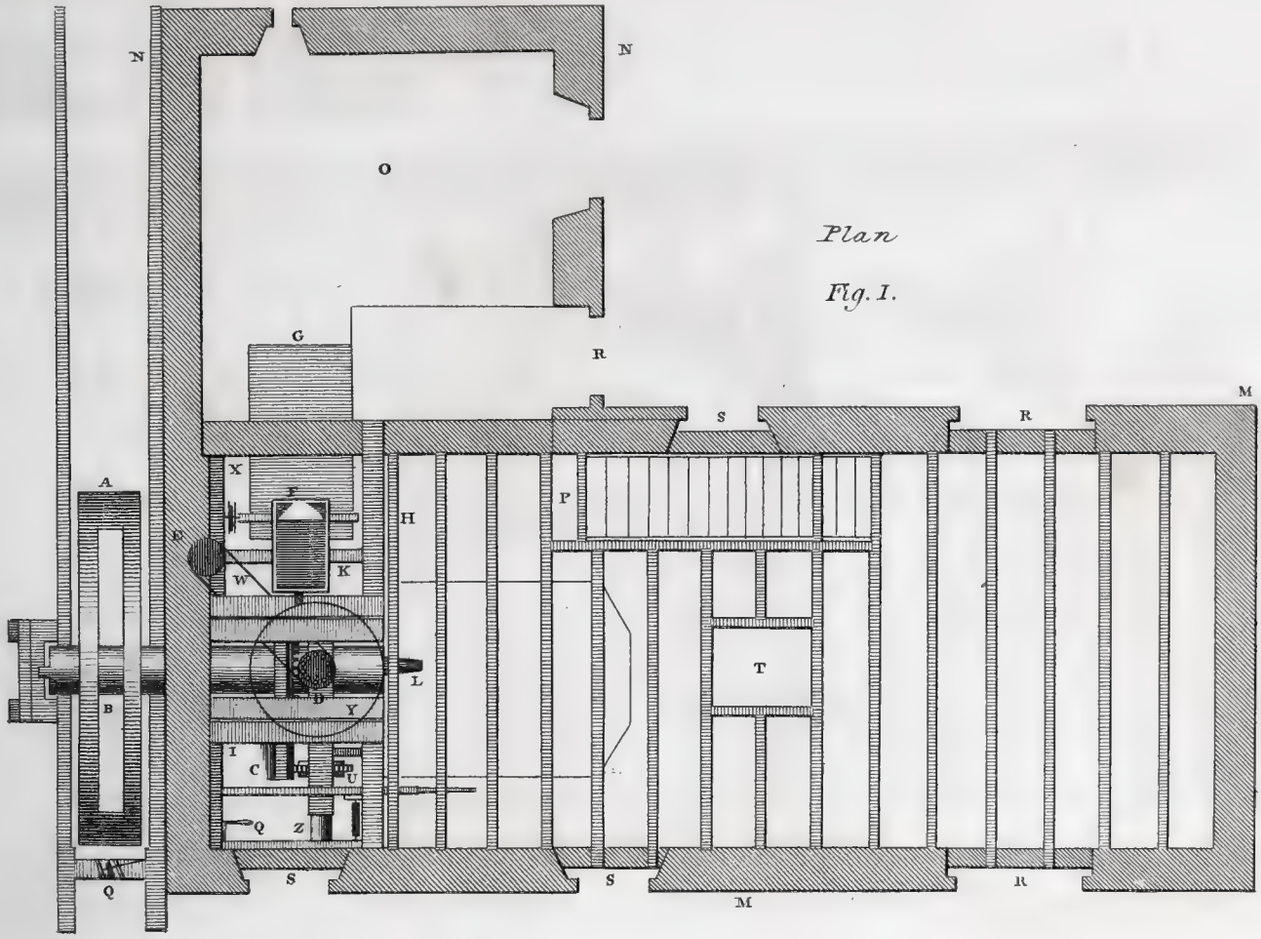


Fig. 7.



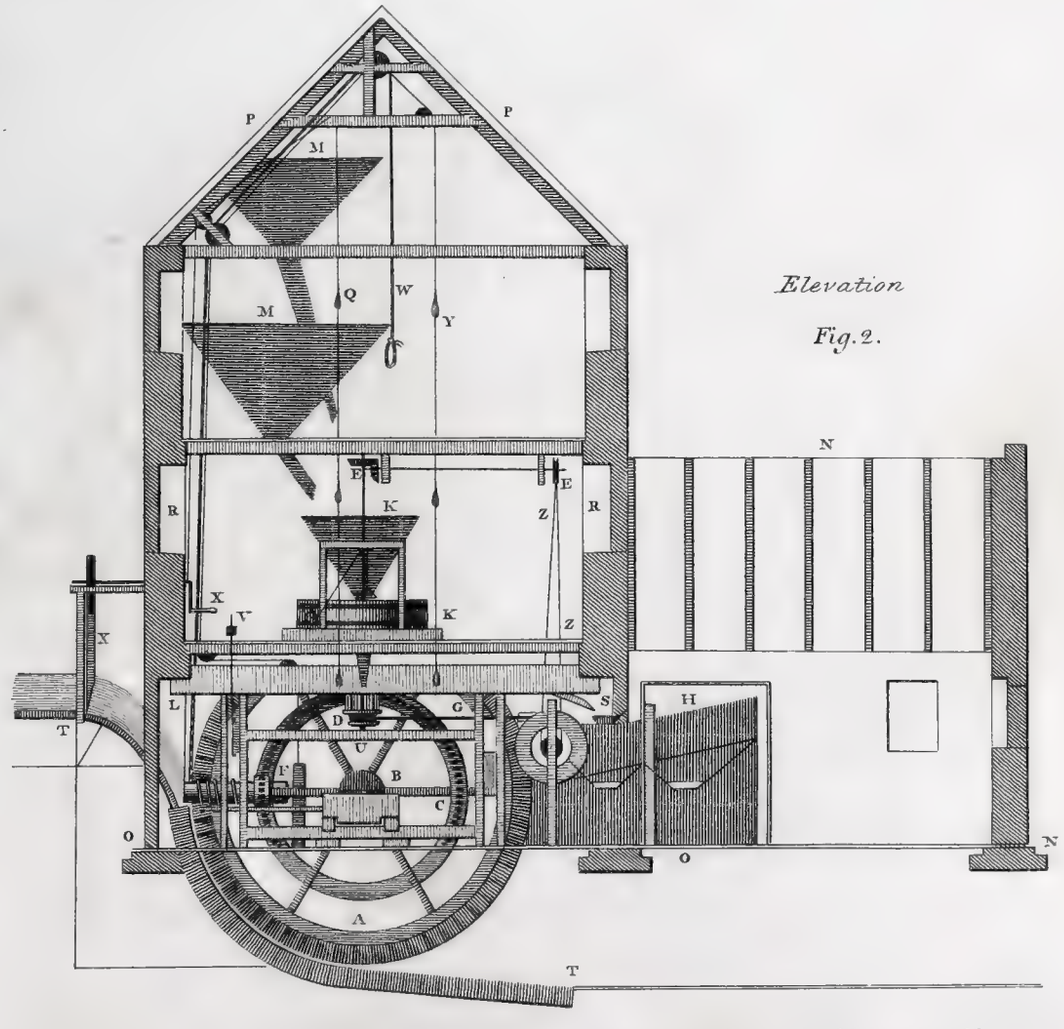
E ◇

Published as the Act directs, Oct. 10. 1807, by Longman, Hurst, Rees, & Orme, Paternoster Row.



Plan

Fig. 1.



Elevation

Fig. 2.

Plate 8. Vol. 2.

Section of Mill for Pot Barley.

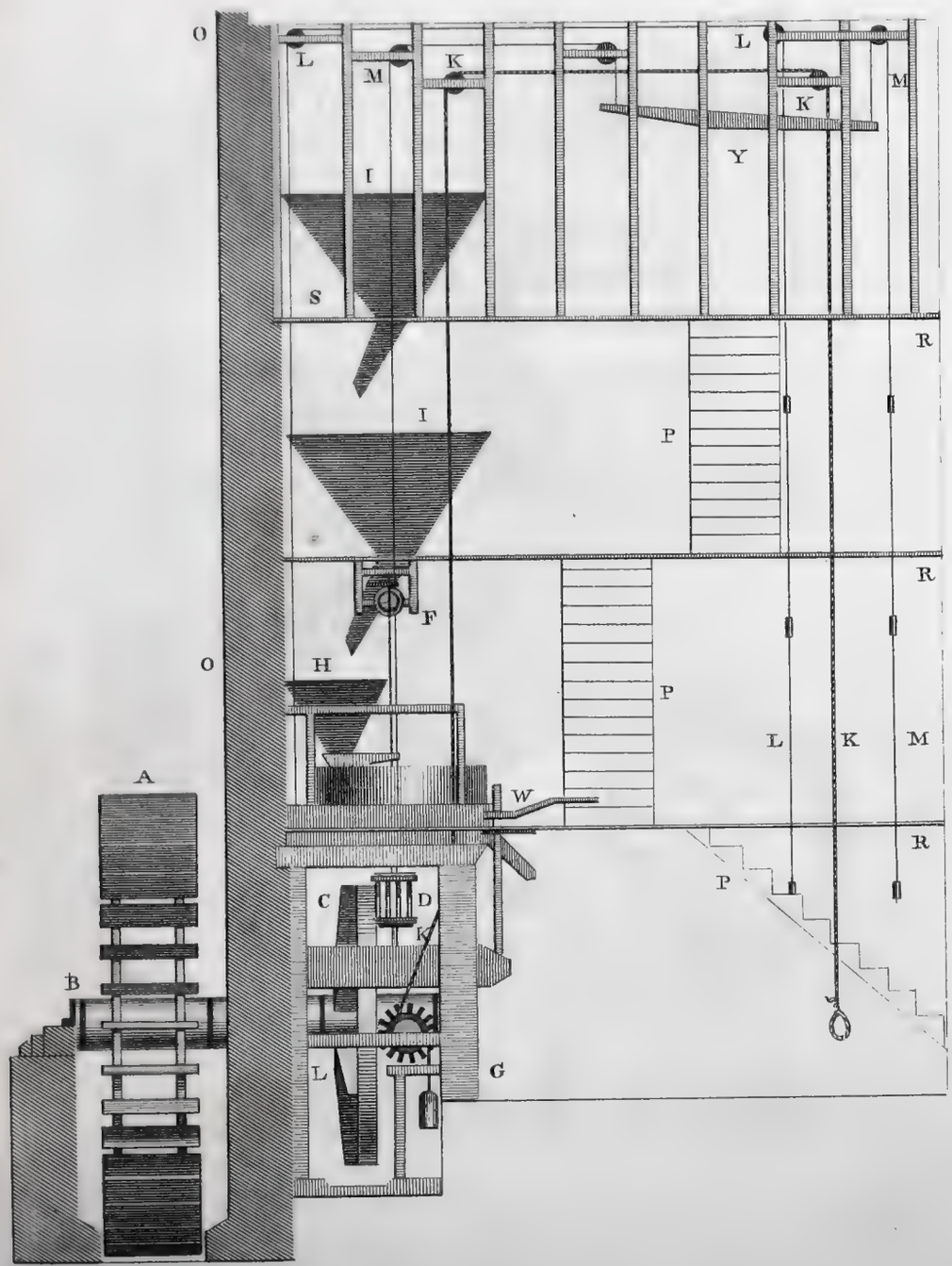
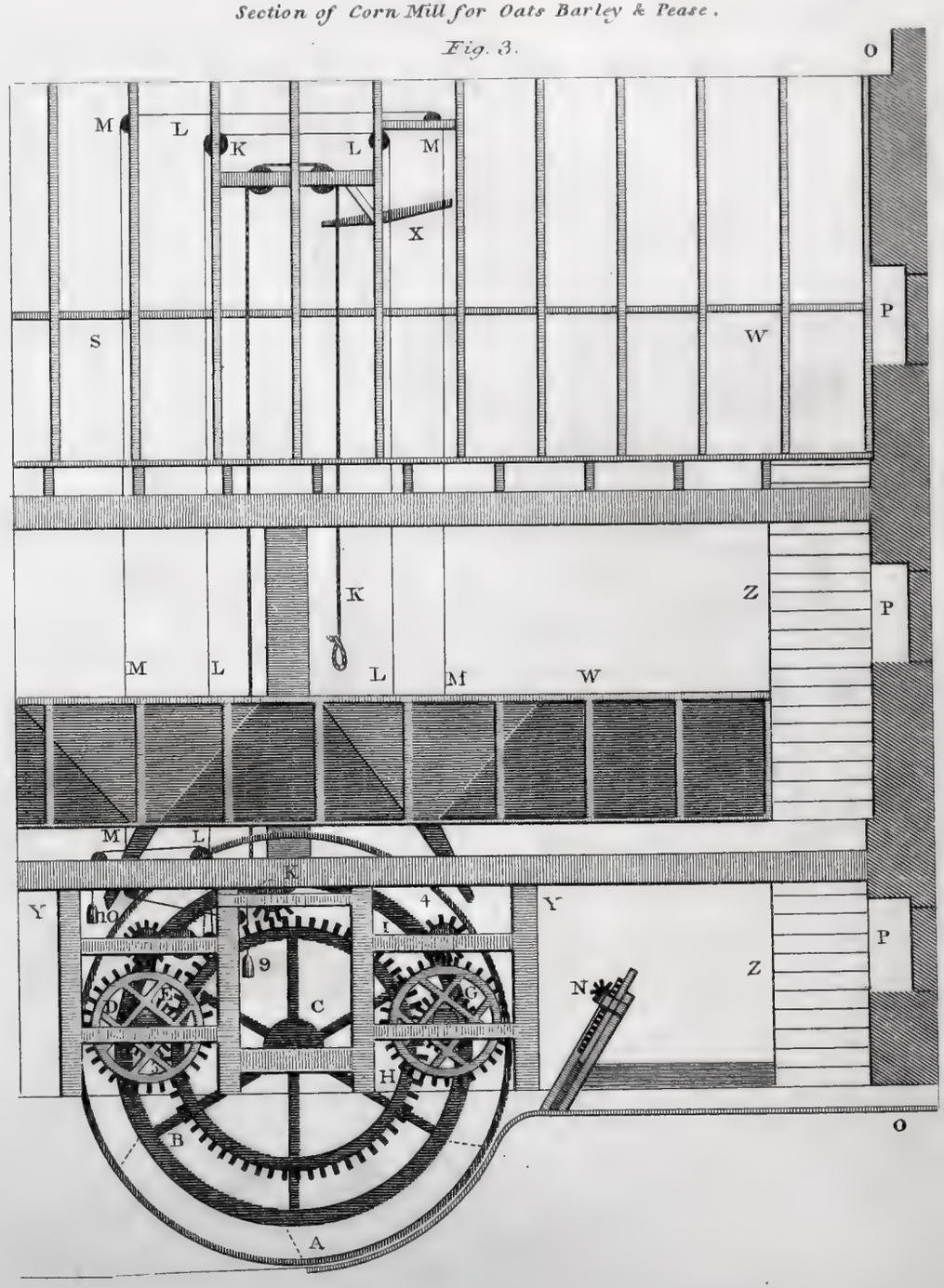
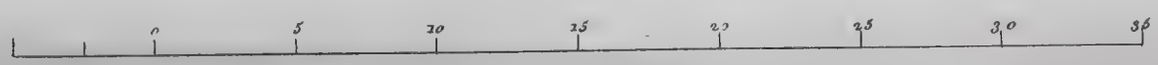


Plate 7. Vol. 2.

Section of Corn Mill for Oats Barley & Pease.

Fig. 3.

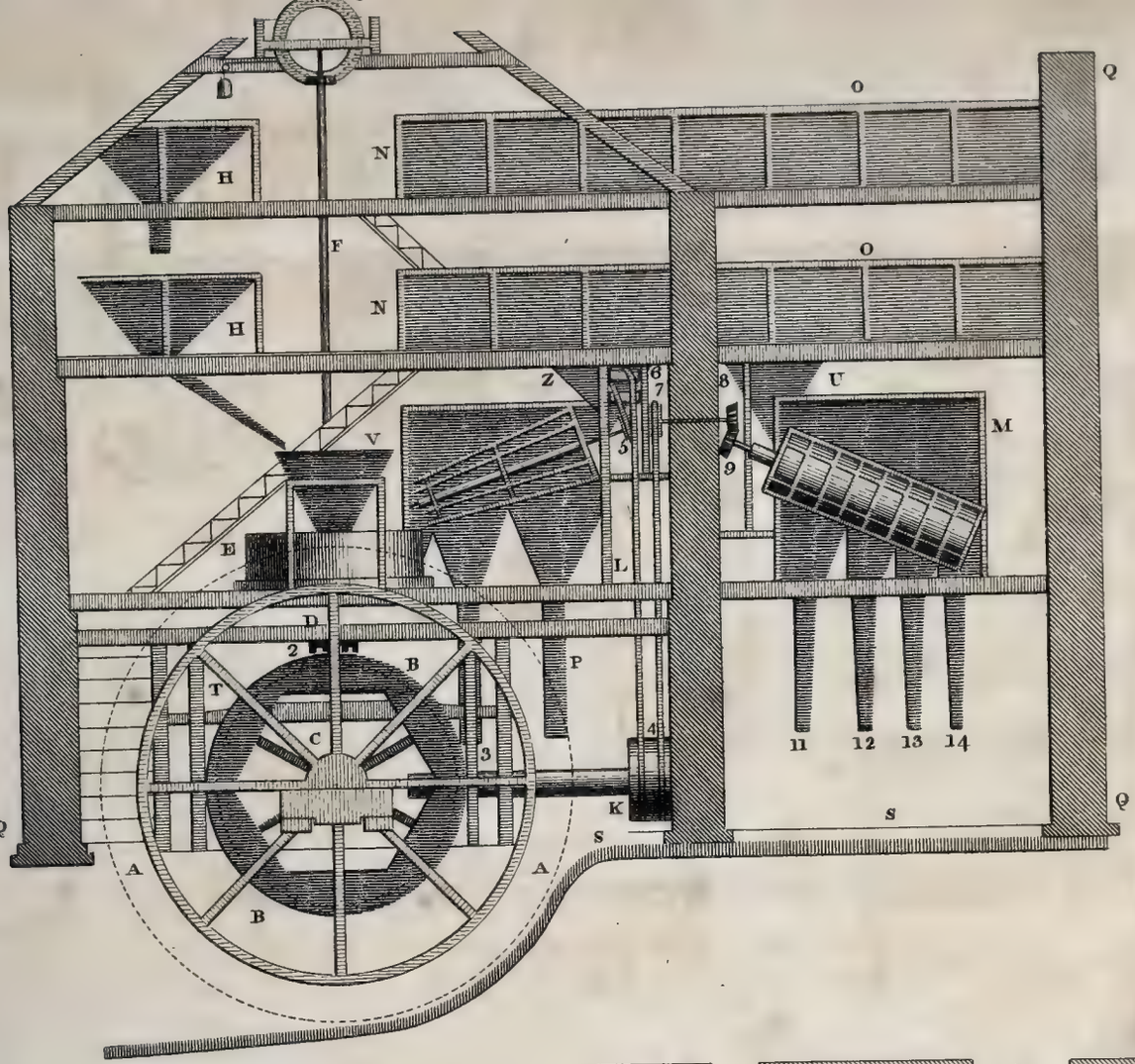




FLOUR MILL.

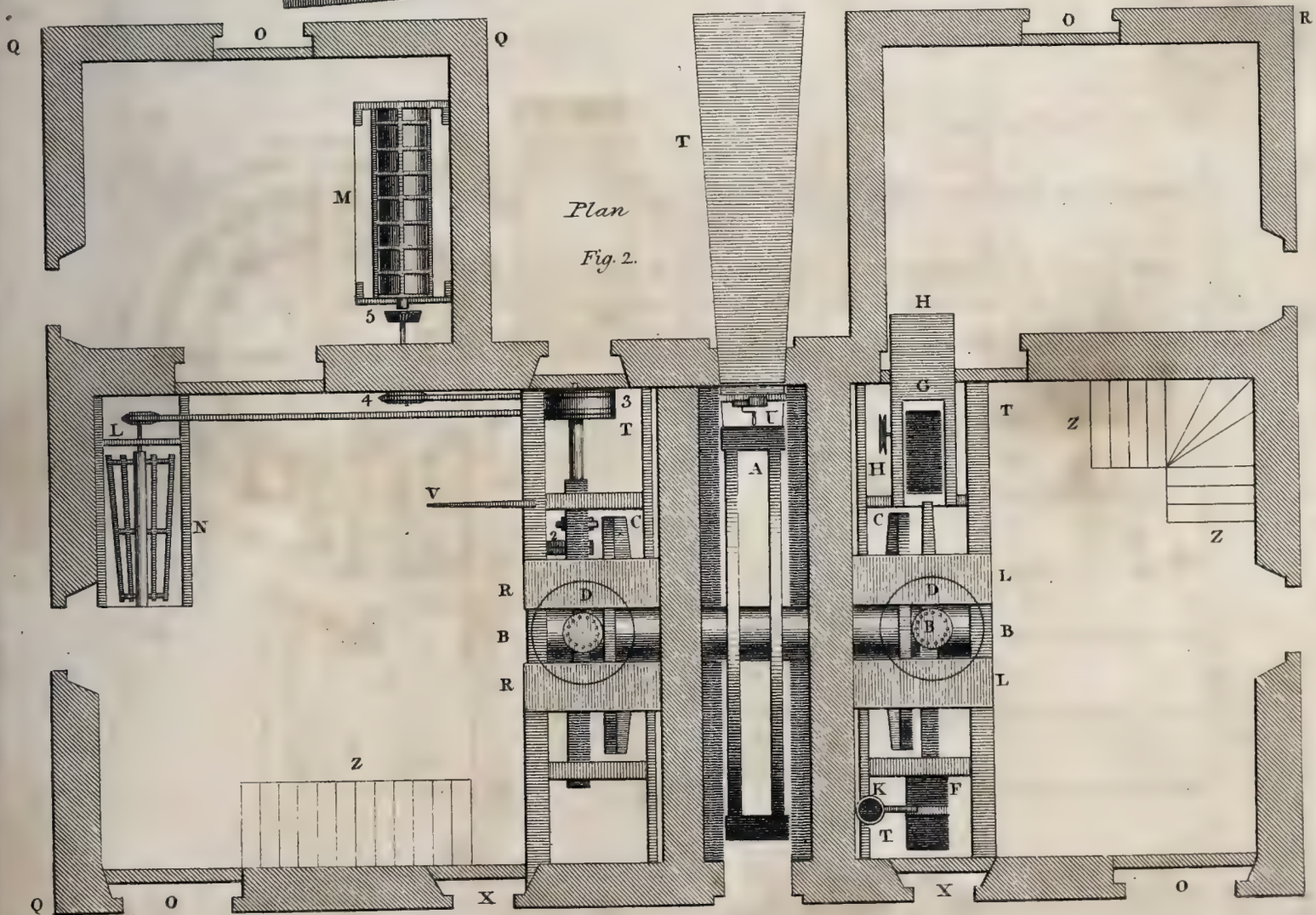
Section of Sheeling Mill

Fig. 1.



Plan

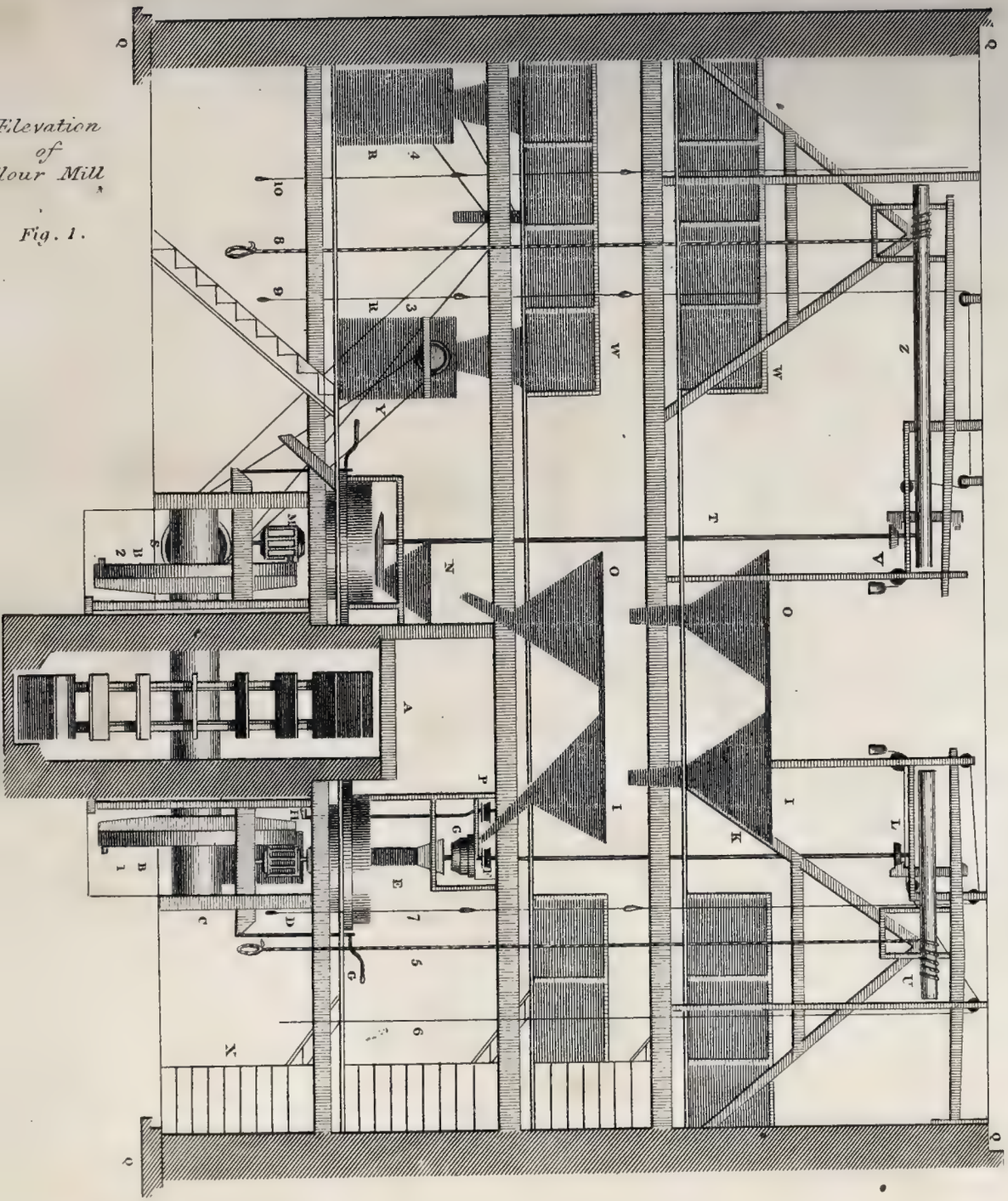
Fig. 2.



Published as the Act directs, July 1. 1806, by Longman, Hurst, Rees, & Orme, Paternoster Row.

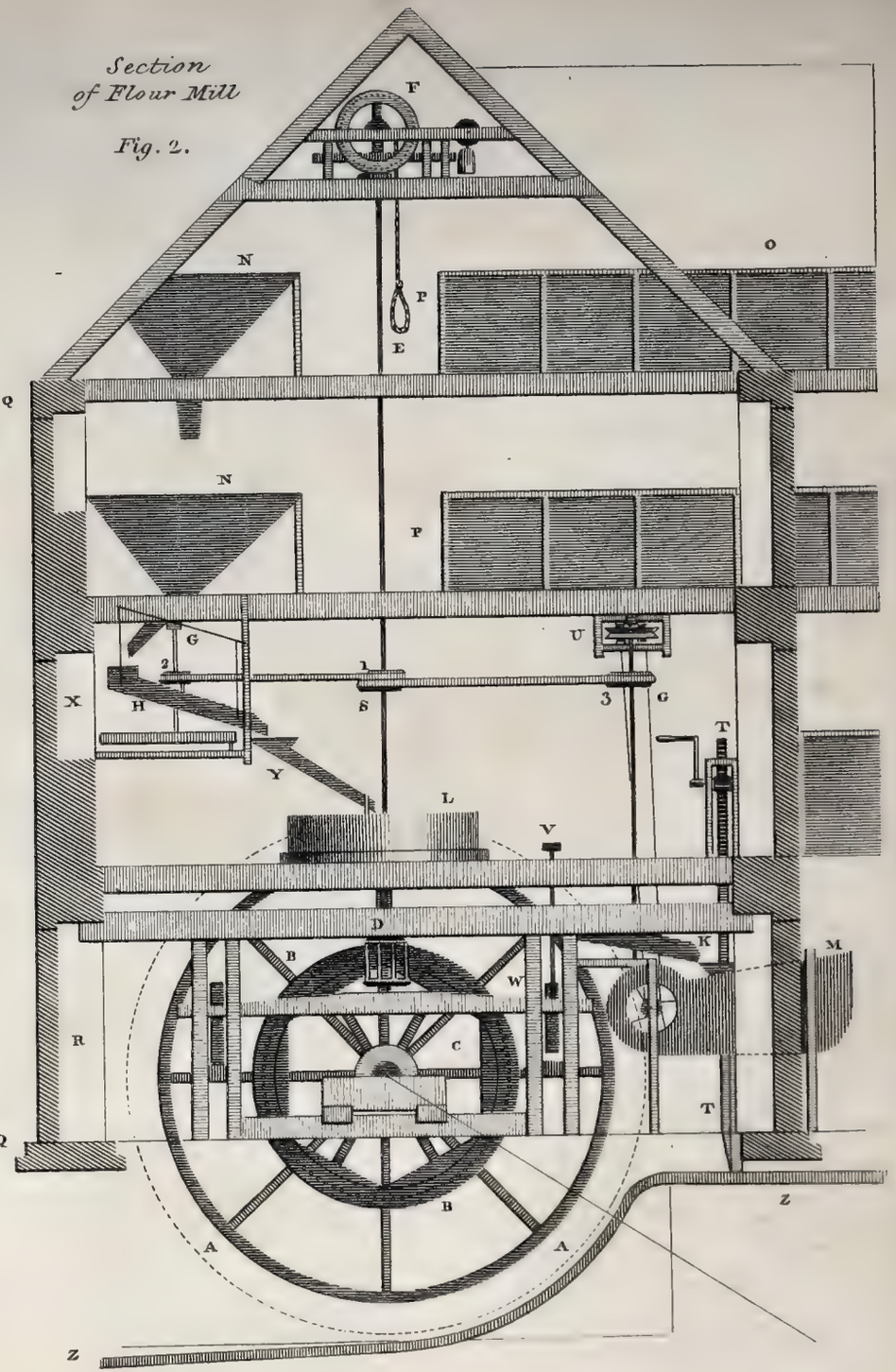
Elevation
of
lour Mill

Fig. 1.



Section
of Flour Mill

Fig. 2.



0 5 10 15 20 25 30 35 40

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Hurst del. et sculp.

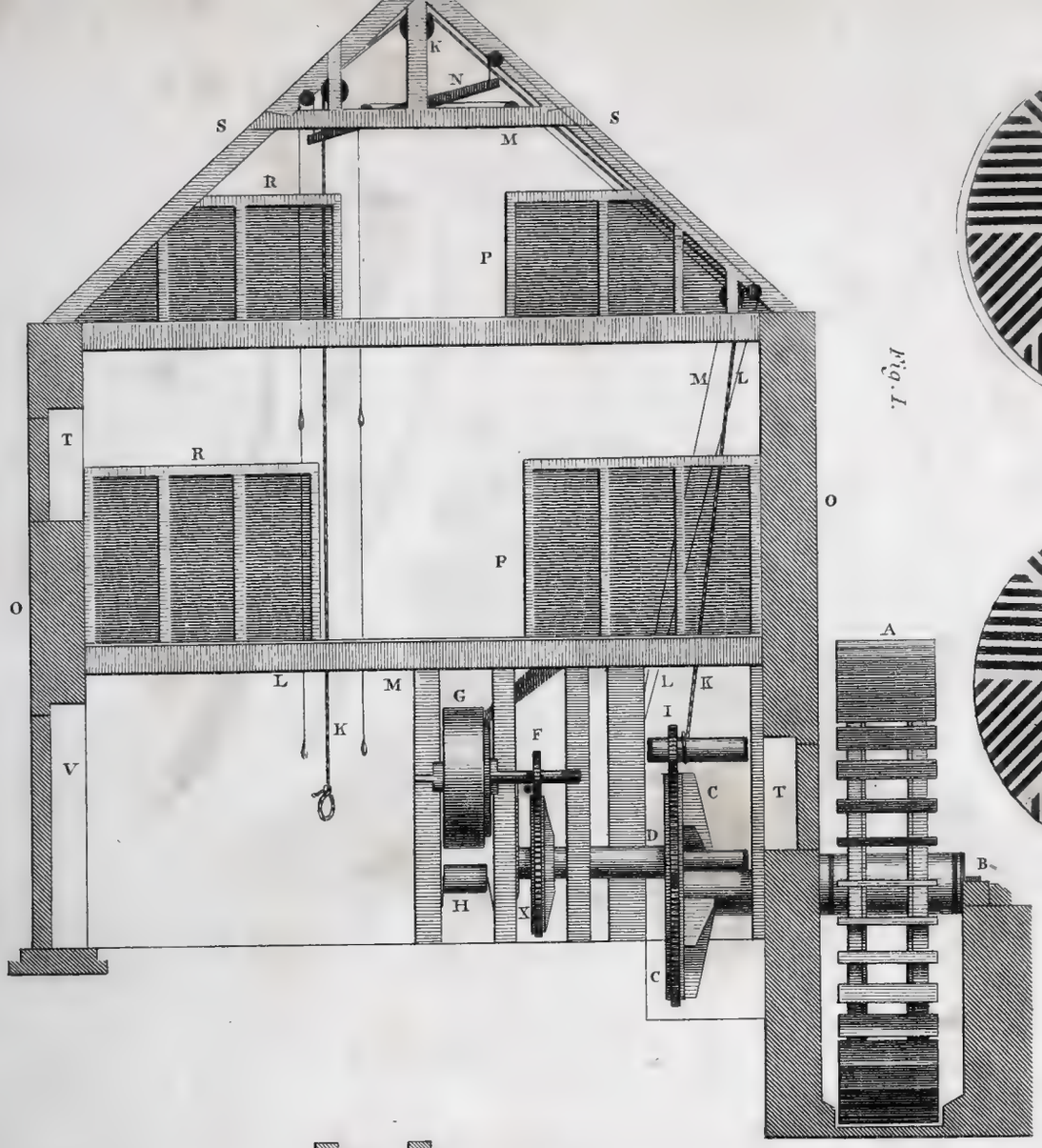
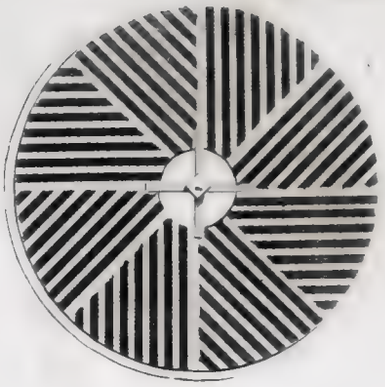
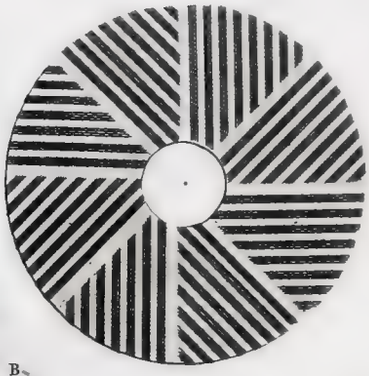


Fig. 1.





MILL for Pot Barley.

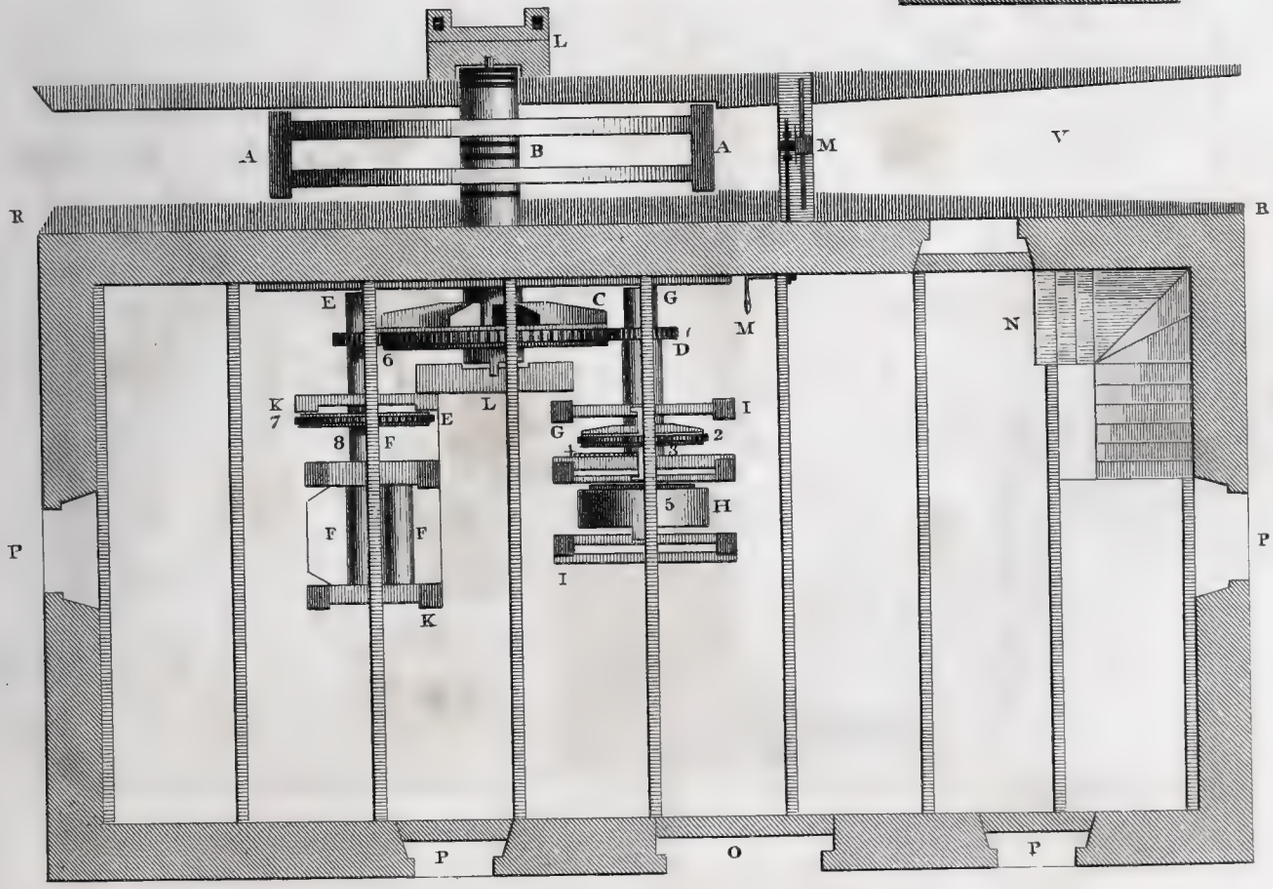


Fig. 2.

Fig. 1.

Fig. 2.

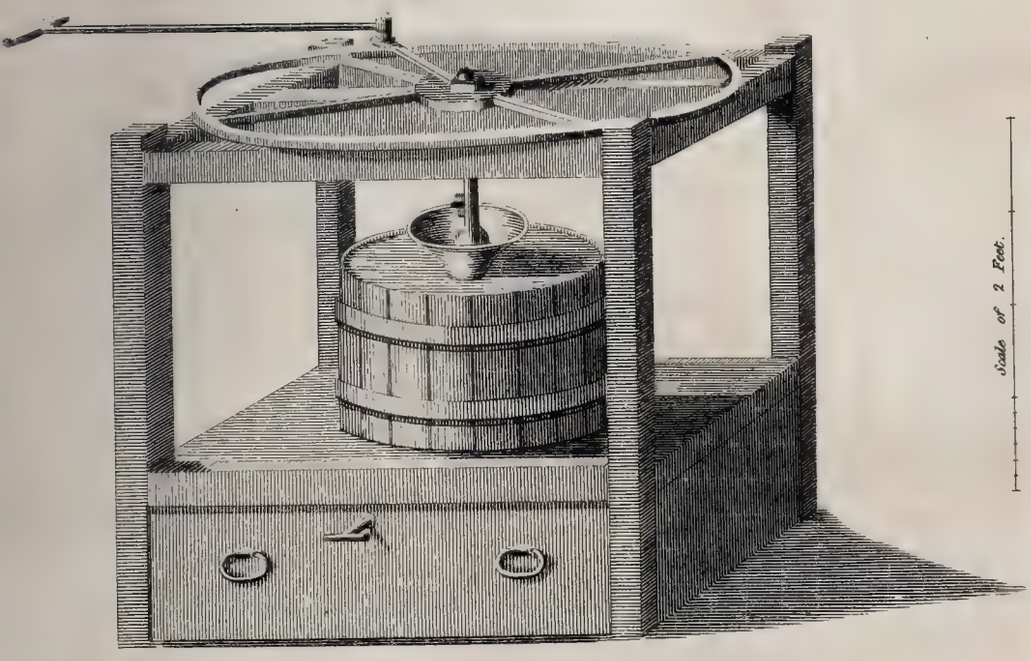
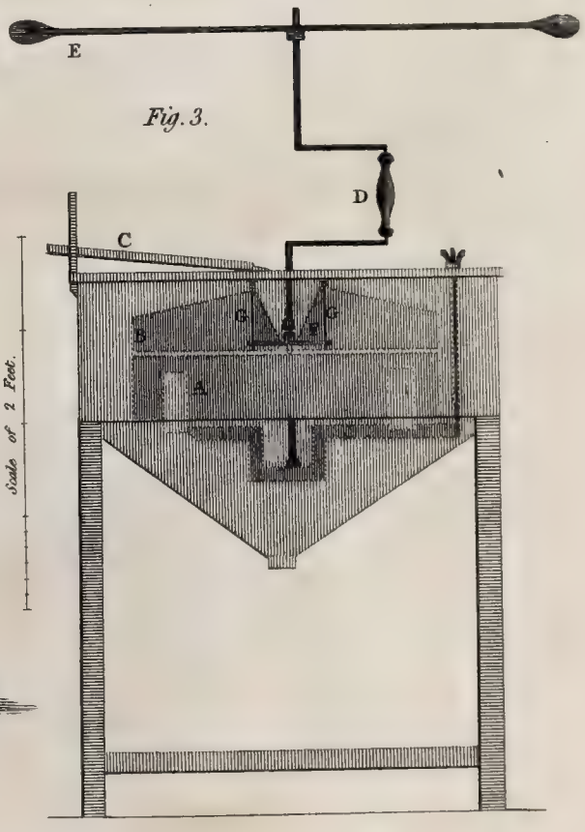


Fig. 3.



Publishd as the Act directs Sep.r 1.1806, by Longman, Rees, Hurst & Orme, Paternoster Row.

Engravd by H. Mutlow.

MOLE CATCHING.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

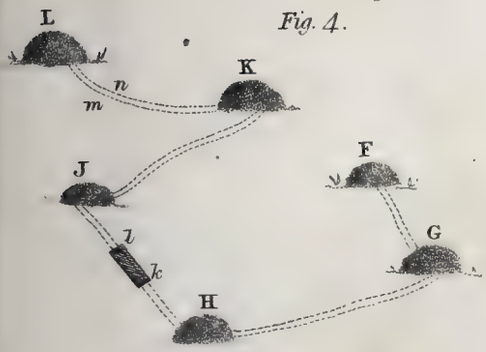
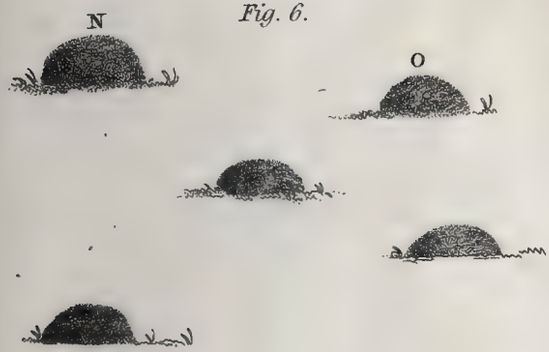


Fig. 7.

Fig. 5.

Fig. 6.



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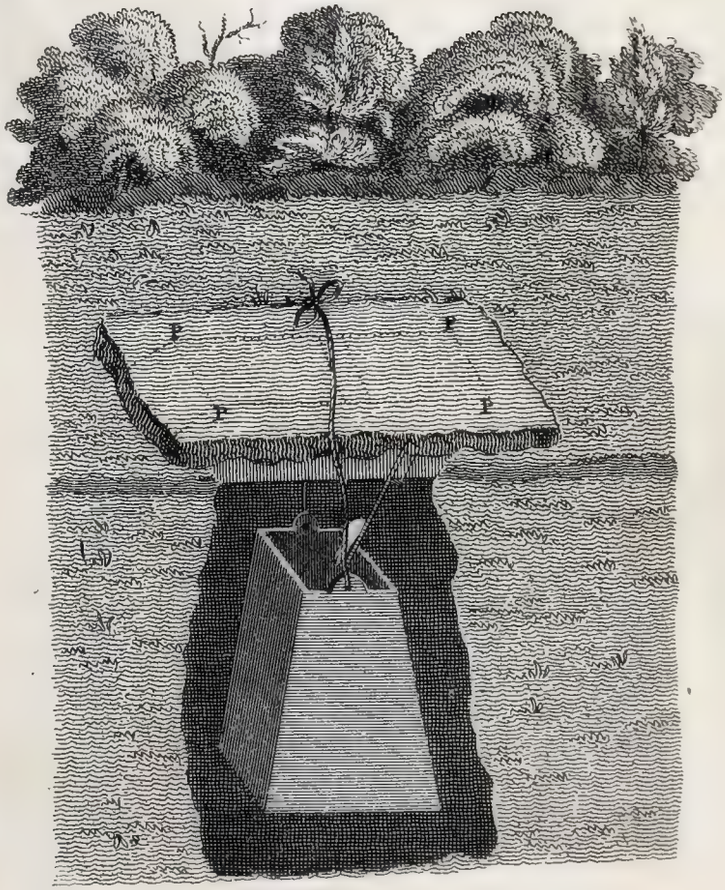


Fig. 11.

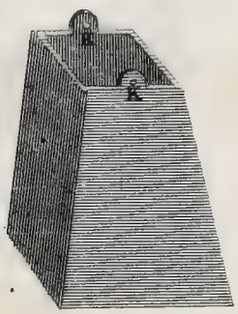


Fig. 8.

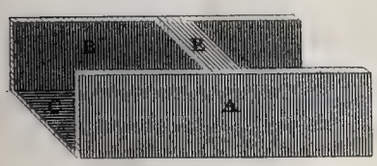


Fig. 10.

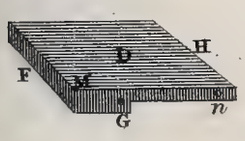
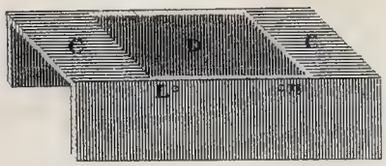


Fig. 9.

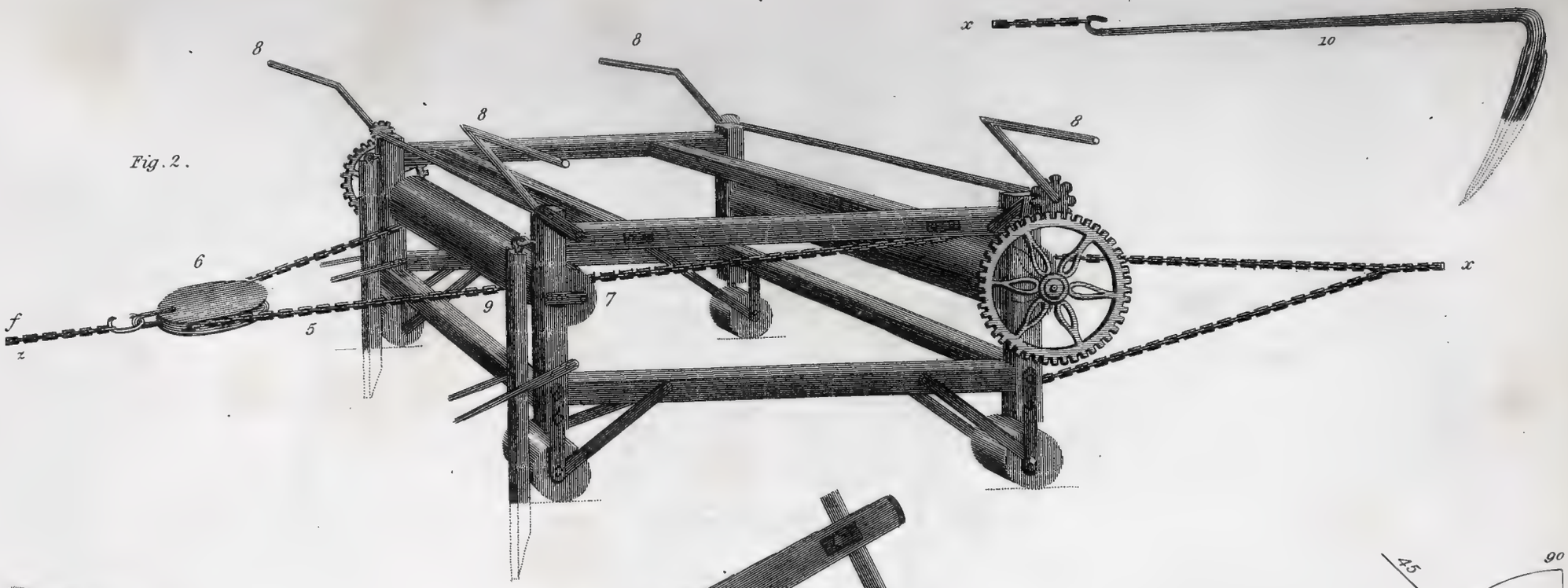


Published as the Act directs Sep.r 1.1806, by Longman, Rees, Hurst & Orme, Paternoster Row.

Engraved by H. Fiddes

MOLE PLOUGHS.

Fig. 2.



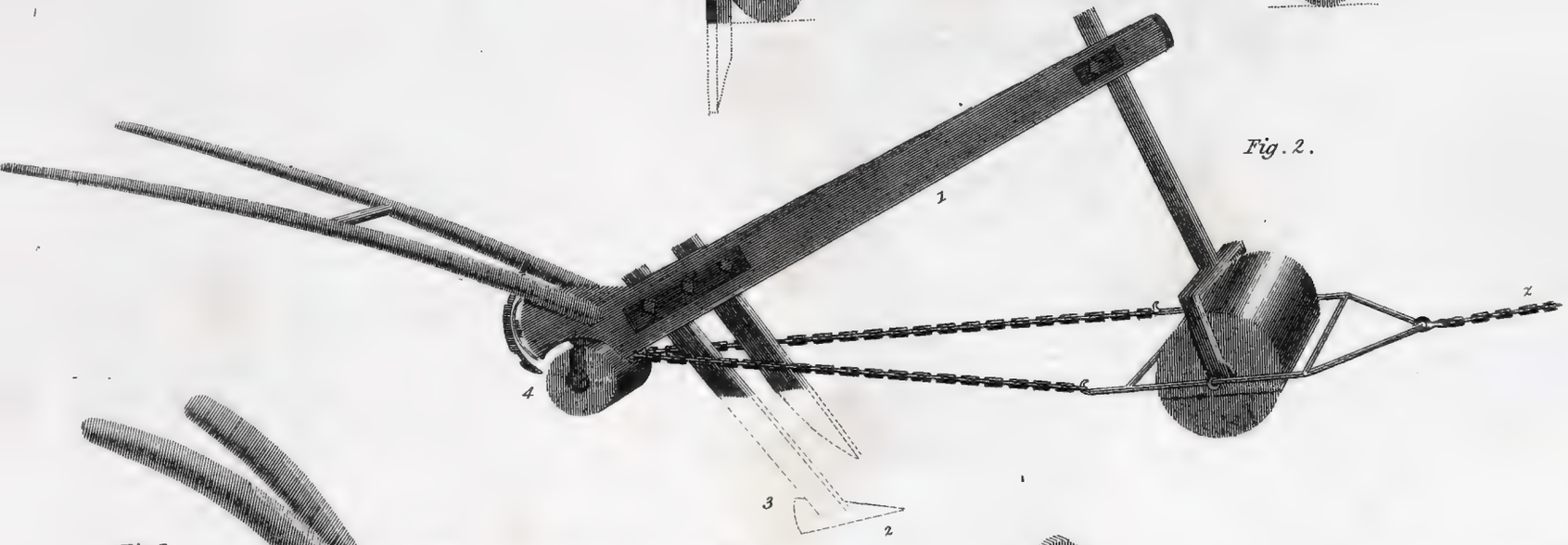


Fig. 2.

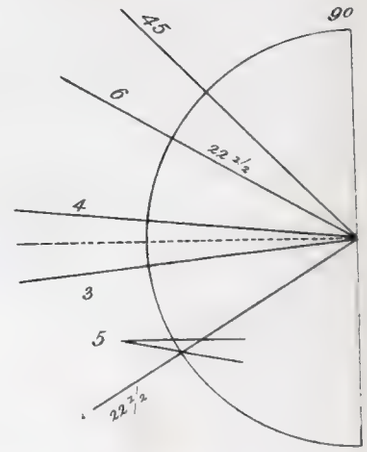
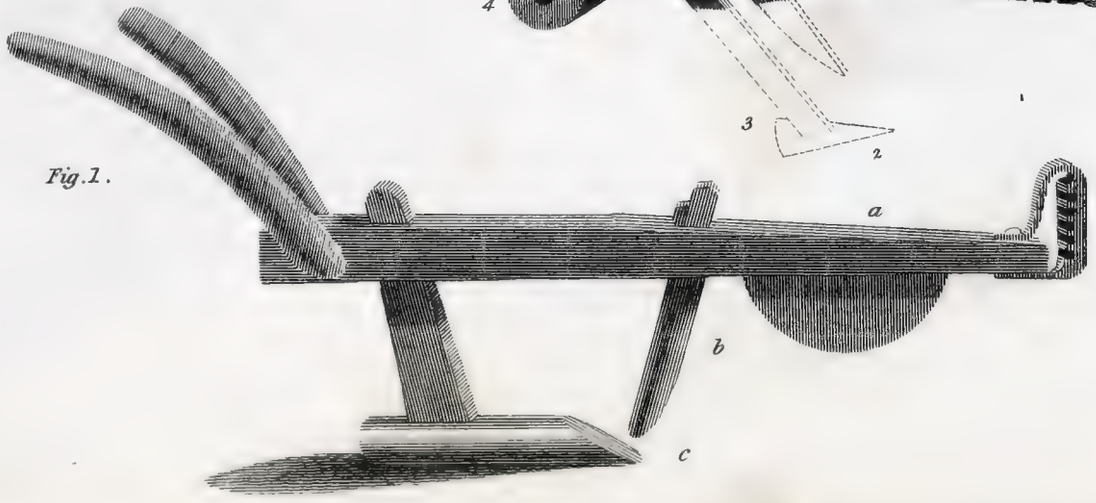


Fig. 1.



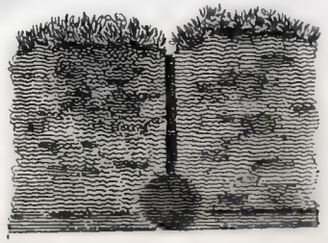


Plate XII. Vol II.

C. Blunt del. et sculp.t

Published Jan.y 2.d 1807, by Longman, Hurst, Rees, & Orme, Paternoster Row.

OX SHOEING MACHINE, &c.

Fig. 1.

Nicking

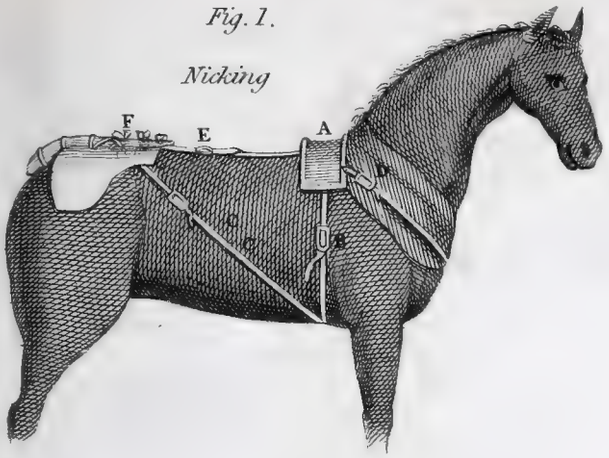


Fig. 2.

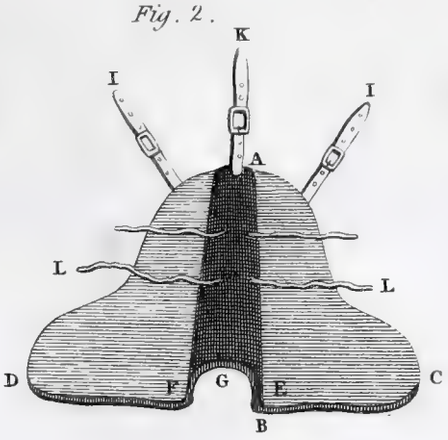


Fig. 3.

Fig. 5.

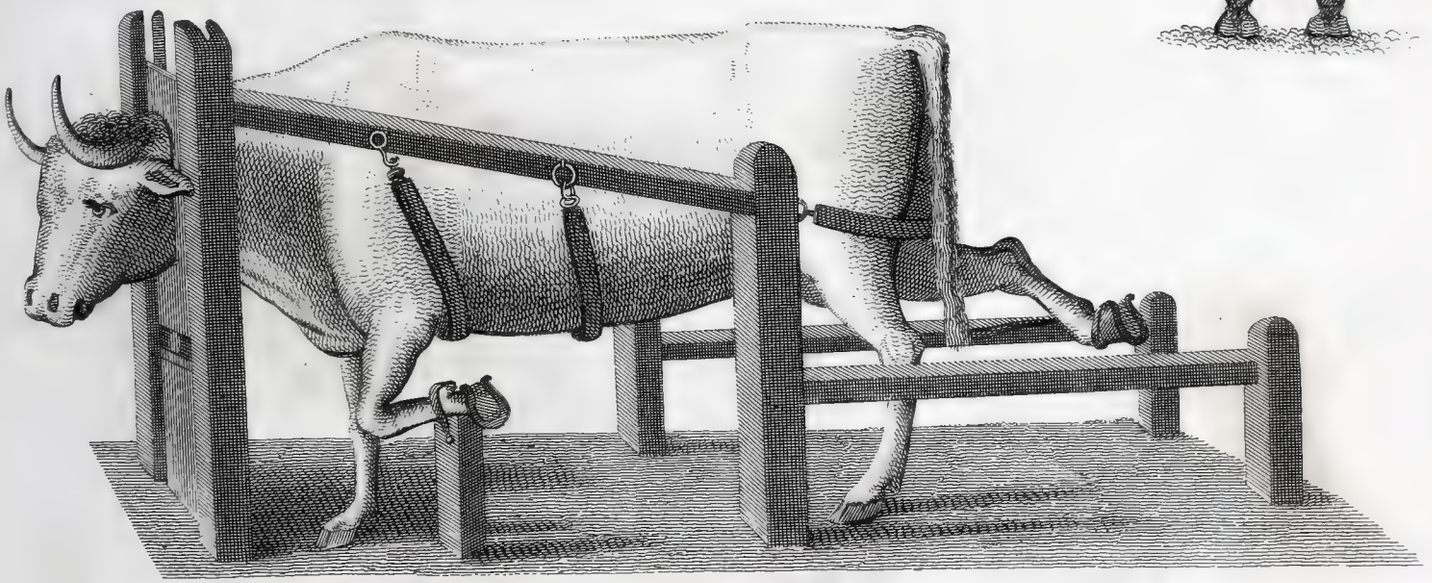
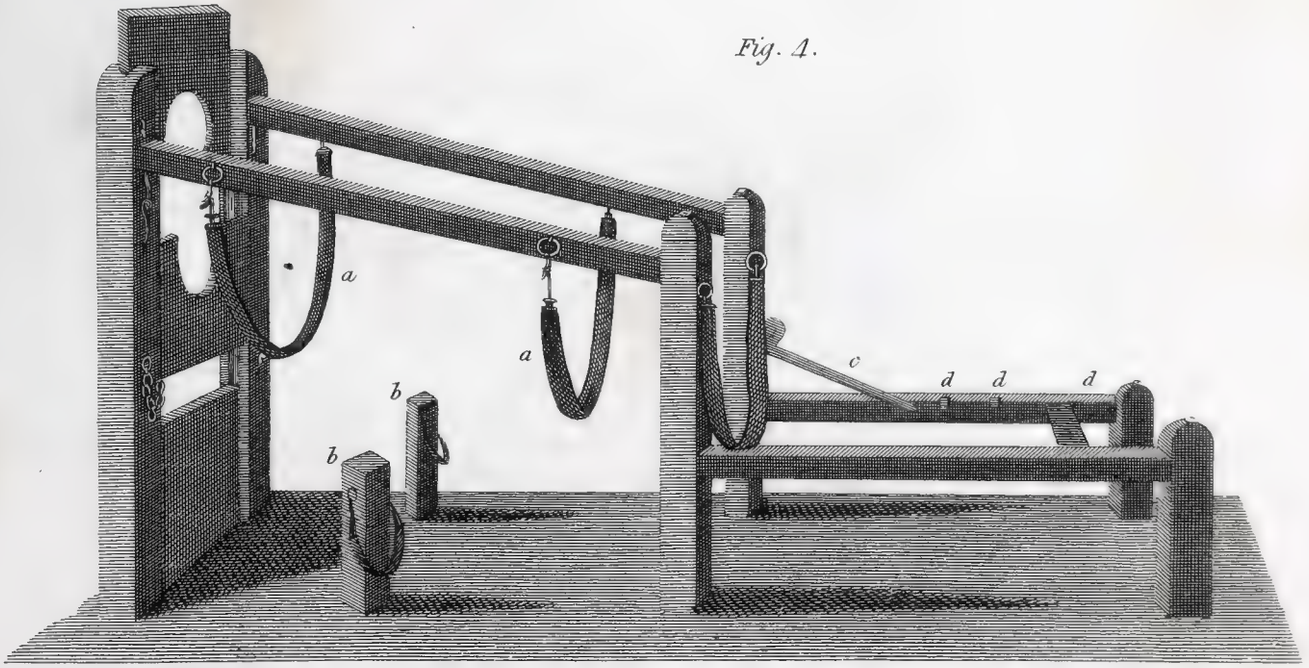


Fig. 4.



1 2 3 4 5 6 7 8 9 10 Scale of Ten Feet.

PARING PLOUGHS

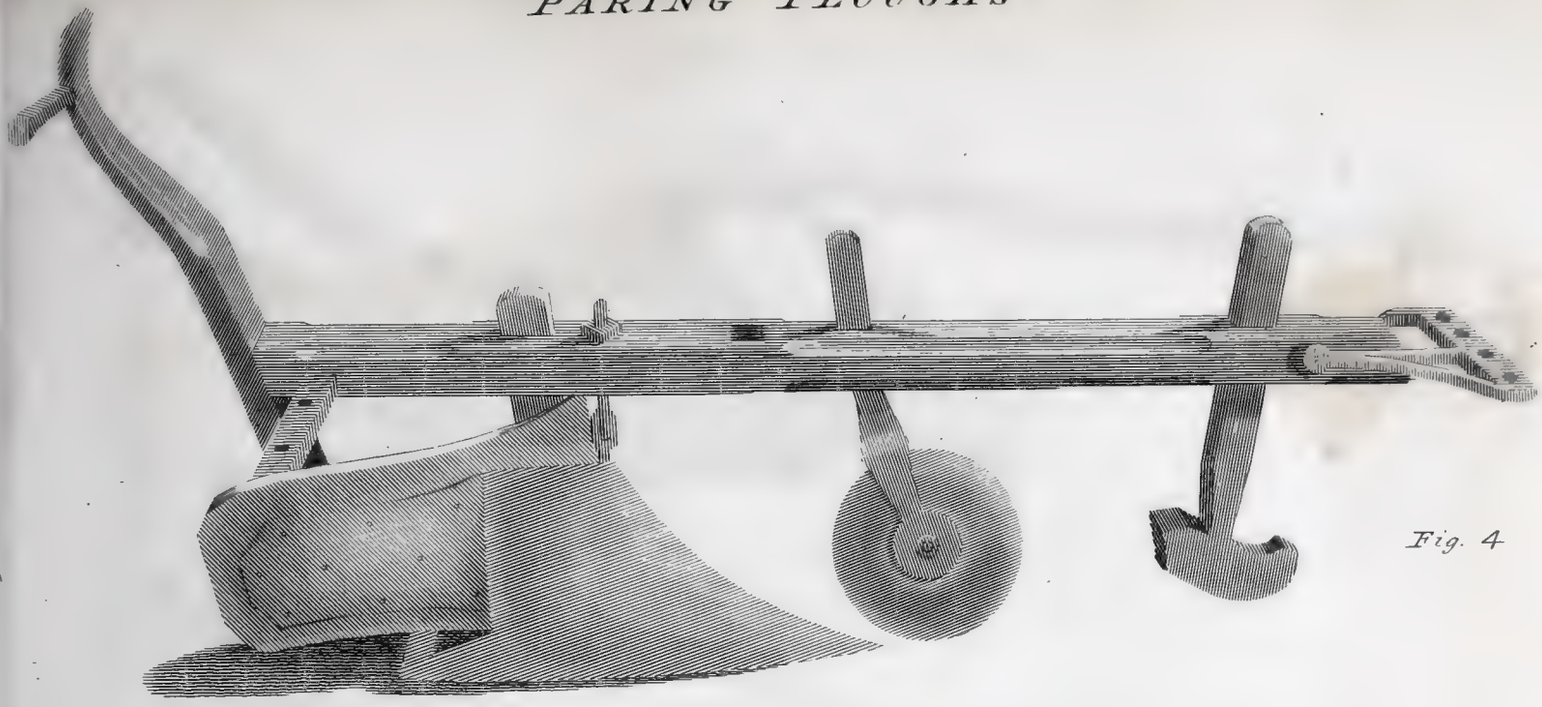


Fig. 4

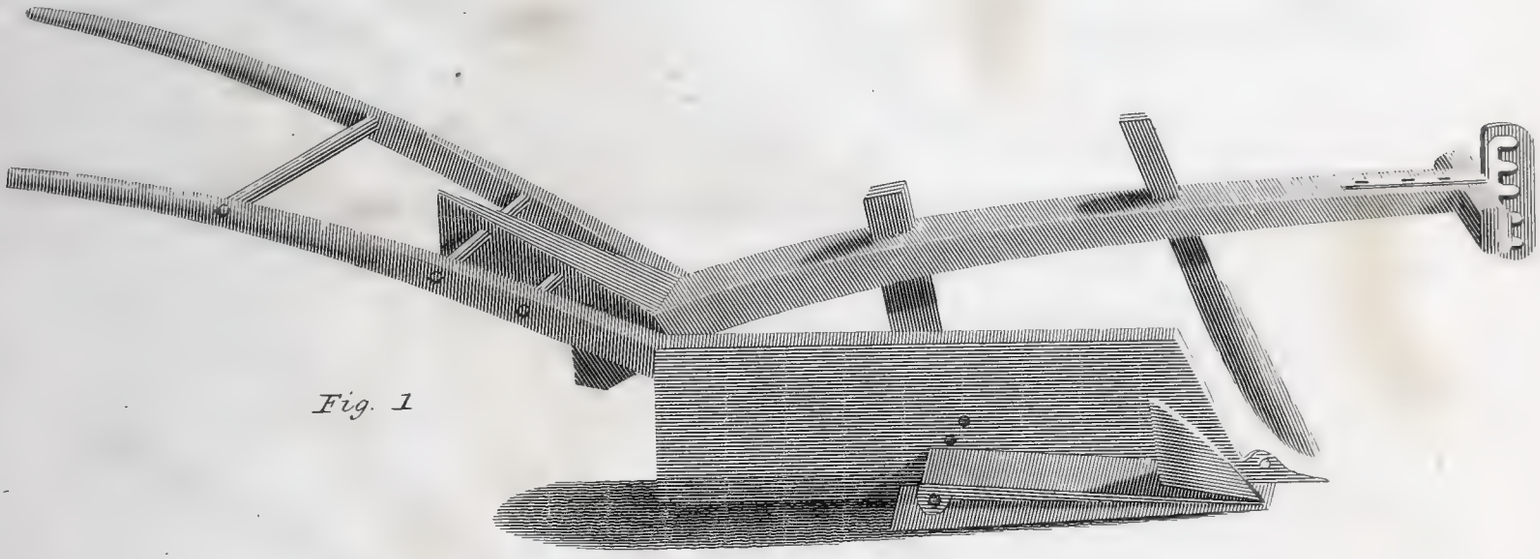


Fig. 1

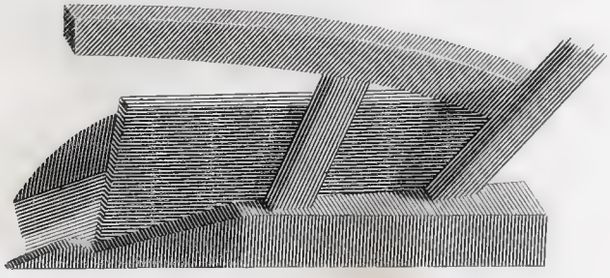


Fig. 2

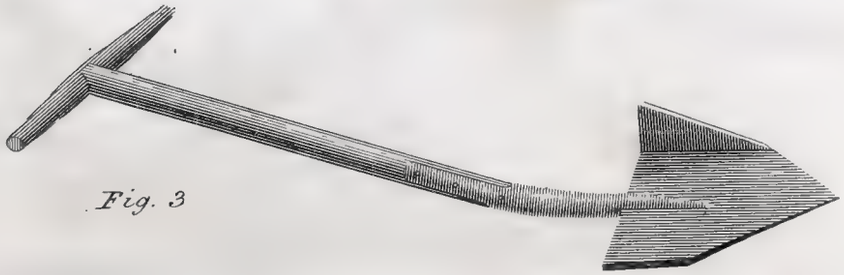


Fig. 3

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Blunt del.t et sculp.t

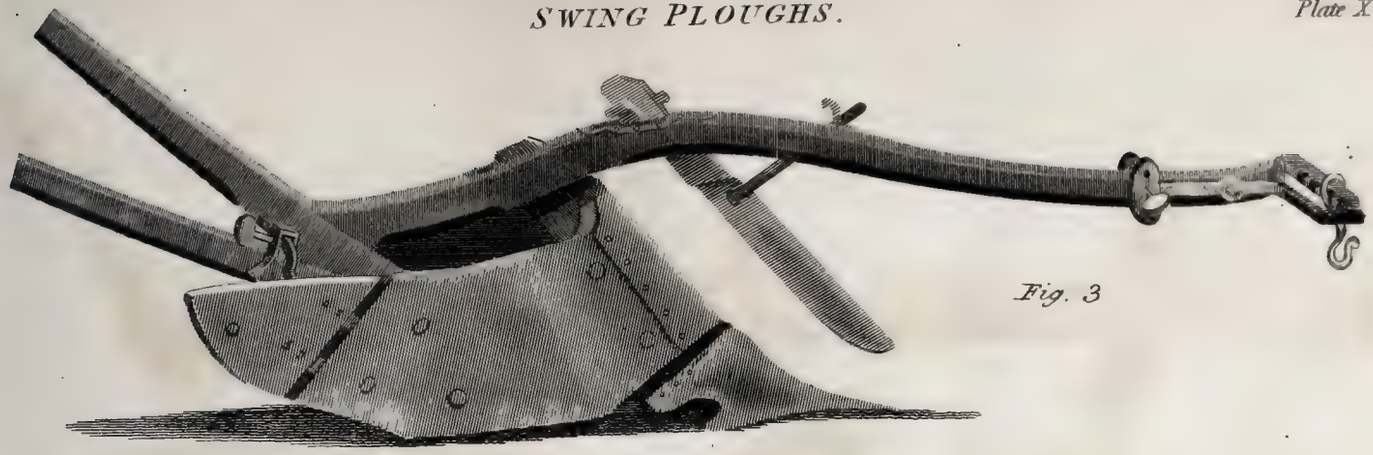

Fig. 3

Fig. 2

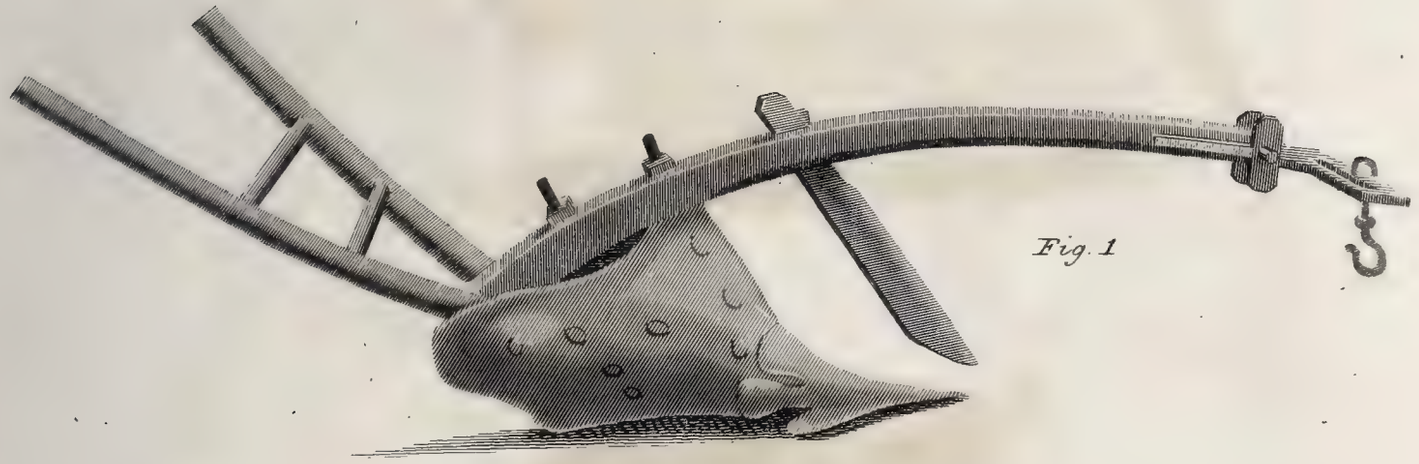

Fig. 1

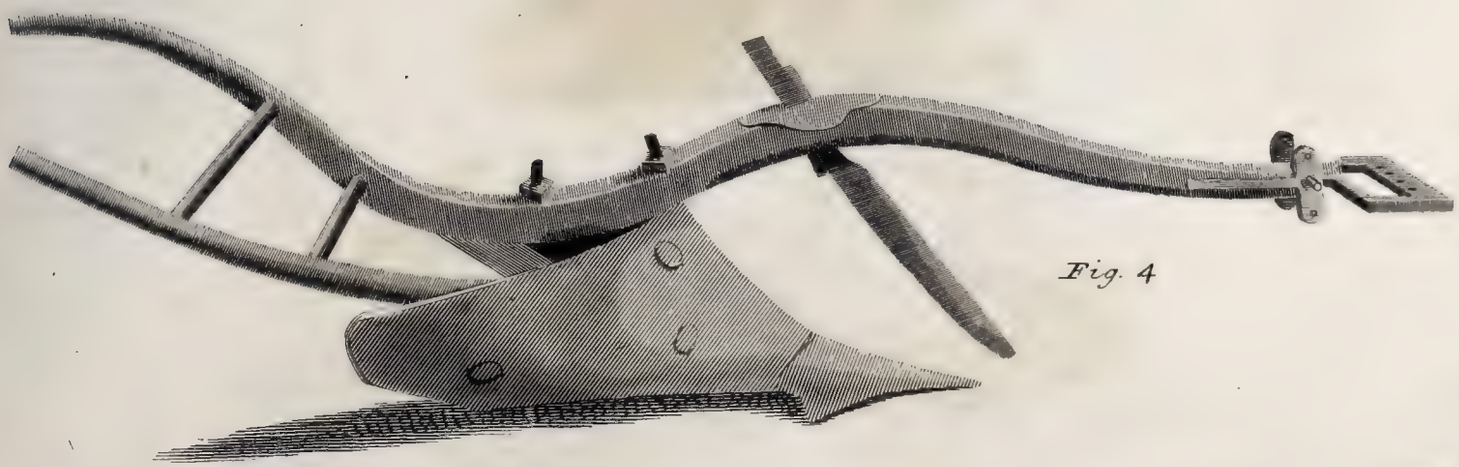

Fig. 4

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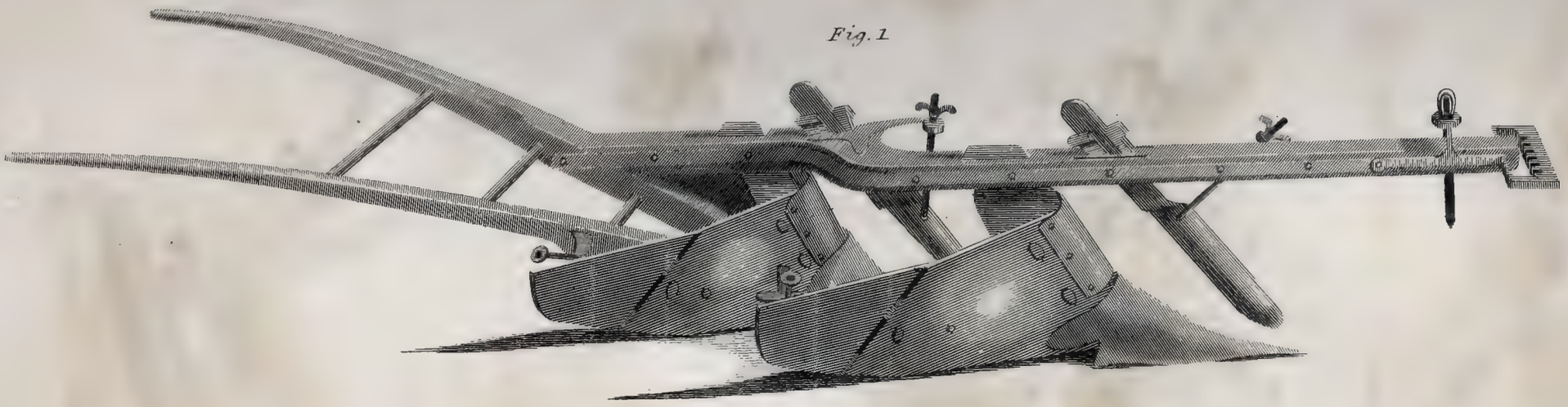
by Longman, Hurst, Rees & Orme, Paternoster Row.

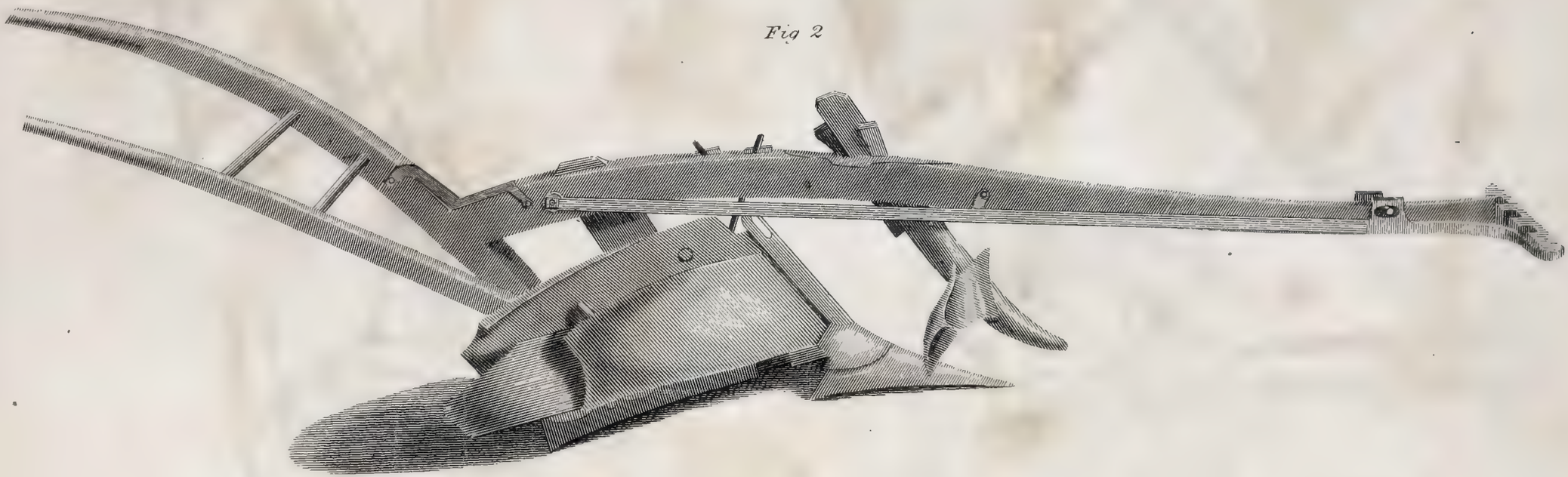
DOUBLE PLOUGH.

Fig. 1



SKIMCOULTER PLOUGH.

Fig 2



Published as the Act directs Oct.r 1 1806 by Longman, Hurst, Rees, & Orme, Paternoster Row.

Fig. 1

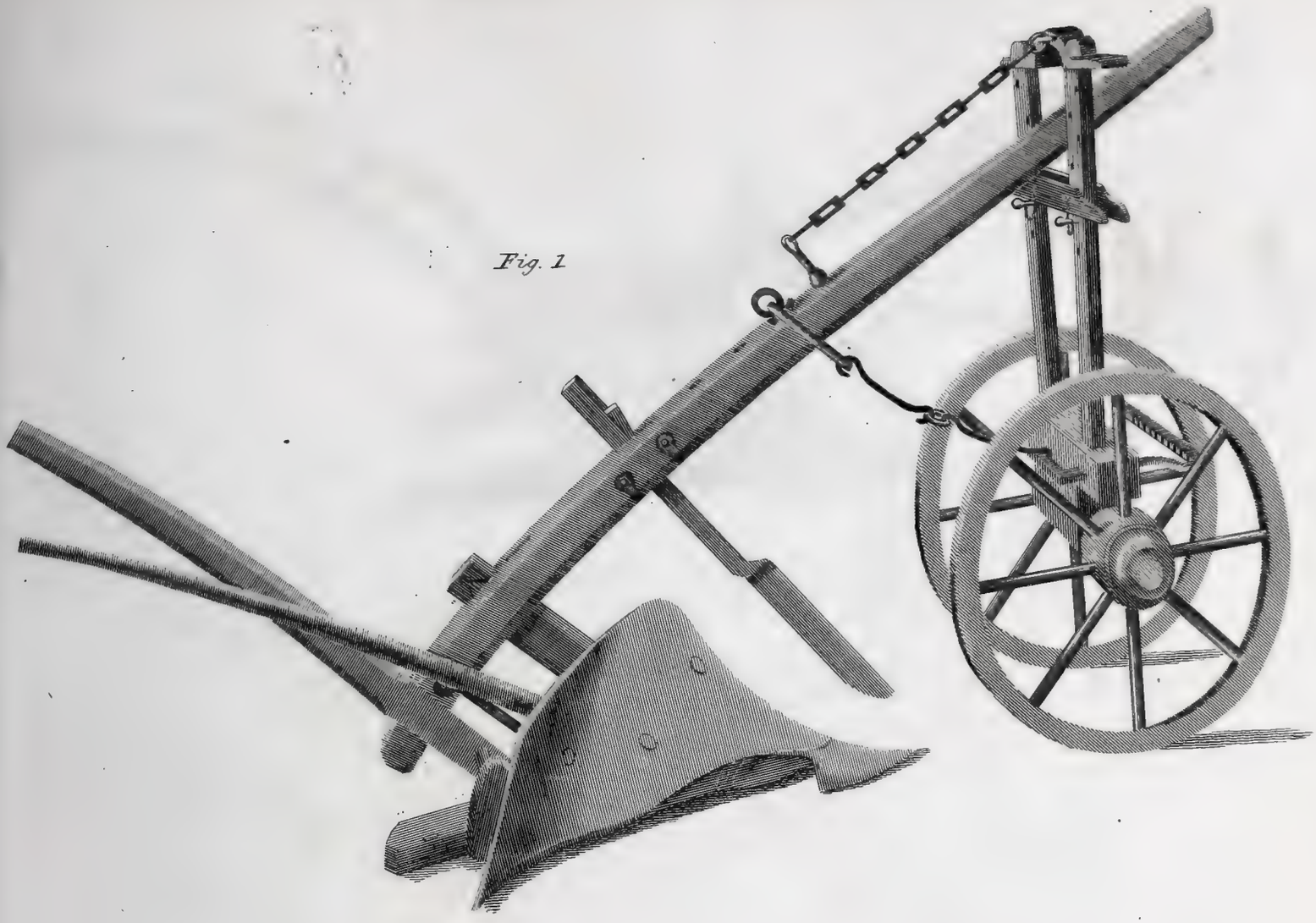
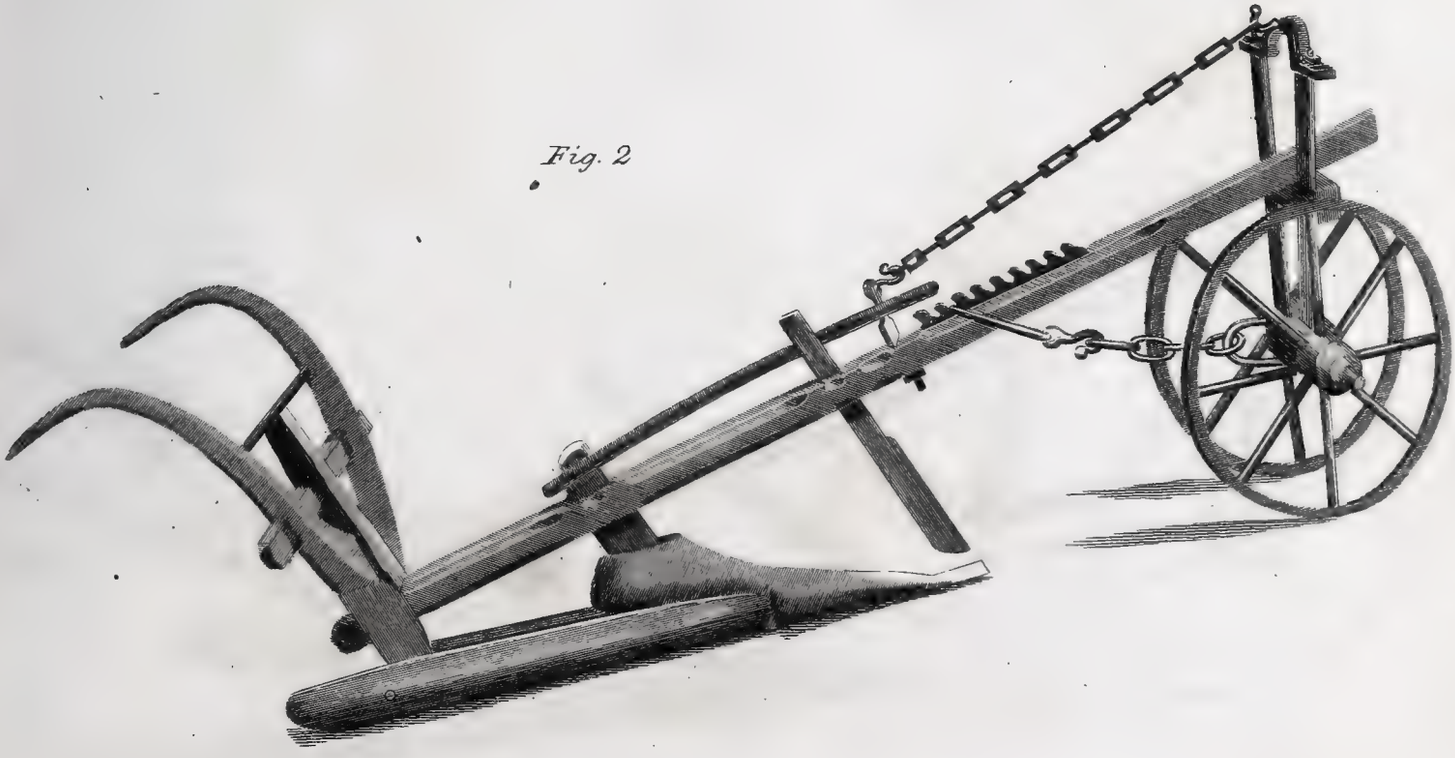


Fig. 2



Longman, Hurst, Rees & Orme, Paternoster Row.

WHEEL PLOUGHS

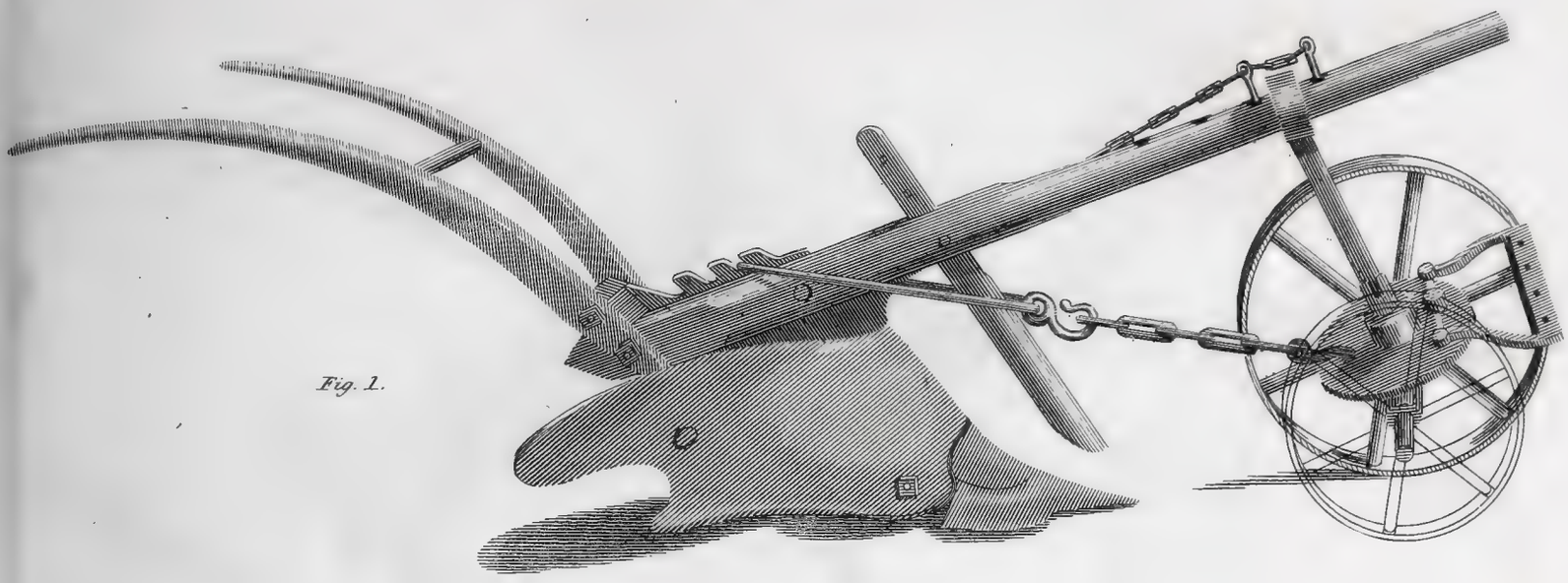
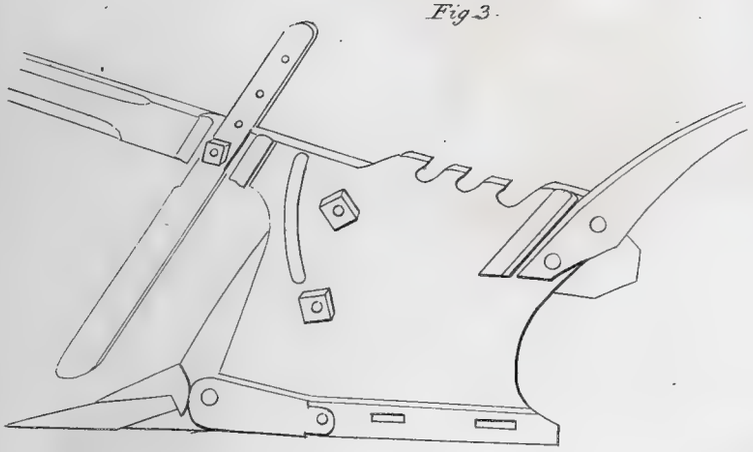


Fig. 1.

Fig 3.



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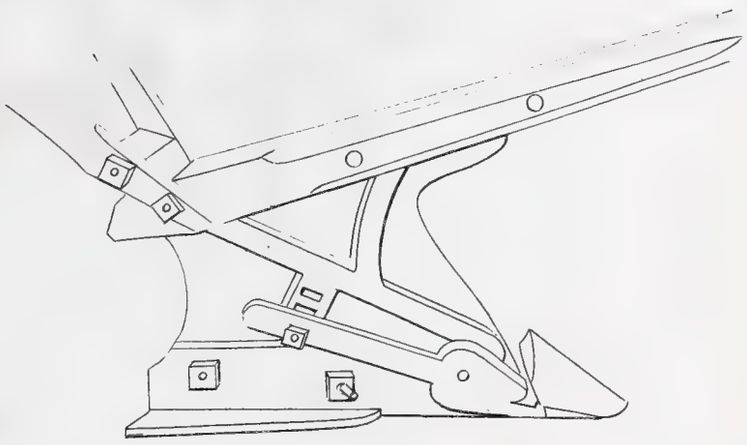

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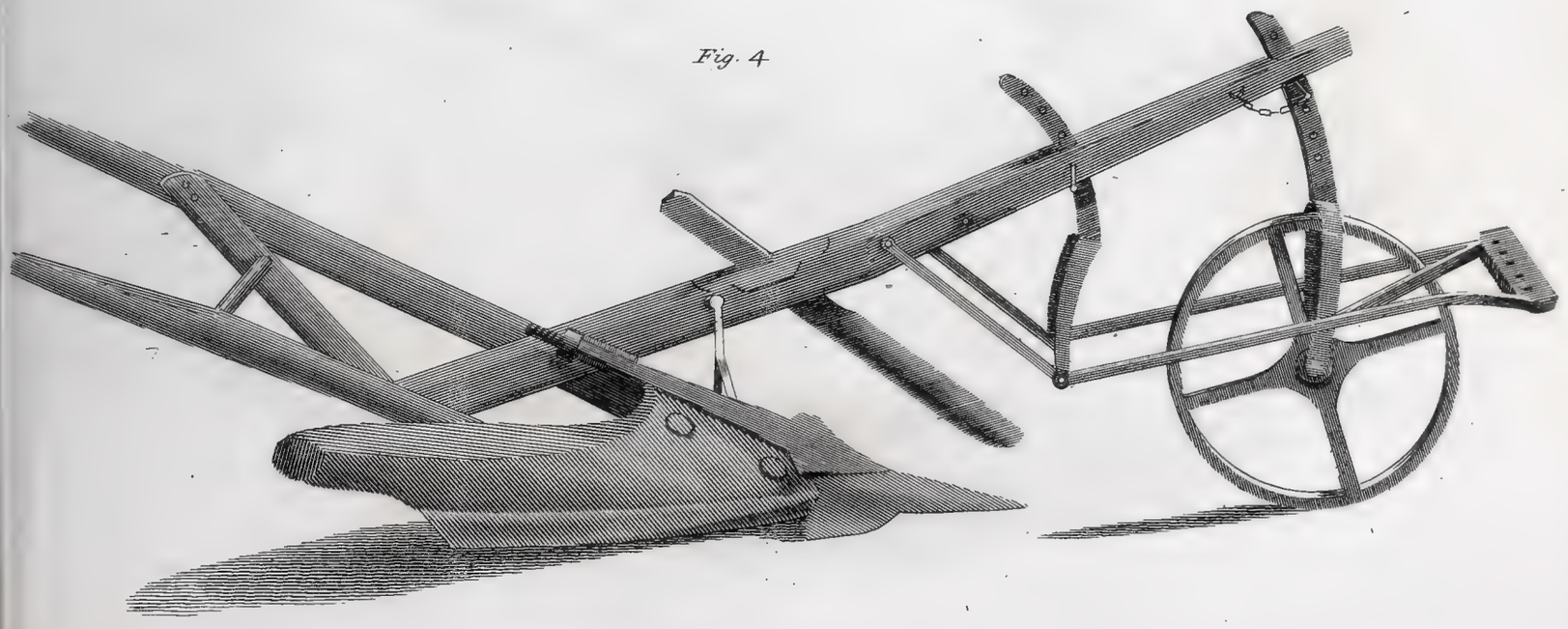

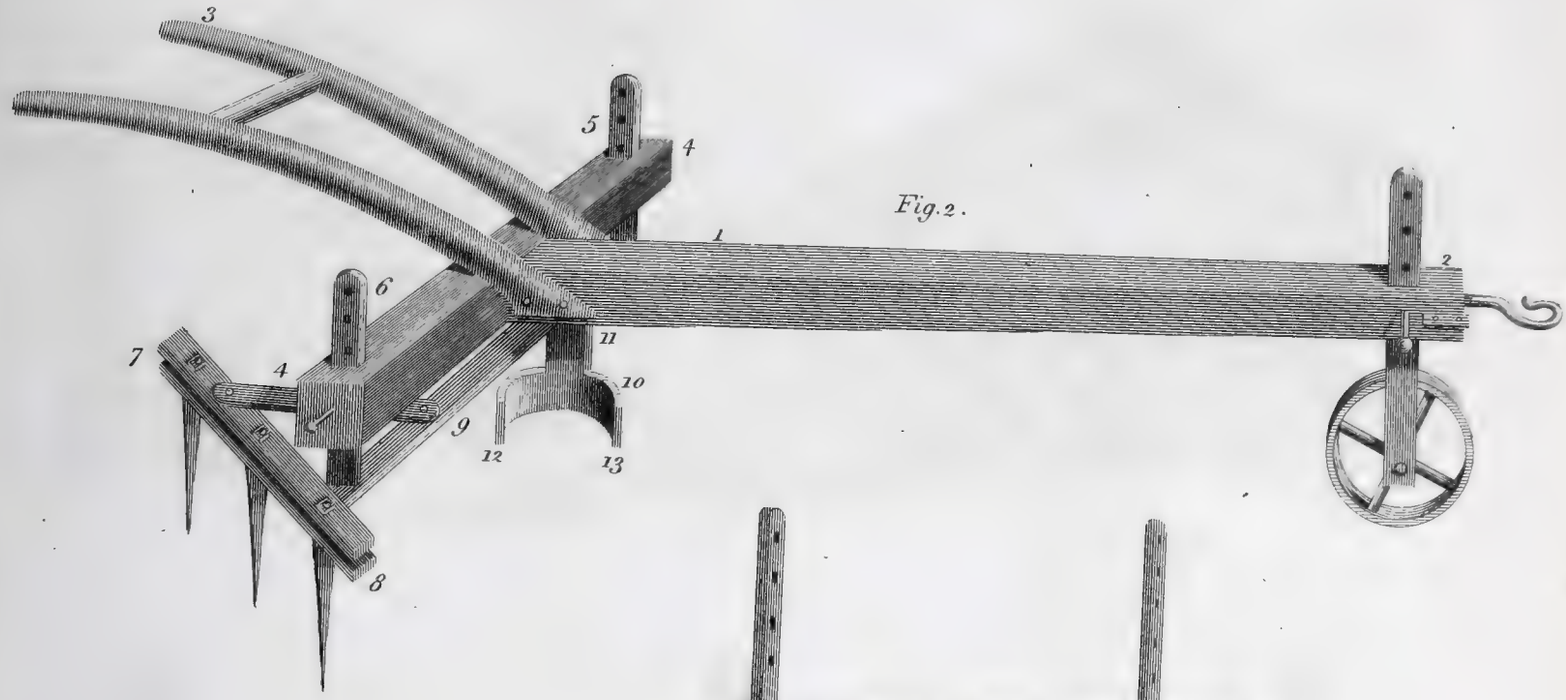

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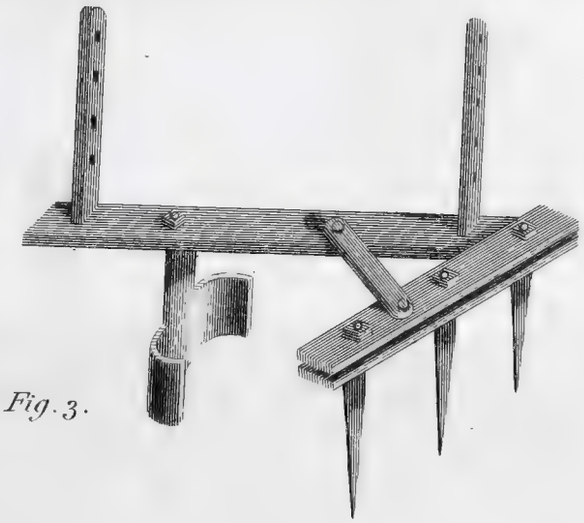

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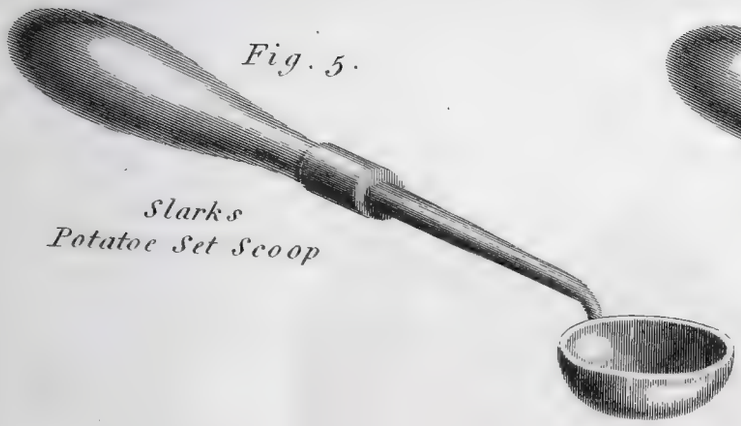
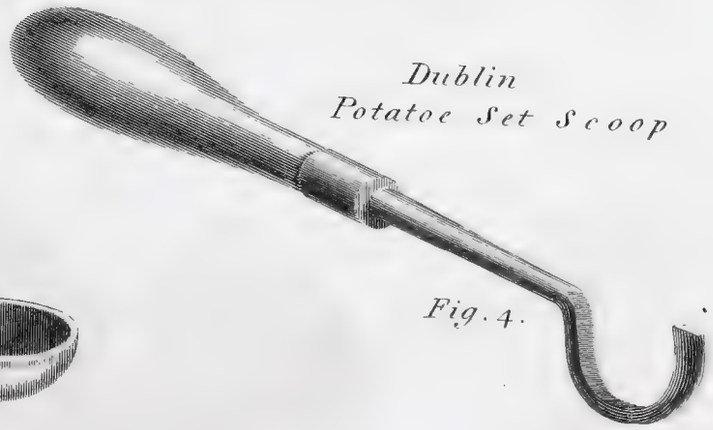


Fig. 5.

Slarks
Potatoe Set Scoop



Dublin
Potatoe Set Scoop

Fig. 4.

Construction of Ponds

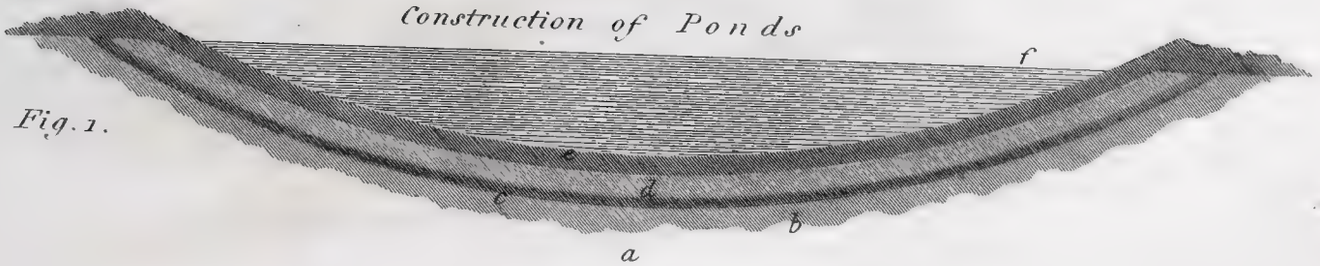


Fig. 1.

Fig. 4.

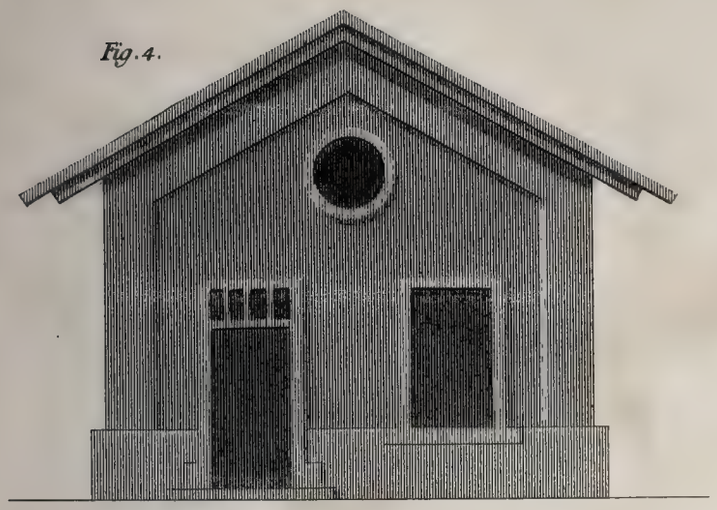
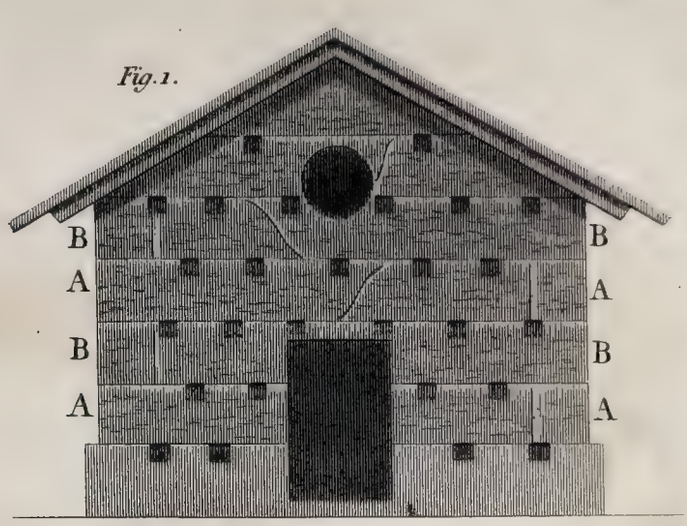


Fig. 1.



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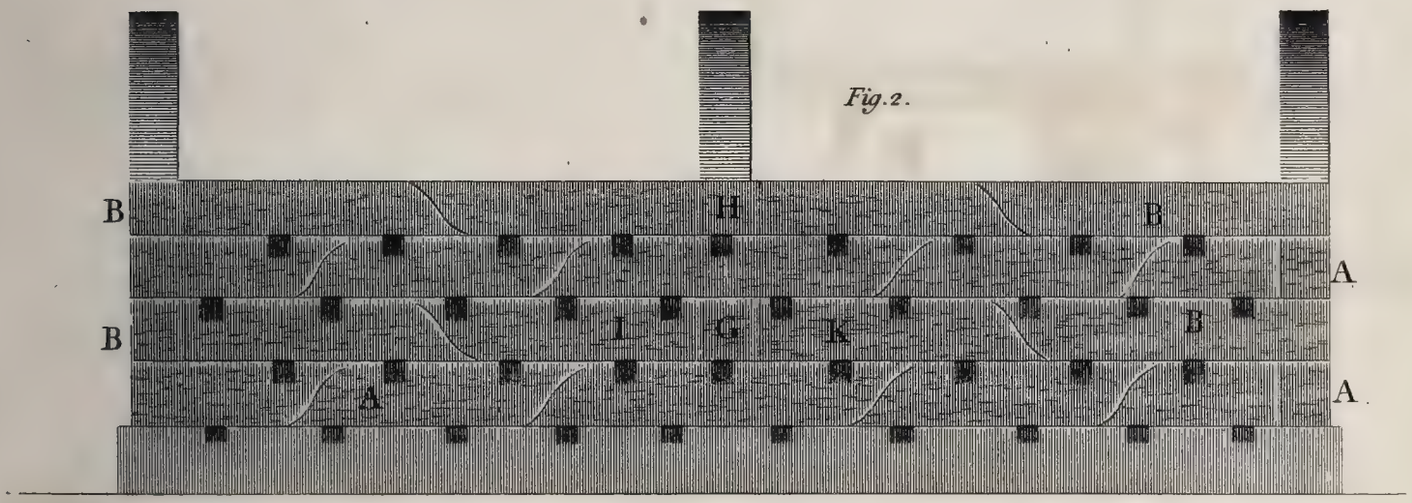

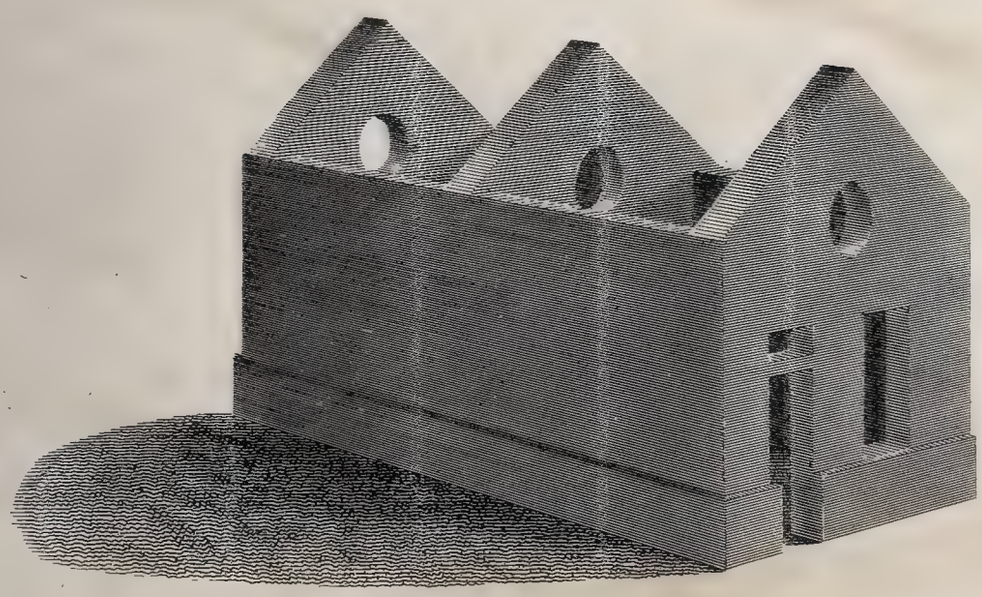

Fig. 3.

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IMPLEMENTS FOR RAMMED EARTH BUILDINGS.

Fig.1.

Fig. 4.

Fig.6.

Fig.5.

Fig.3.

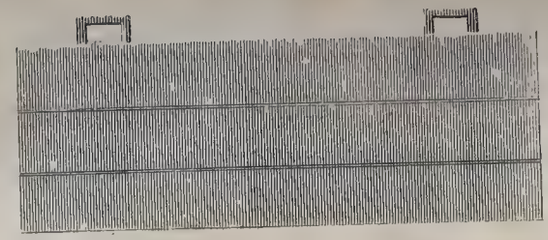


Fig.2.

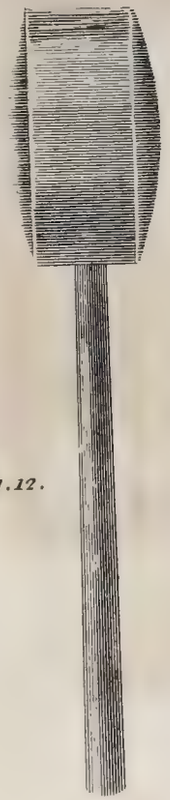


Fig.12.

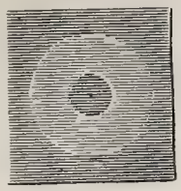


Fig.14.

Fig.13.

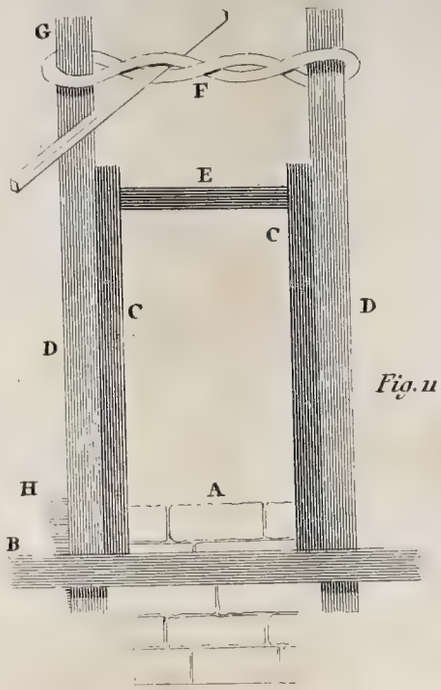
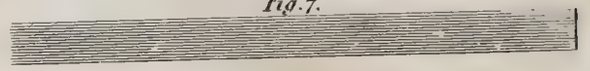


Fig.11.

Fig.7.



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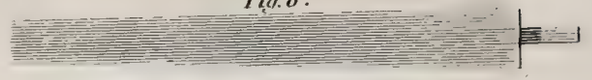

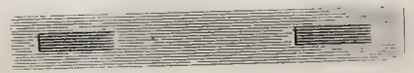

Fig.9.

Fig.10.

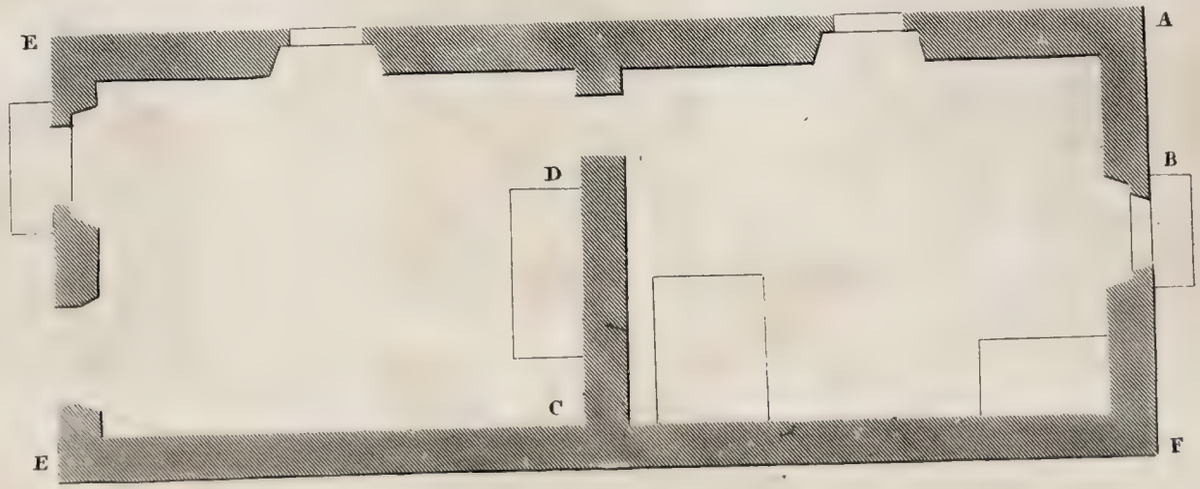

Fig.15.

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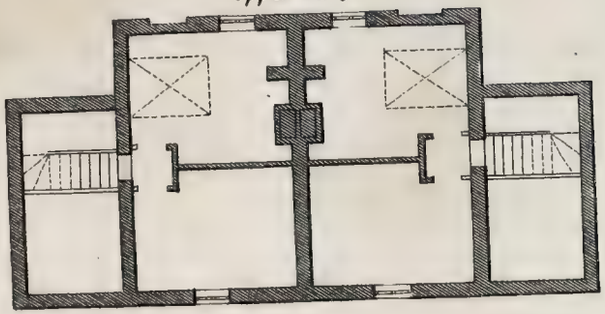
PISÉ COTTAGES.

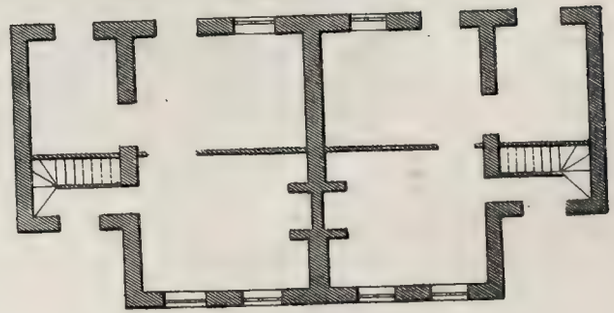
Back Elevation.

Front Elevation.

Upper Story.

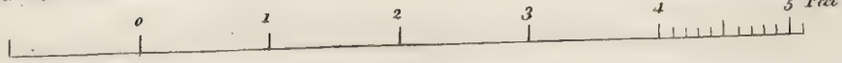


Ground Plan.



End Elevation.

Section.



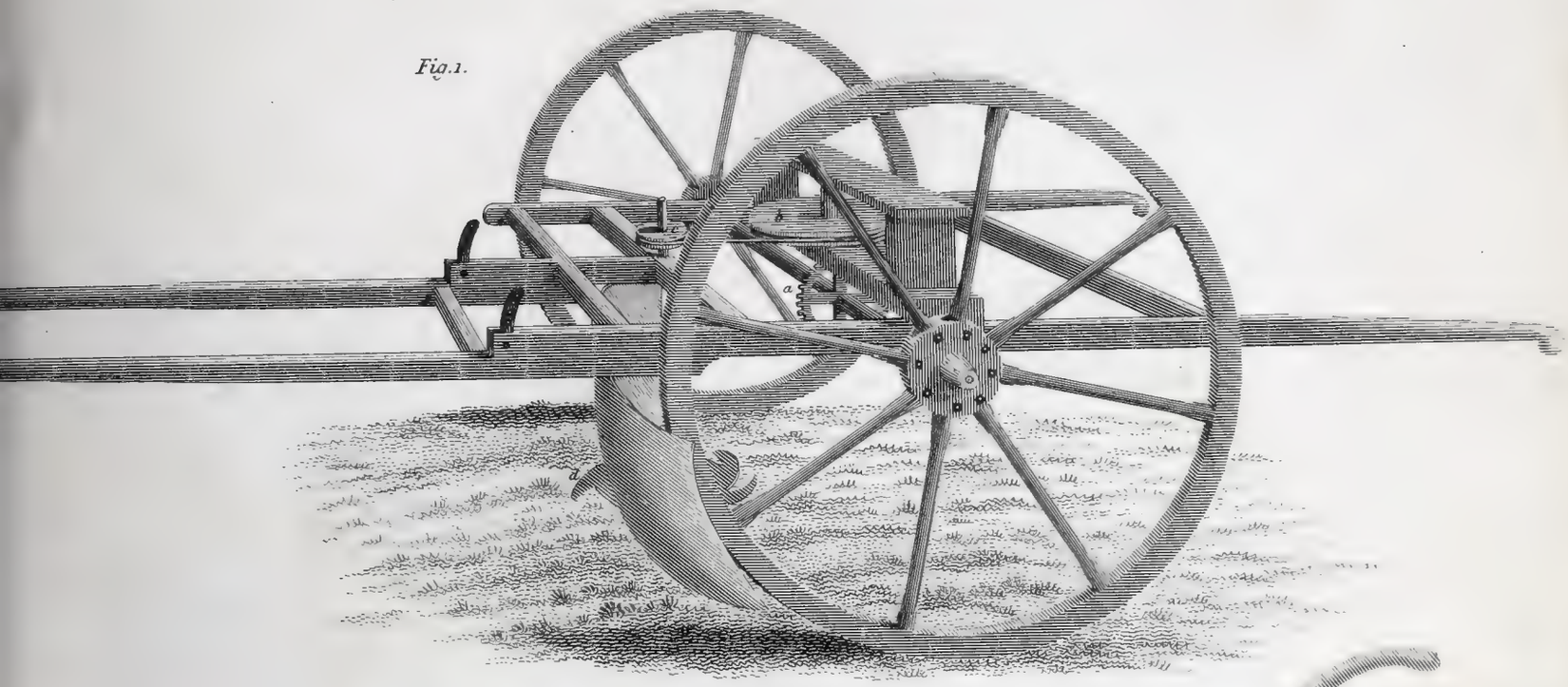
Published as the Act directs April 1 1806, by Longman, Hurst, Rees & Orme Paternoster Row.

Drawn & Engraved by C. Hunt

REAPING MACHINES.

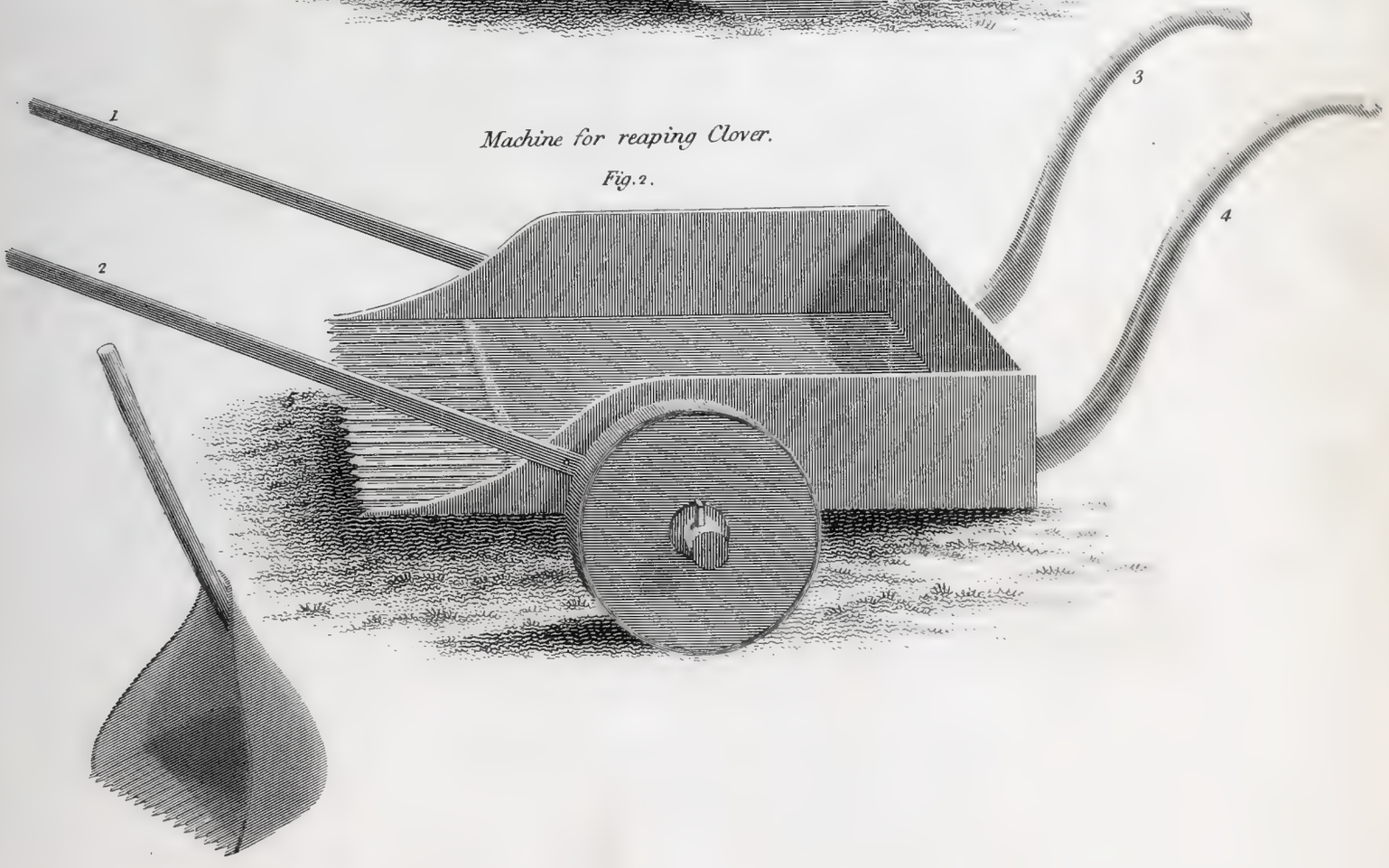
Plucknets Reaping Machine.

Fig. 1.



Machine for reaping Clover.

Fig. 2.



1. 2. The shafts 4 ft. long & 3 feet asunder. — 5. The fingers or teeth are 13 Inches long.

3. 4. The handles 3 feet long & 20 In. asunder. — The wheels are 16 Inches in diameter.

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Mr. SALMON'S REAPING MACHINE.

AA *Two large Wheels on which the Machine runs, they are fixed to their axle by racket wheels, so as not to turn it when the Machine is drawn backwards.*

a. *A small Wheel which regulates the distance of the cutters from the Ground.*

B *Cog Wheel on the main Axis turning a pinion b, which is thrown out of gear, by withdrawing a wedge* C. *when the Machine is to be wheeled along without cutting.*

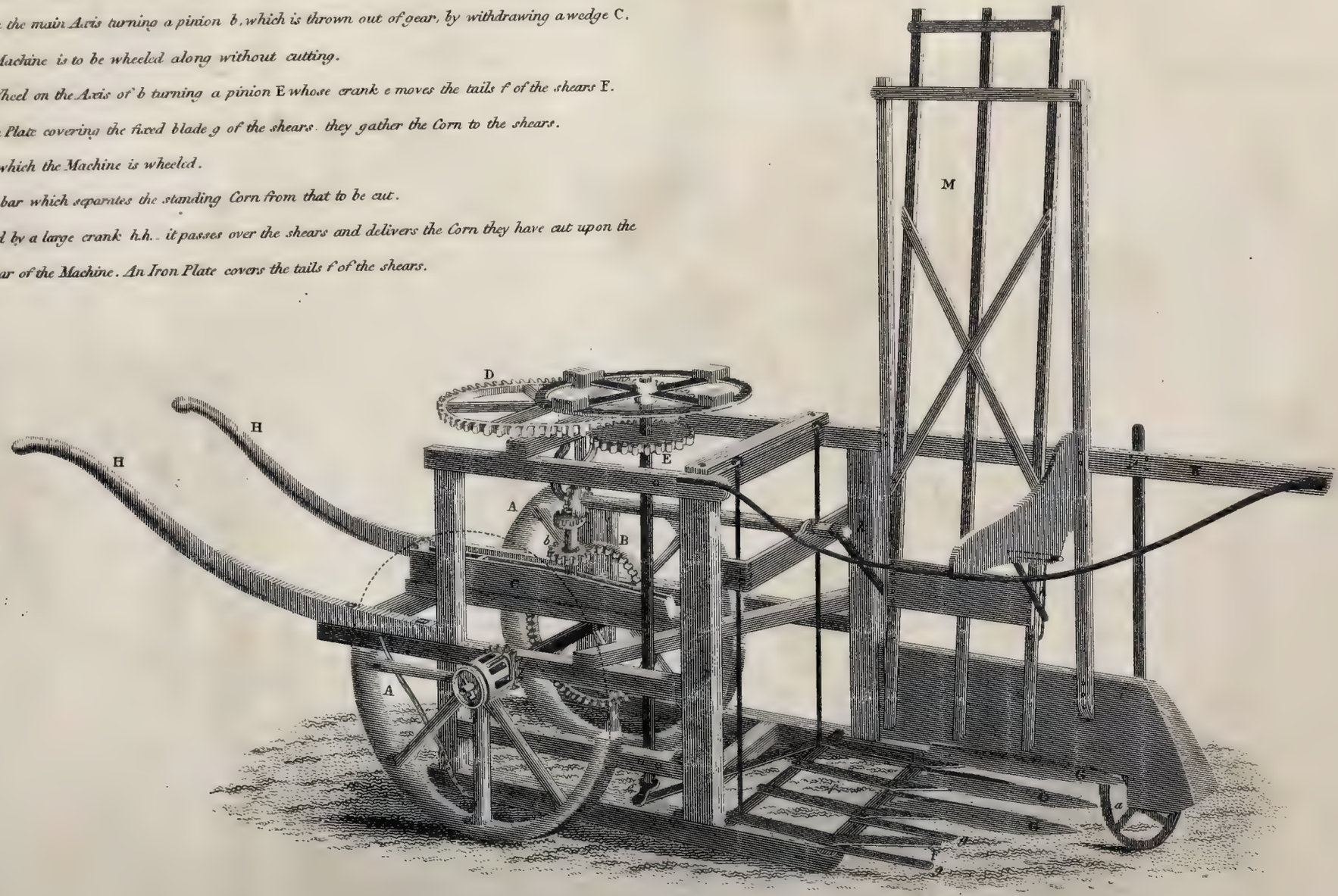
D *Large Cog Wheel on the Axis of b turning a pinion* E *whose crank e moves the tails f of the shears* F.

G *Pieces of Iron Plate covering the fixed blade g of the shears. they gather the Corn to the shears.*

H *Handles by which the Machine is wheeled.*

K *A projecting bar which separates the standing Corn from that to be cut.*

M *A rake moved by a large crank h.h. it passes over the shears and delivers the Corn they have cut upon the Ground clear of the Machine. An Iron Plate covers the tails f of the shears.*



Published as the Act directs, Nov. 14th. 1807, by Longman, Hurst, Rees & Orme Paternoster Row.

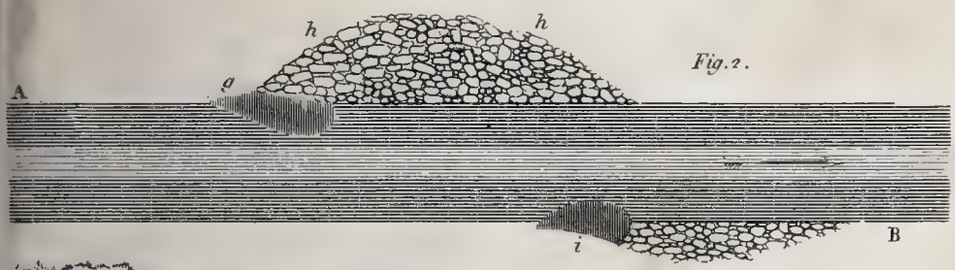
Davis sculp.

J. Farey Jun. del.

DEFENDING RIVER BANKS.

Fig. 1.

Fig. 2.



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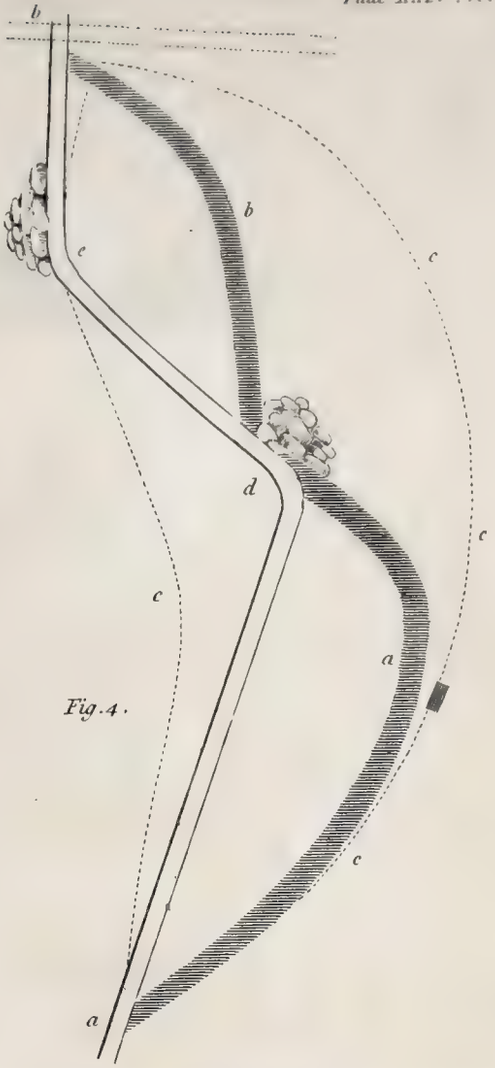


Fig. 4.

Fig. 5.

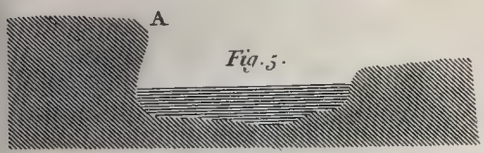


Fig. 7.

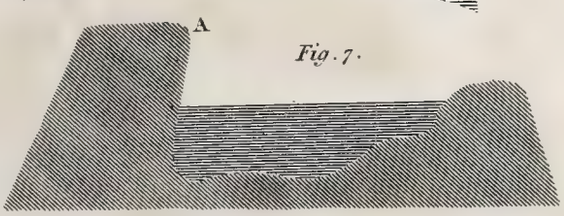


Fig. 5.

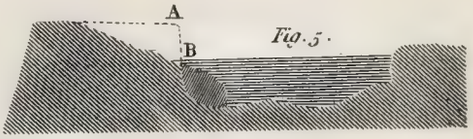


Fig. 8.

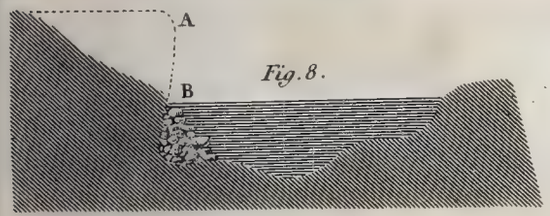
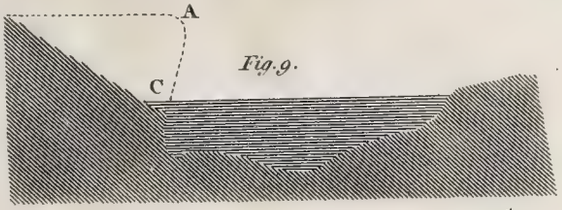


Fig. 9.



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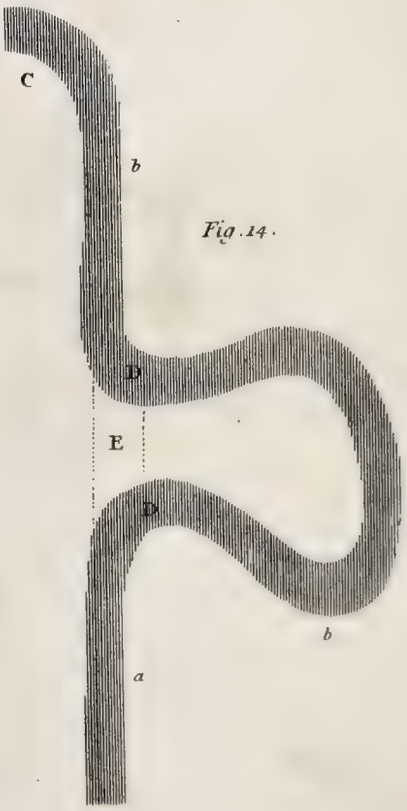

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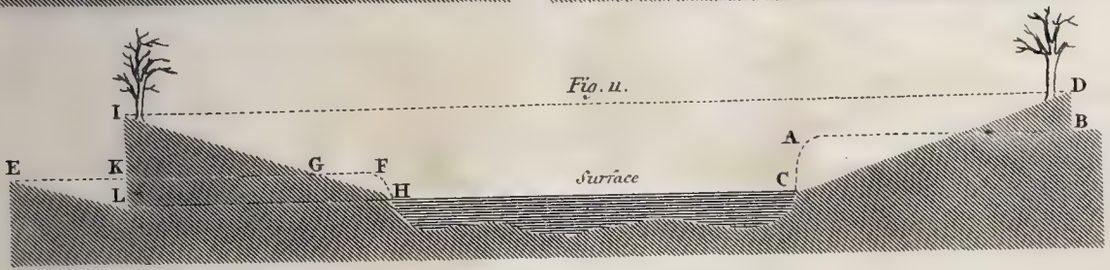
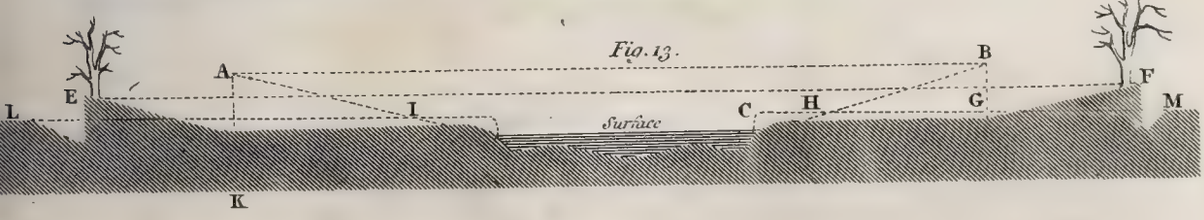


Fig. 13.



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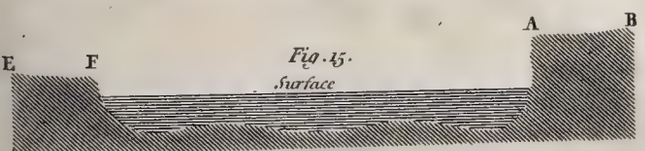
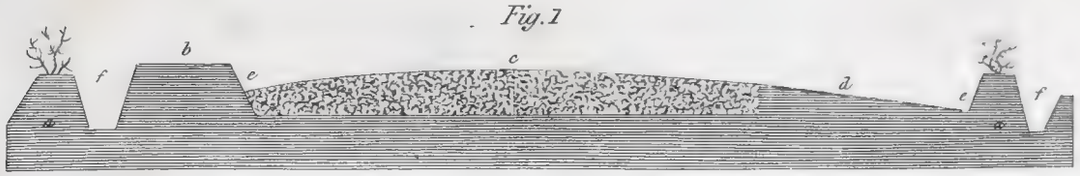


Fig. 12.

Fig. 1



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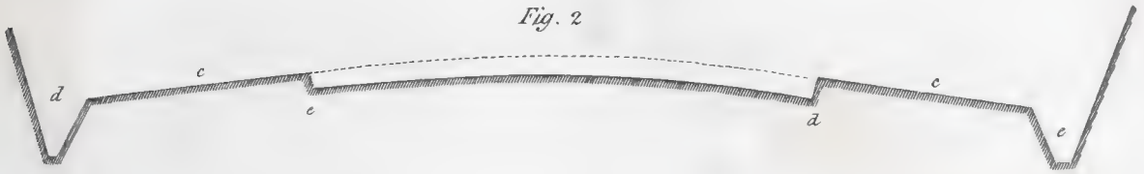

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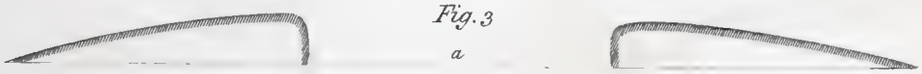
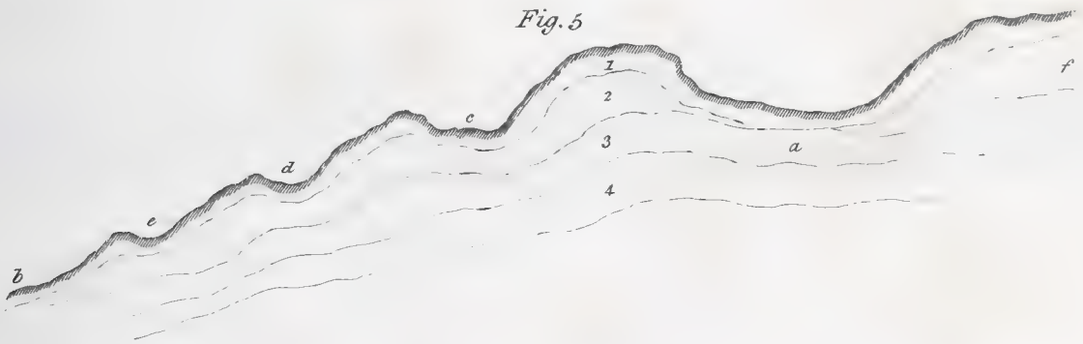


Fig. 4.

Fig. 5



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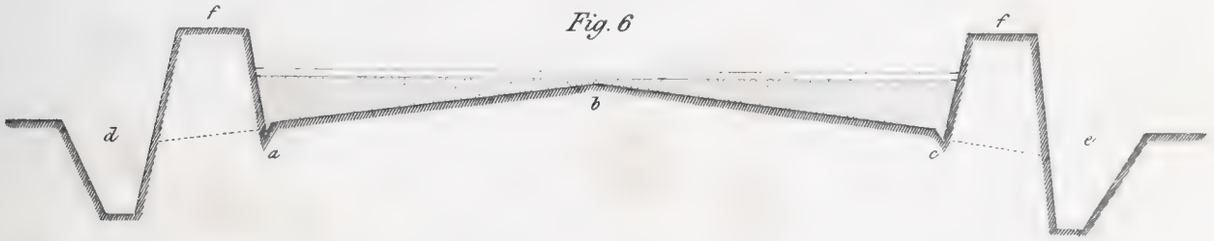

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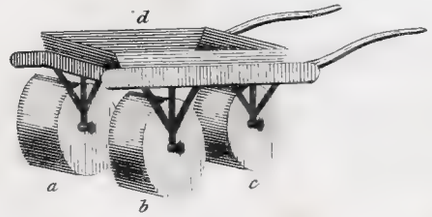

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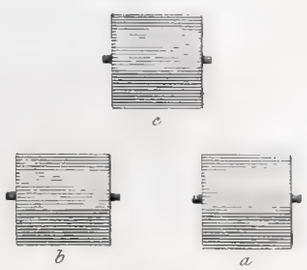
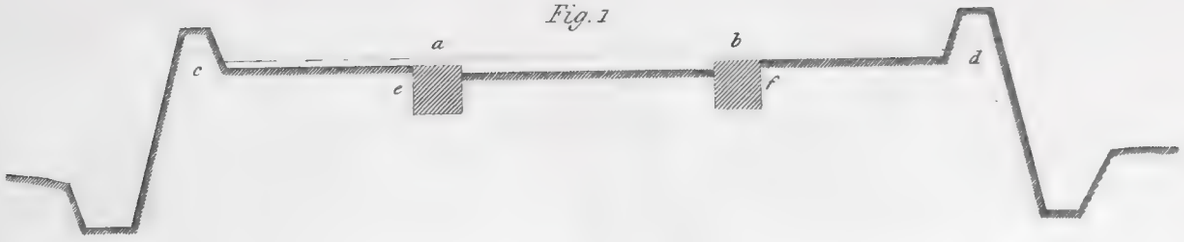


ROADS.

Fig. 1



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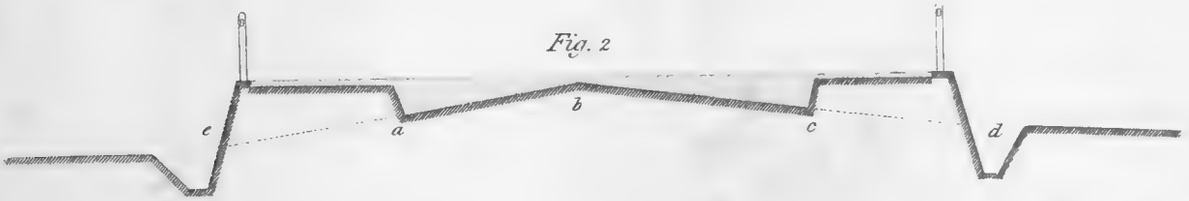

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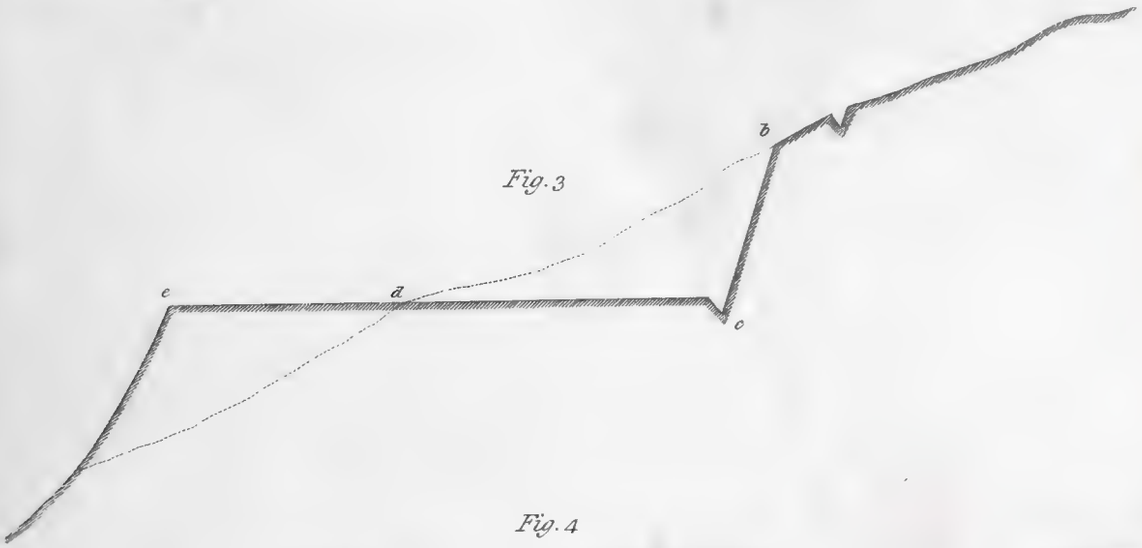
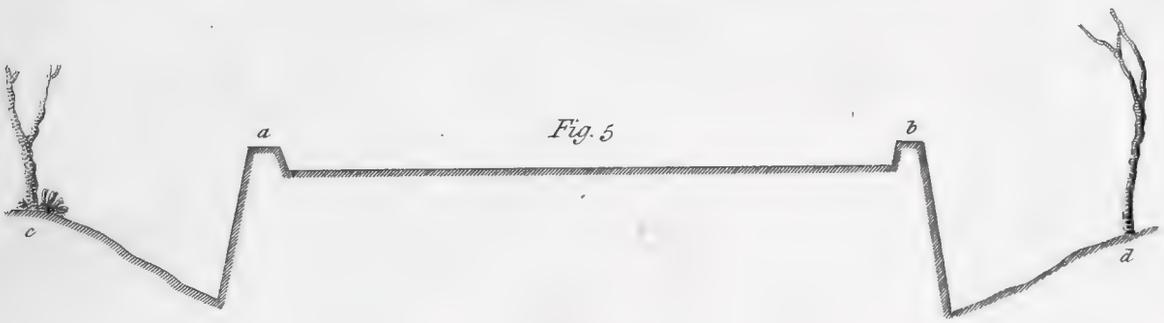


Fig. 4

Fig. 5



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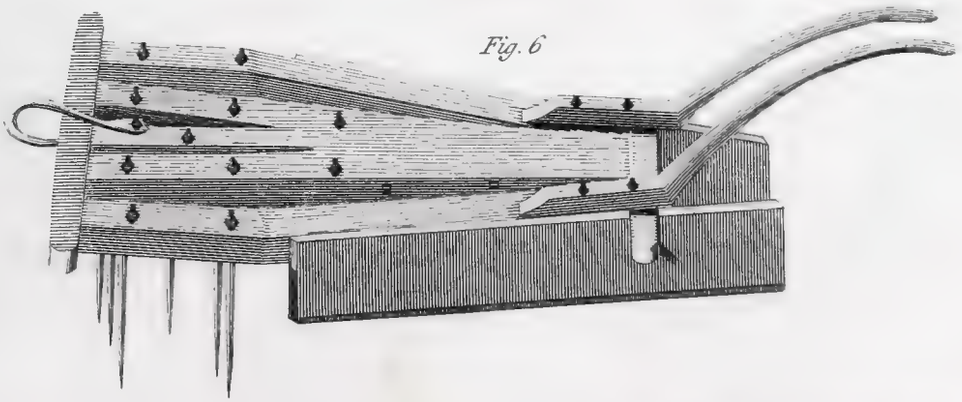

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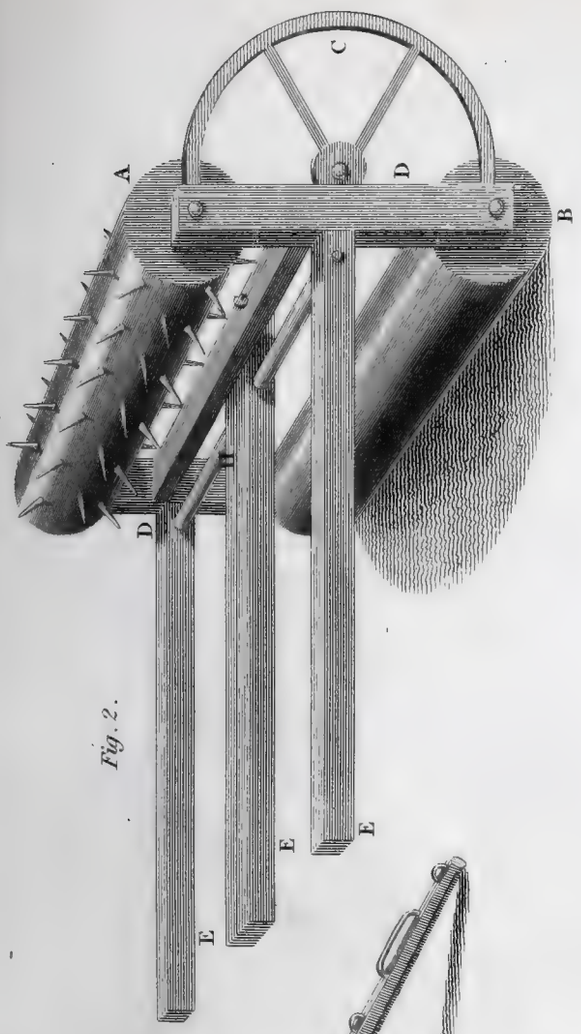
Engraved by H. Mutlow.

ROLLERS.



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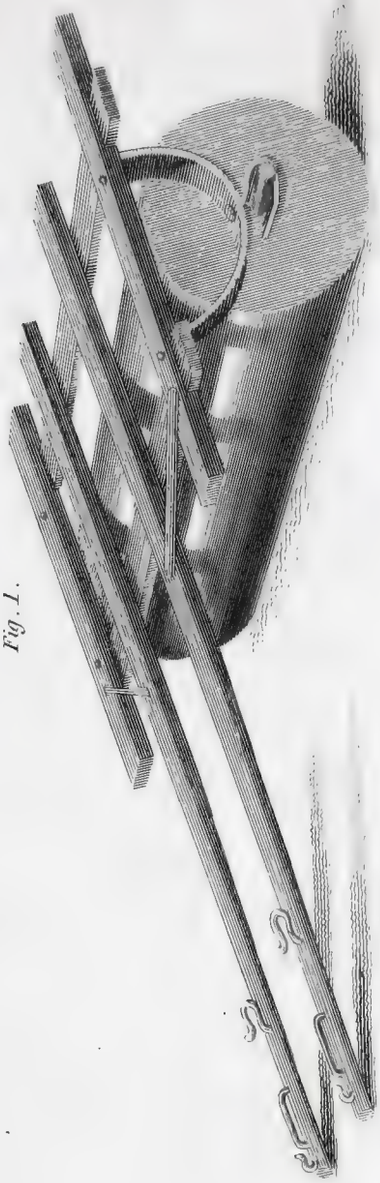

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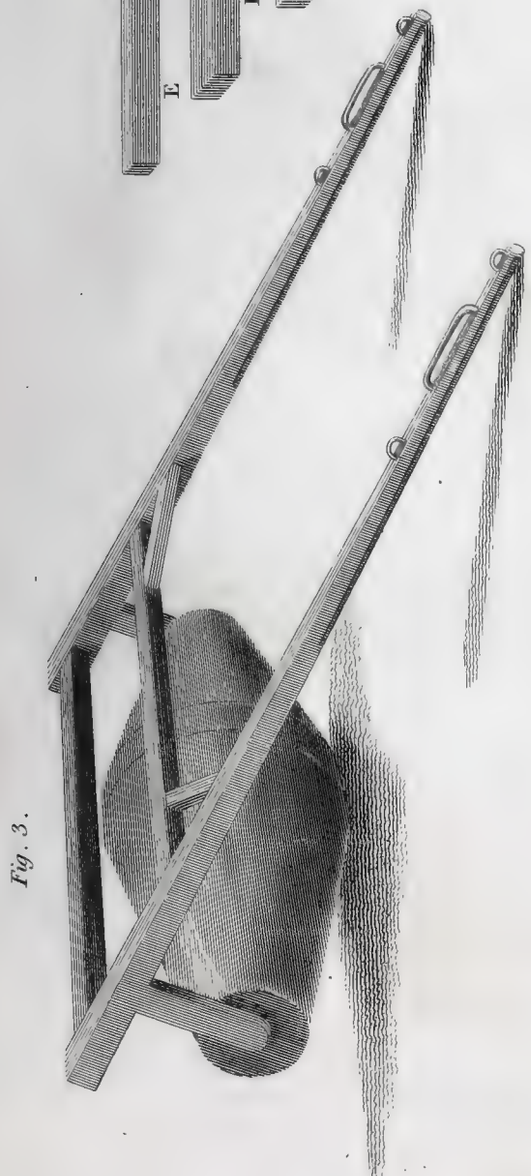

Fig. 3.

Fig. 4.

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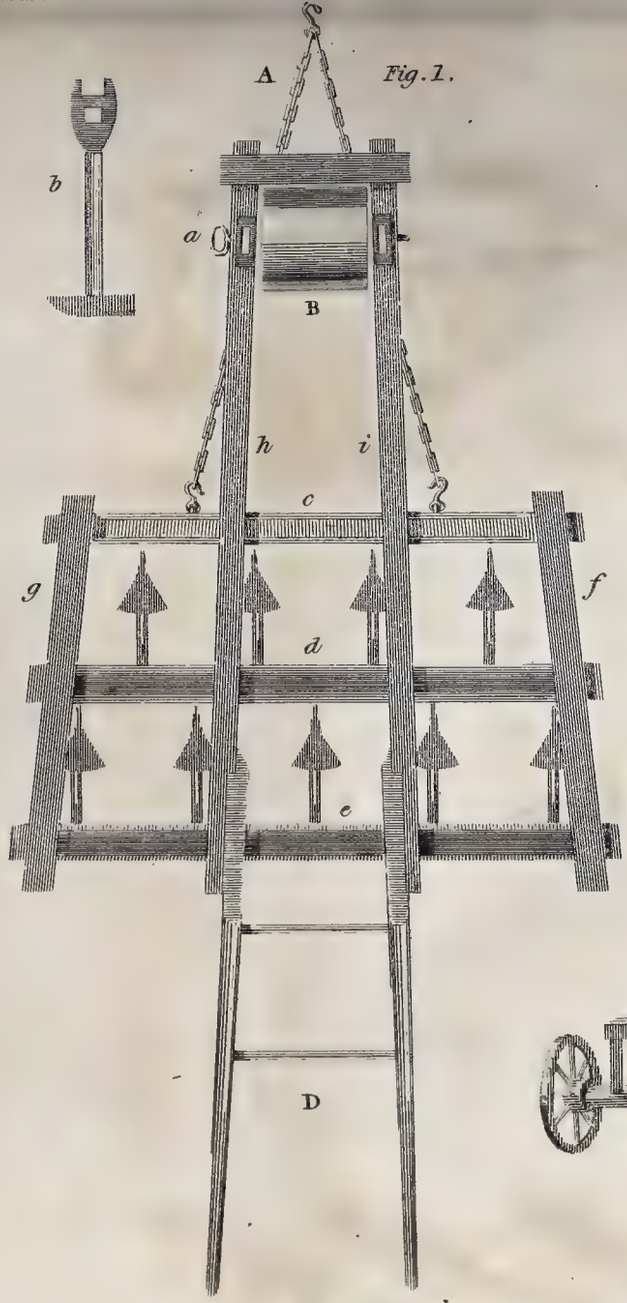
SCARIFIERS AND SCUFFLERS.



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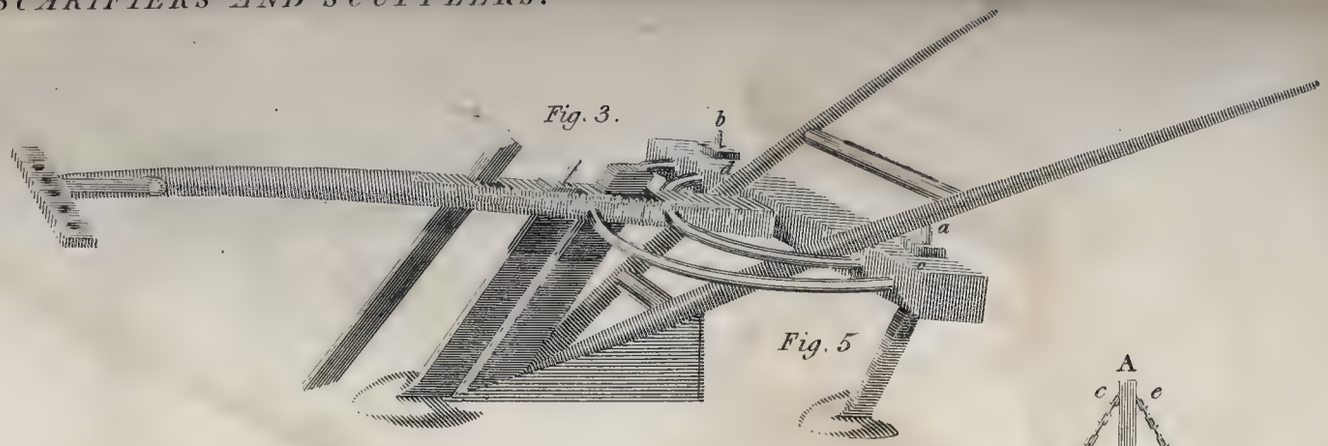
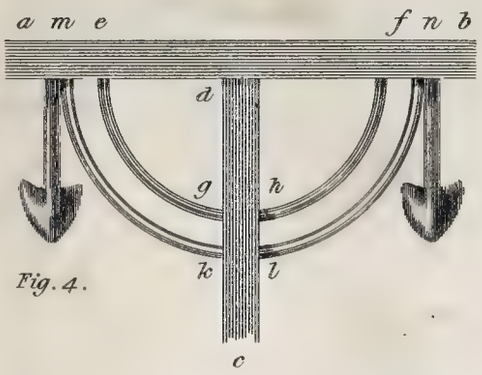


Fig. 3.

Fig. 5



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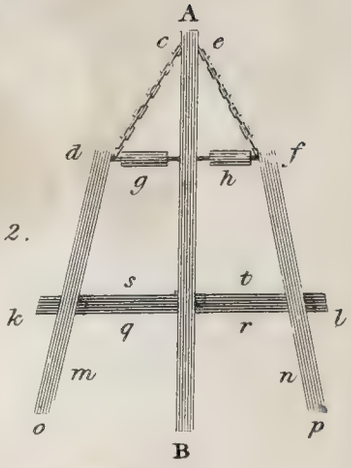
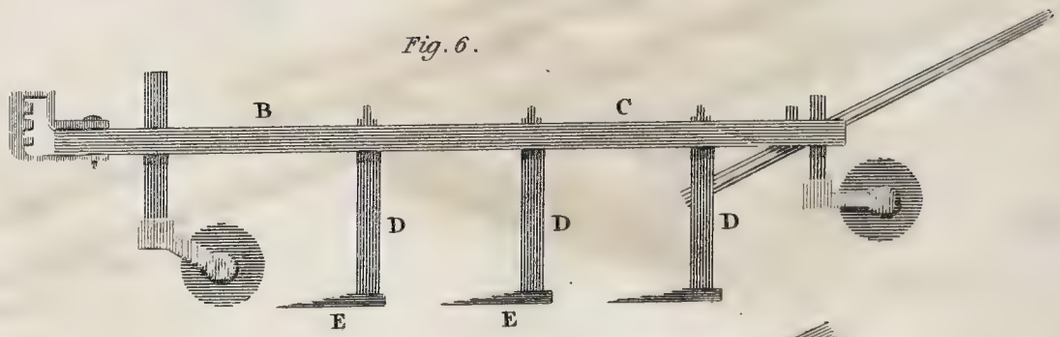
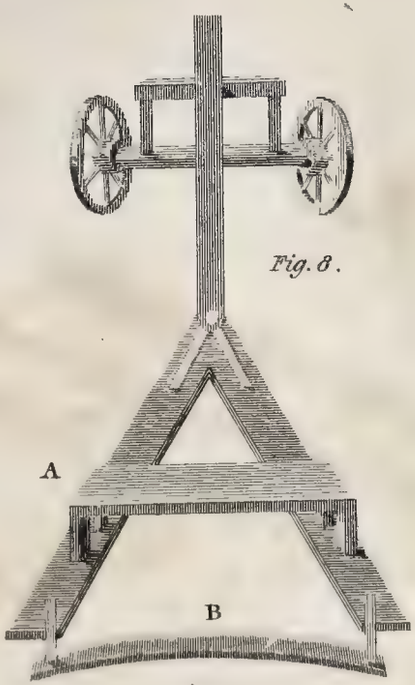


Fig. 2.

Fig. 6.





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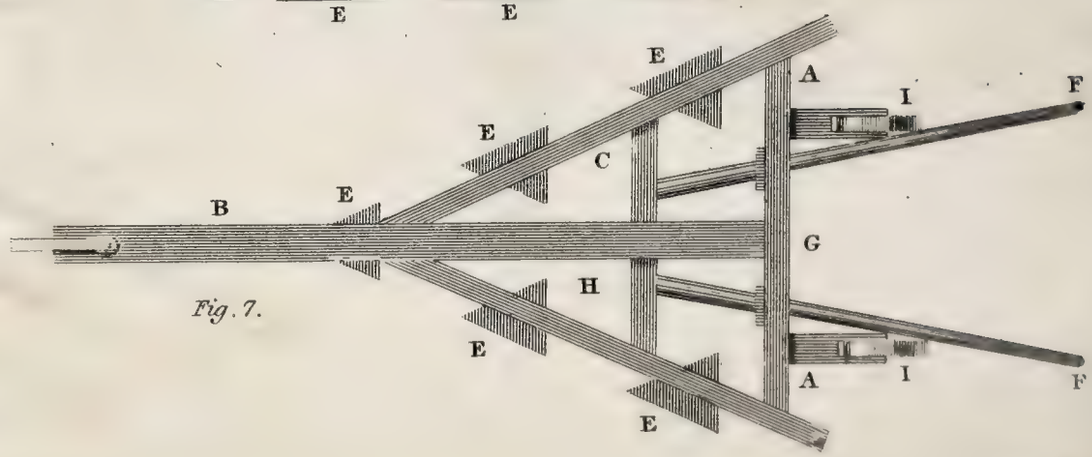

Fig. 7.

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IMPROVED BREEDS OF SHEEP.

Fig. 1.

Fig. 2.

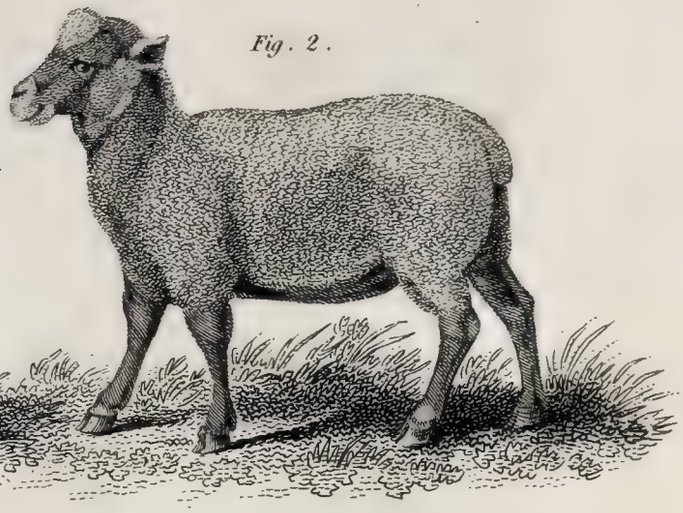
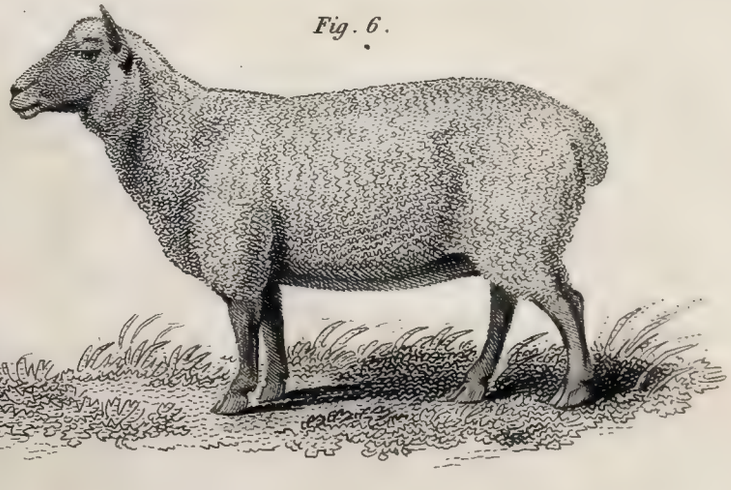


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.



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Published June 1st 1807, by Longman, Hurst, Rees, & Orme, Paternoster Row, London.

Moveable Sheep-house.

Fig. 1. Plan of the Building.

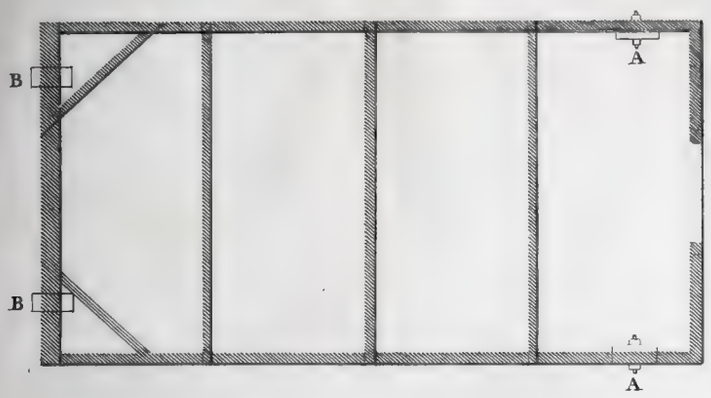


Fig. 3. Section of the Building crosways.

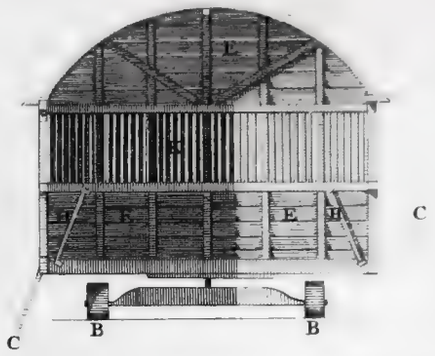


Fig. 2. Section of the Building side-ways.

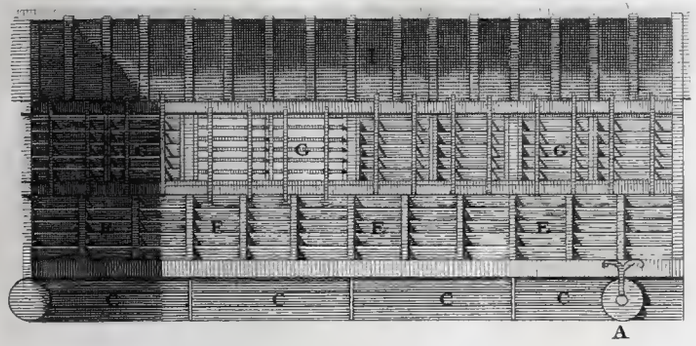


Fig. 5. Elevation of the end.

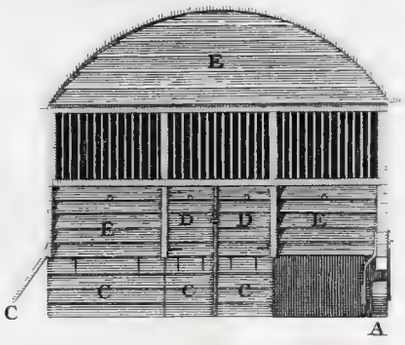


Fig. 4. Elevation of the side of the Building.

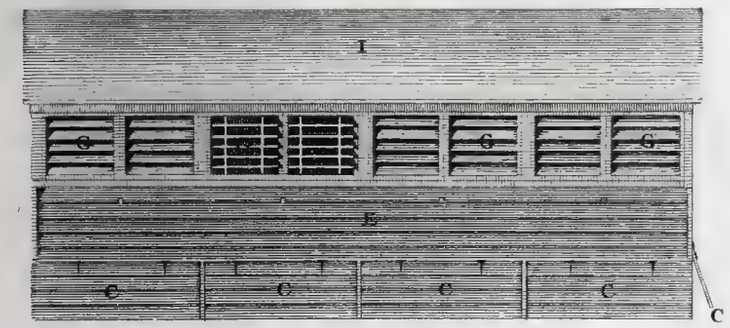


Fig. 6. View of the Building.

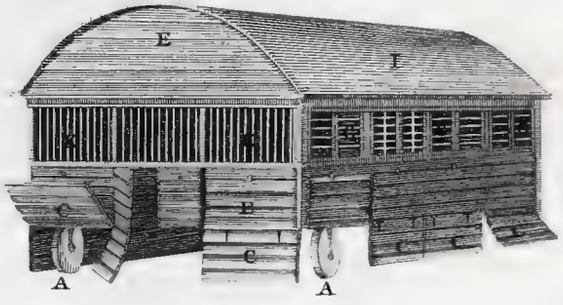
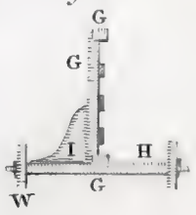


Fig. 7.

Fig. 9.



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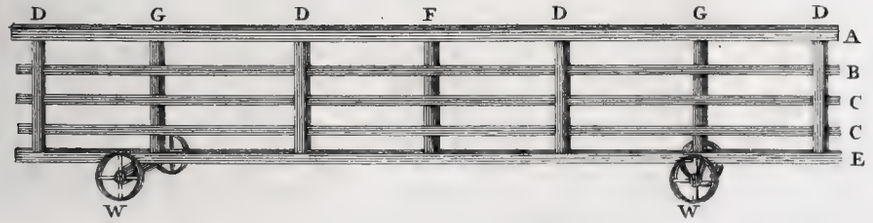

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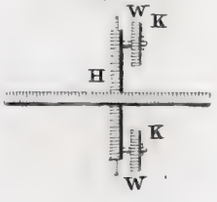

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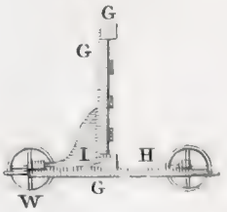


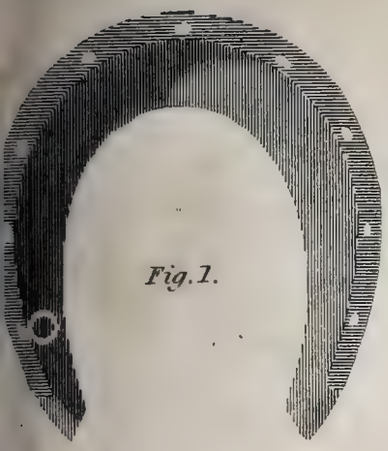


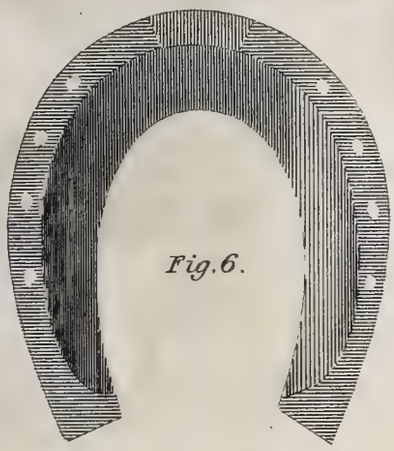
Fig.1.

Fig.2.

Fig.3

Fig.4.

Fig.5.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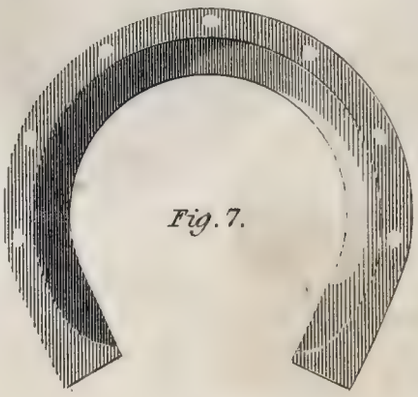
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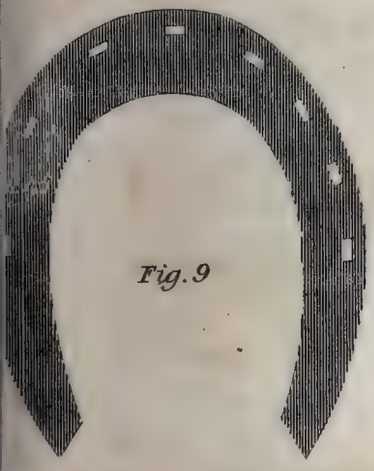
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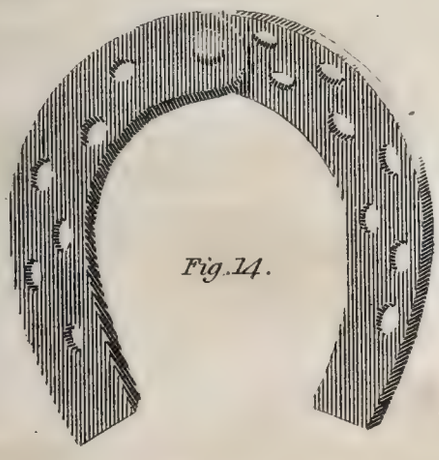
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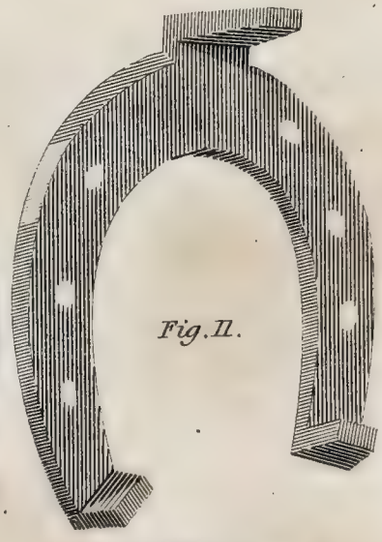
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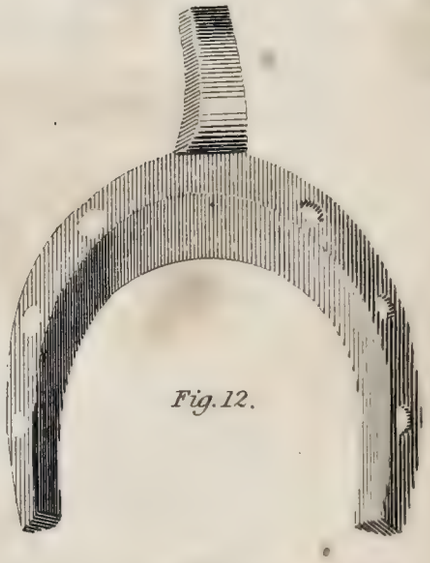
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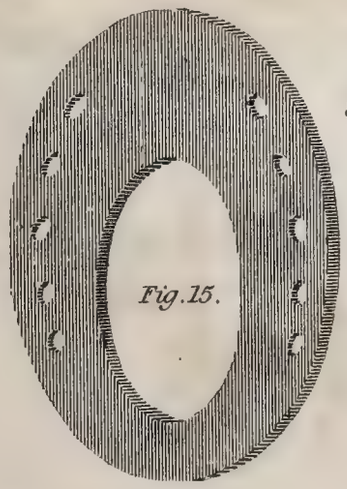
Fig.13.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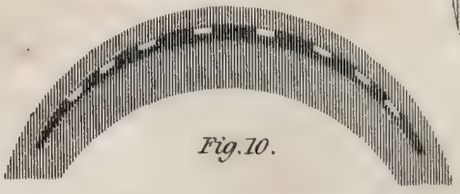
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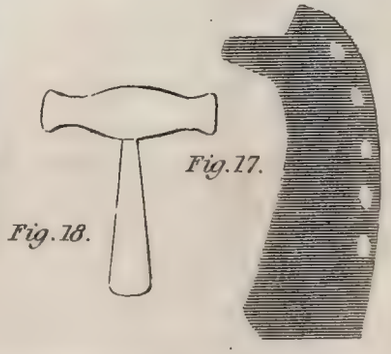
Fig.17.

Fig.18.

Fig.16.

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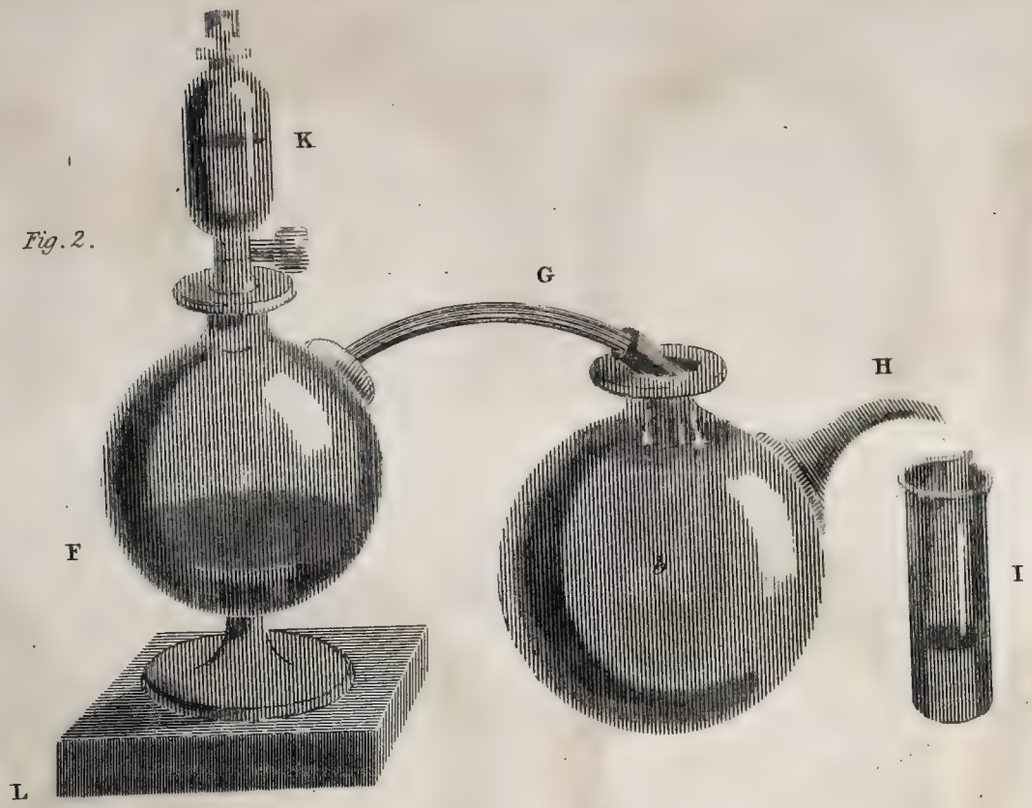
Hunt del et sculp

Fig. 2.



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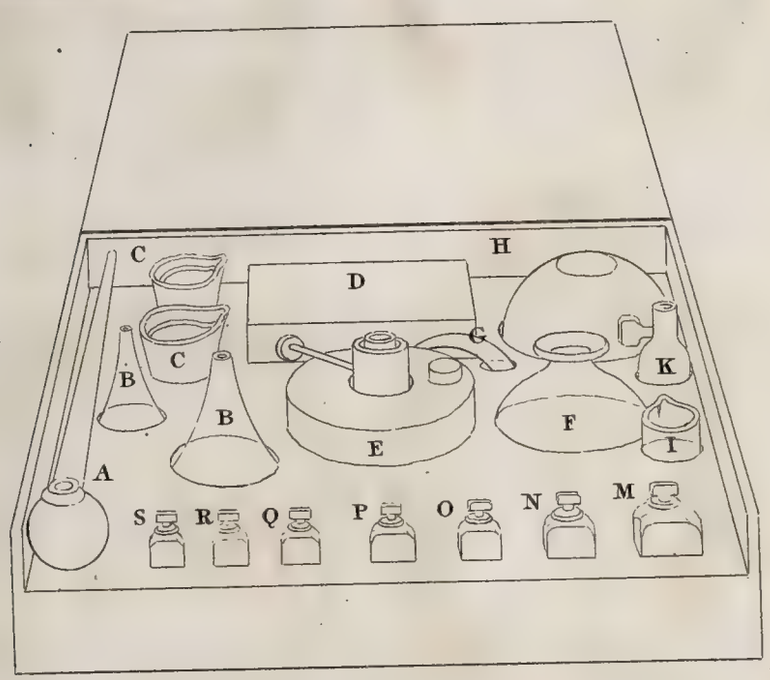

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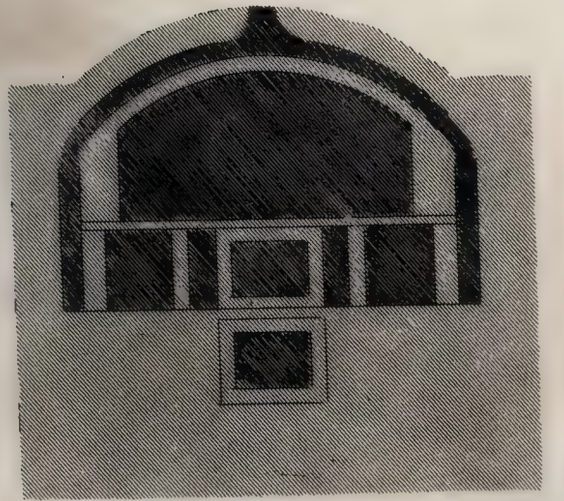

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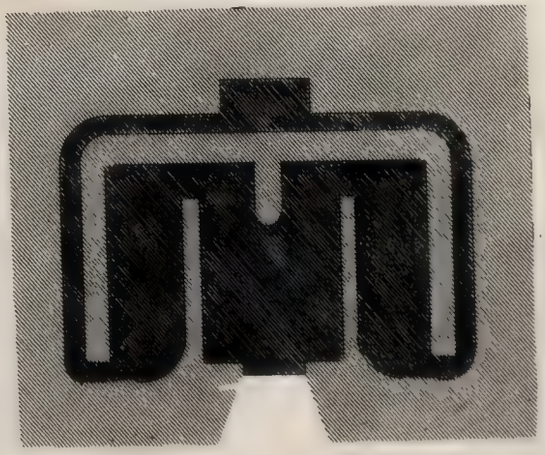

Fig. 1.

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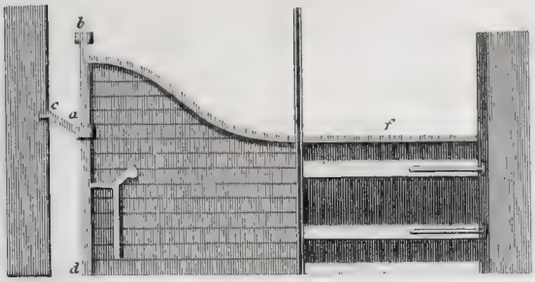

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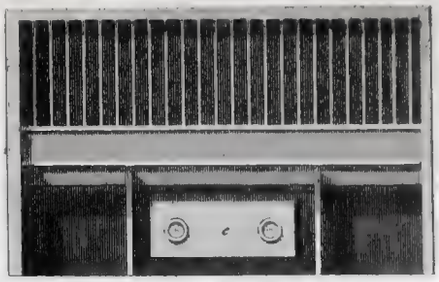


Fig. 4.

Fig. 11.

Fig. 5.

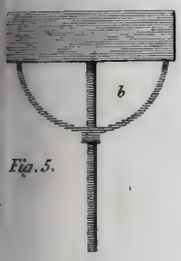
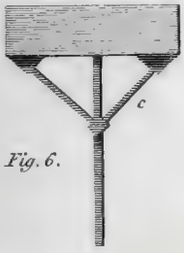


Fig. 6.



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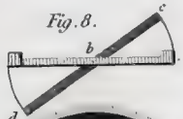

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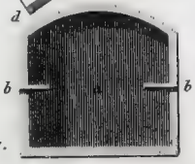

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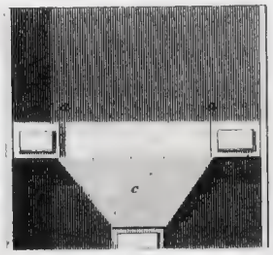

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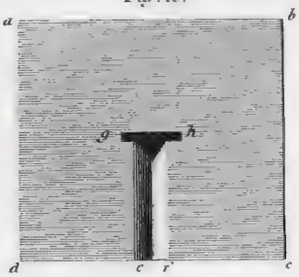


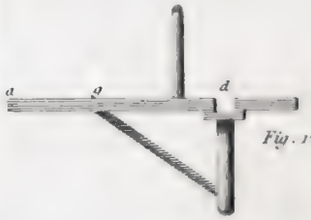
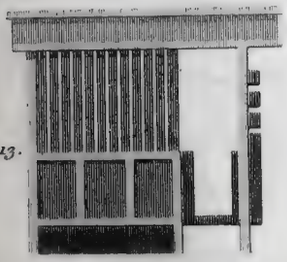


Fig. 12.

Fig. 13.



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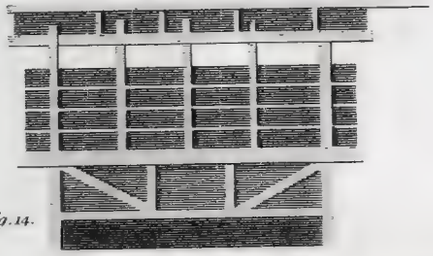

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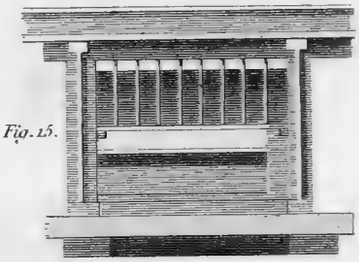


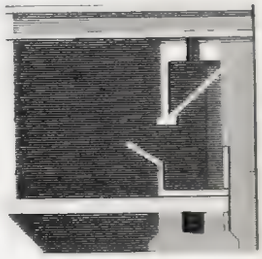
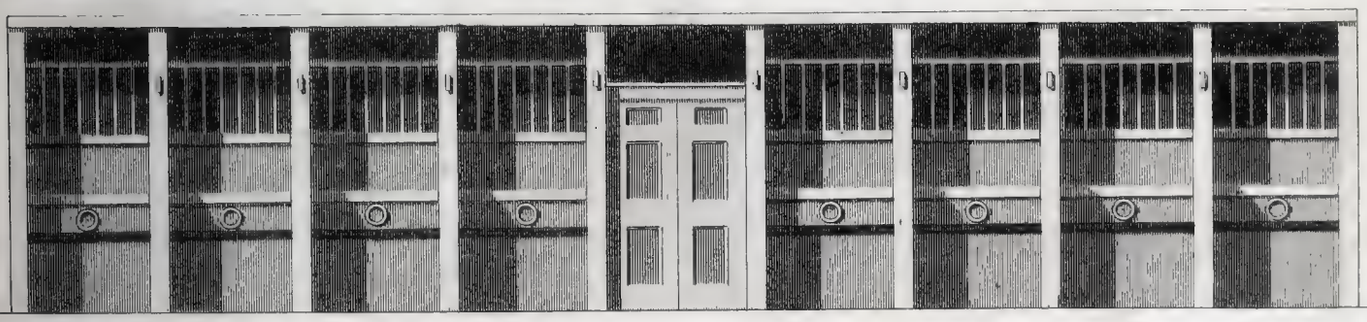


Fig. 16.

Fig. 17.



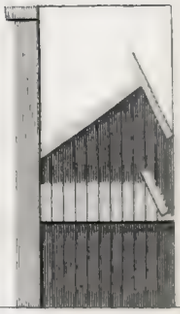


Fig. 18.

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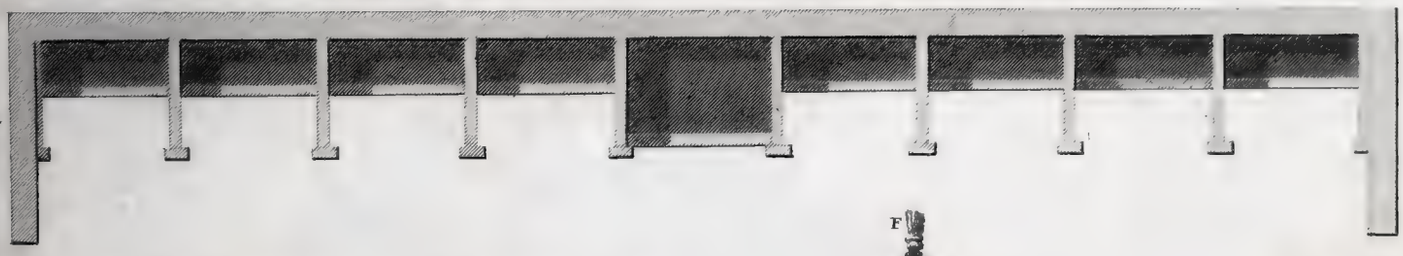

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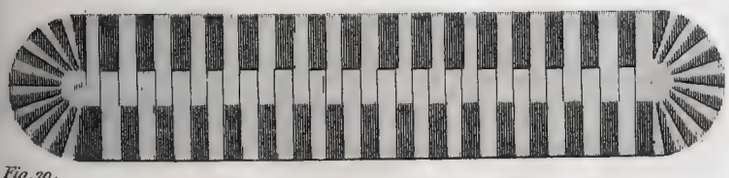

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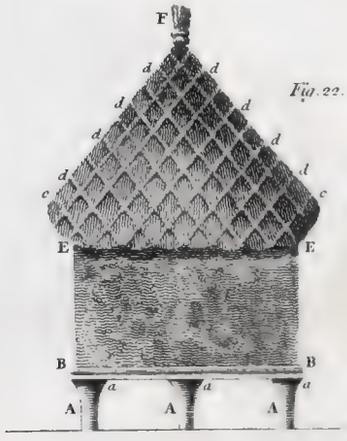
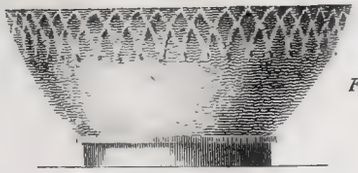
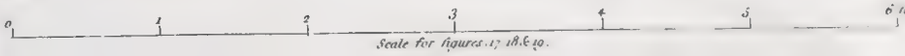


Fig. 21.

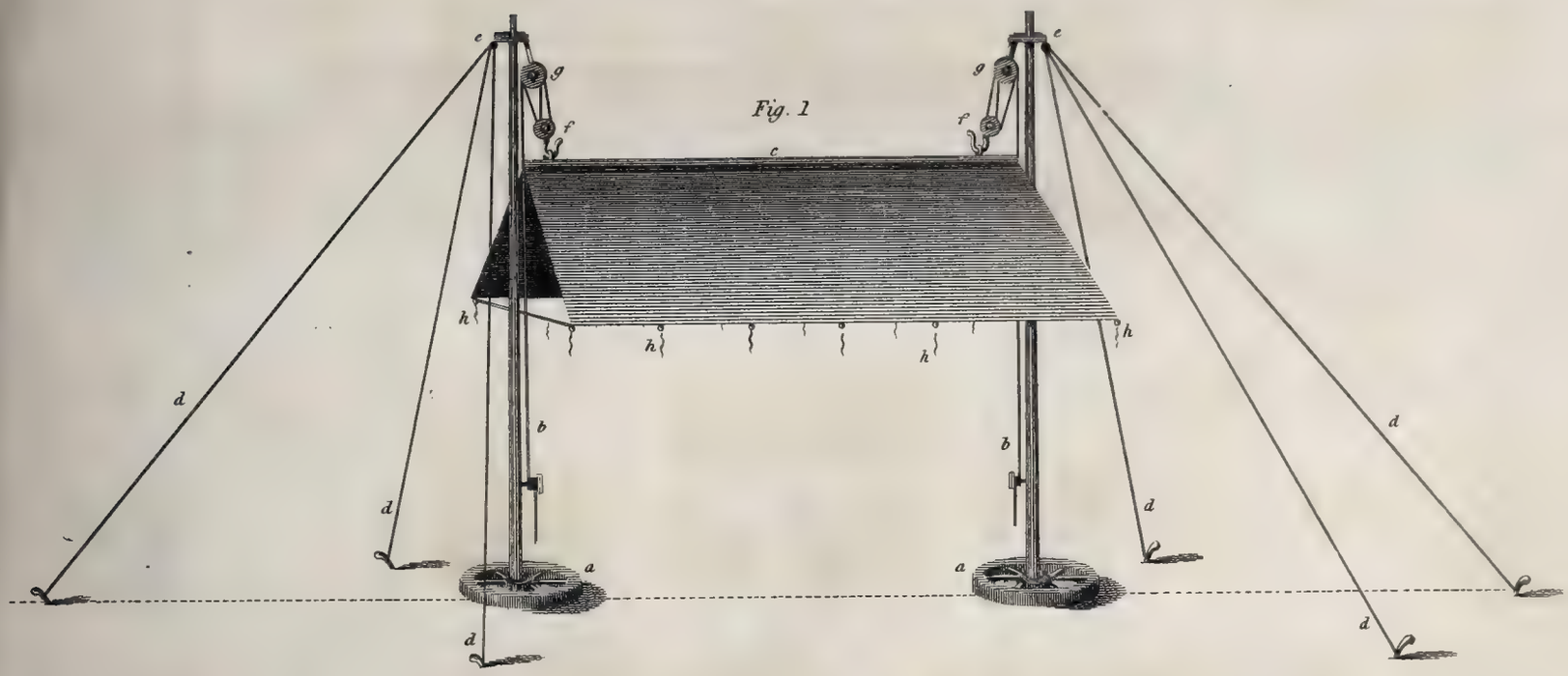
Fig. 23.

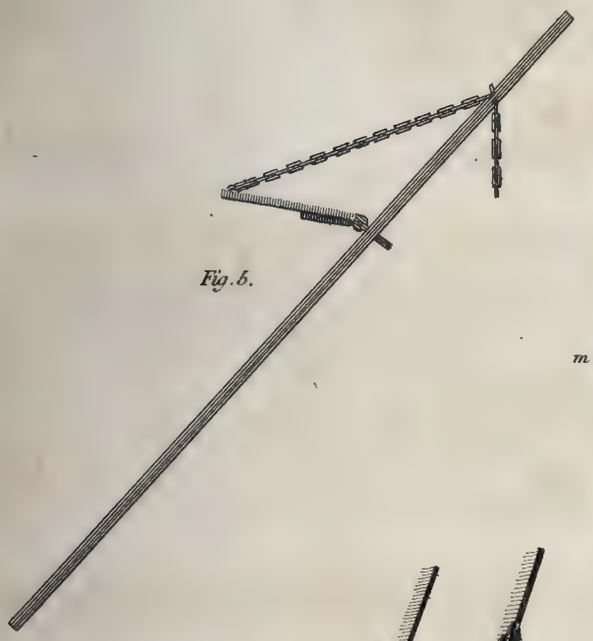




Scale for figures 17, 18 & 19.

Fig. 1





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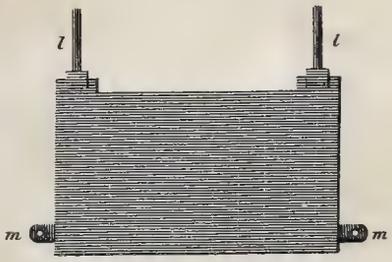

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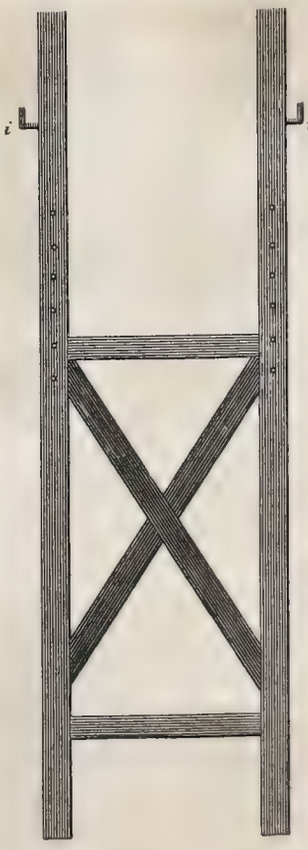
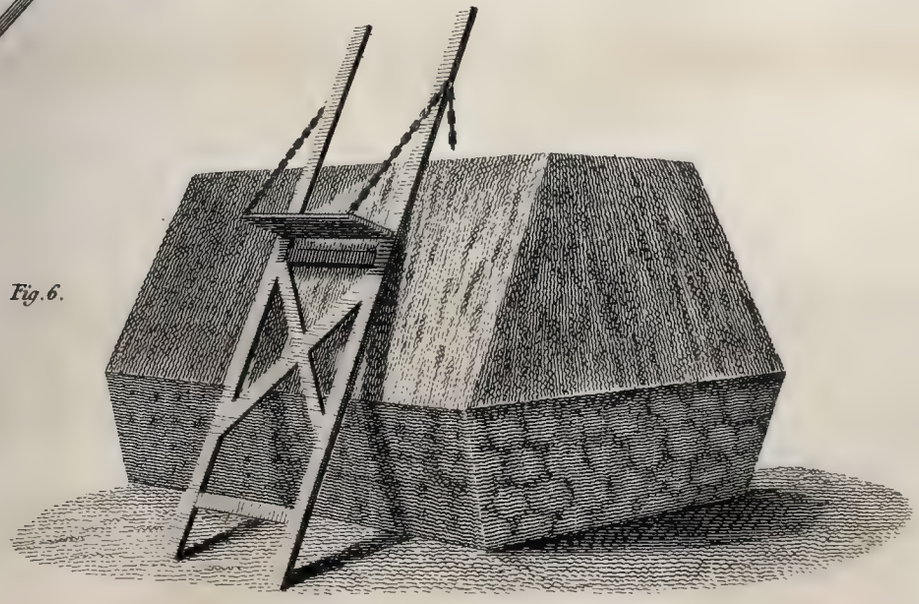


Fig. 3.

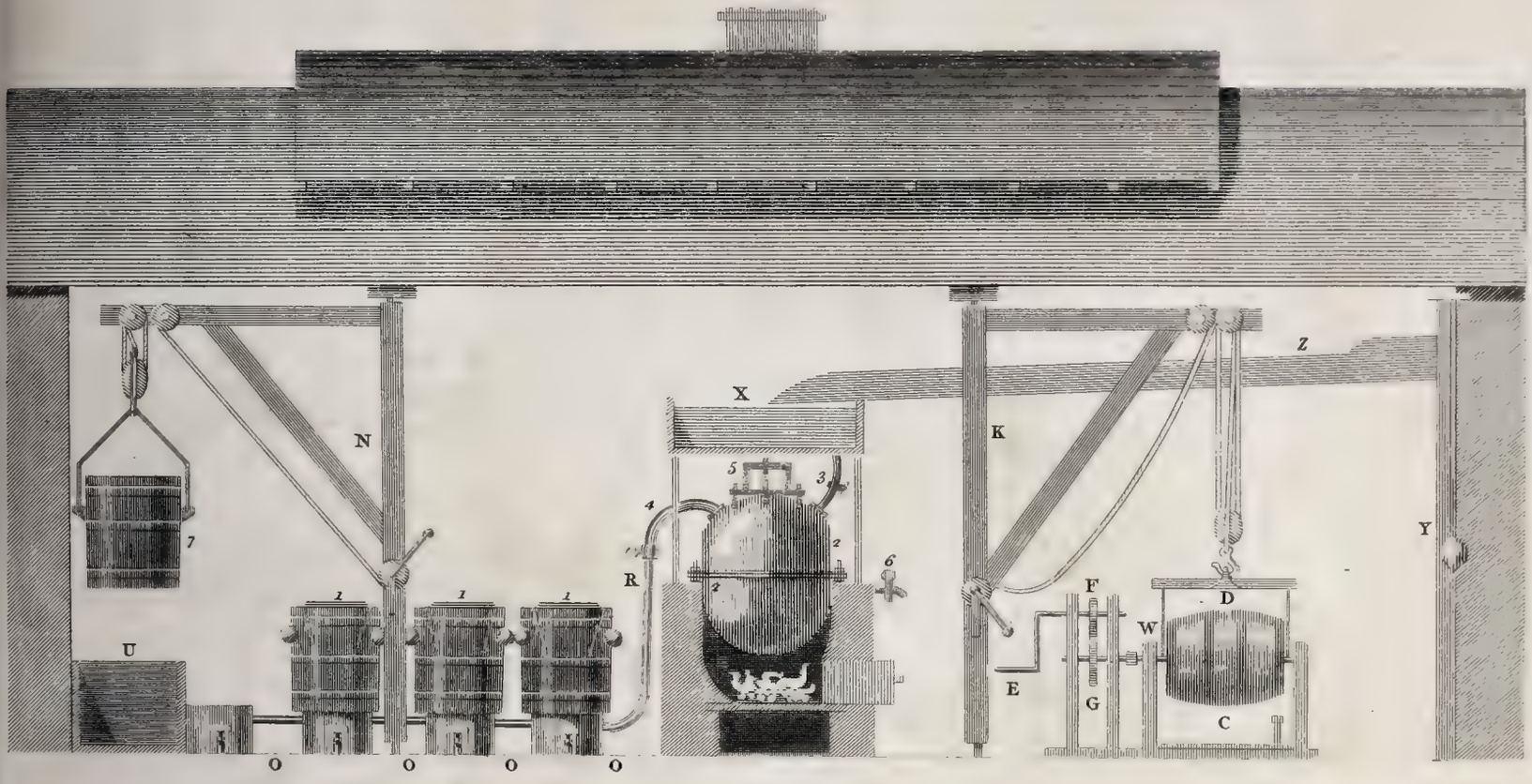
Fig. 6.

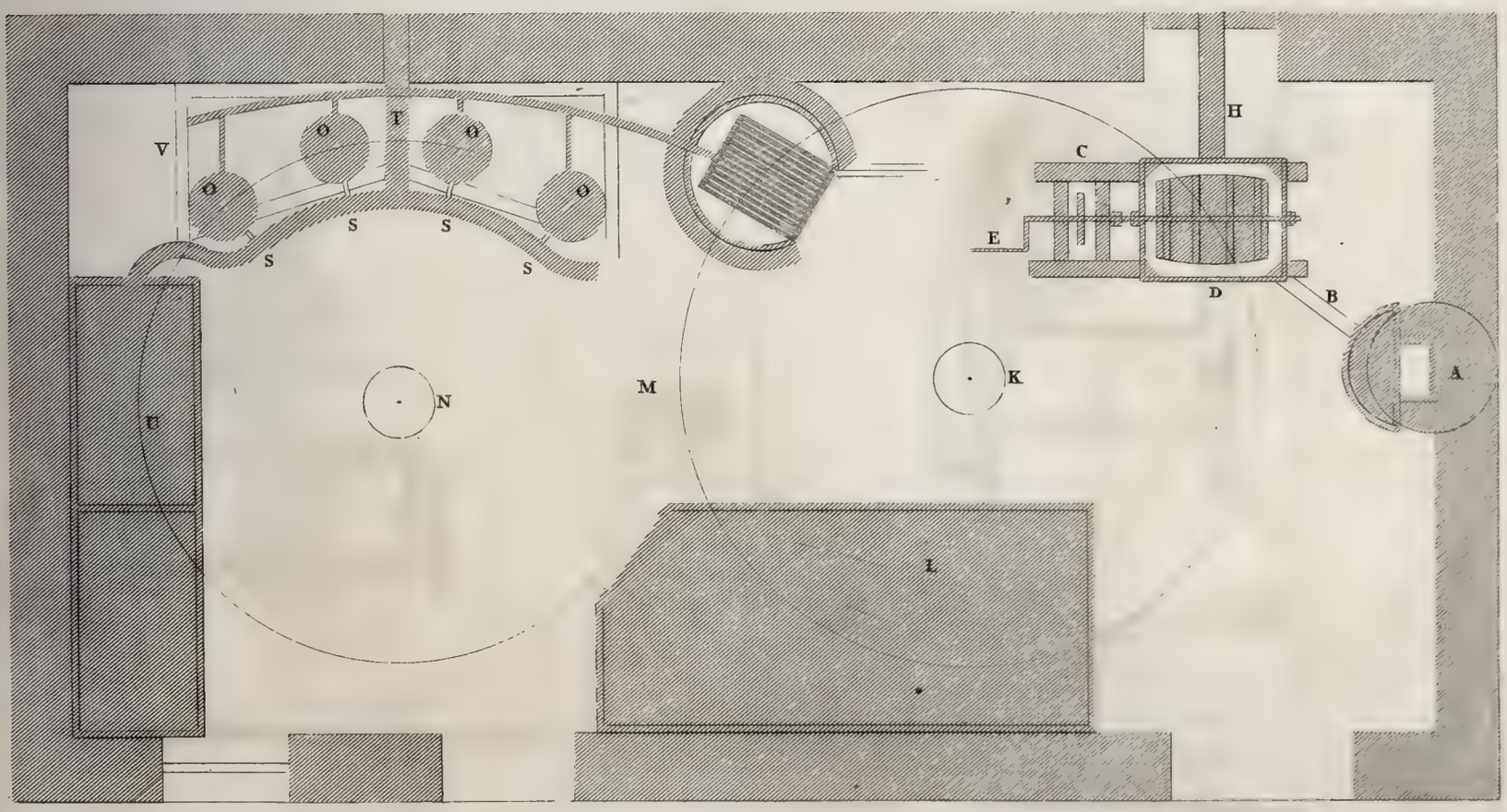


Blunt del. et sculp.

Published as the Act directs, June 1st 1807, by Longman, Hurst, Rees & Orme, Paternoster Row.

STEAMING APPARATUS.





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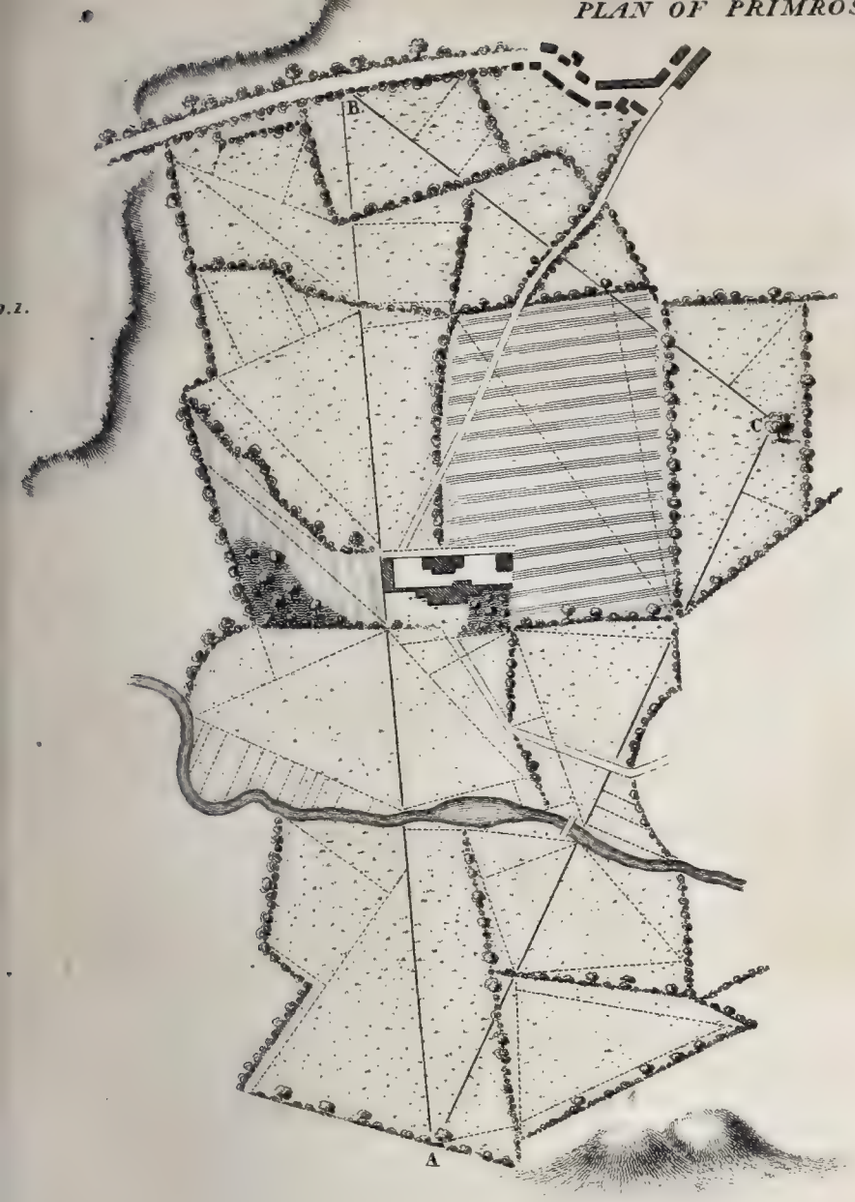
PLAN OF PRIMROSE FARM.



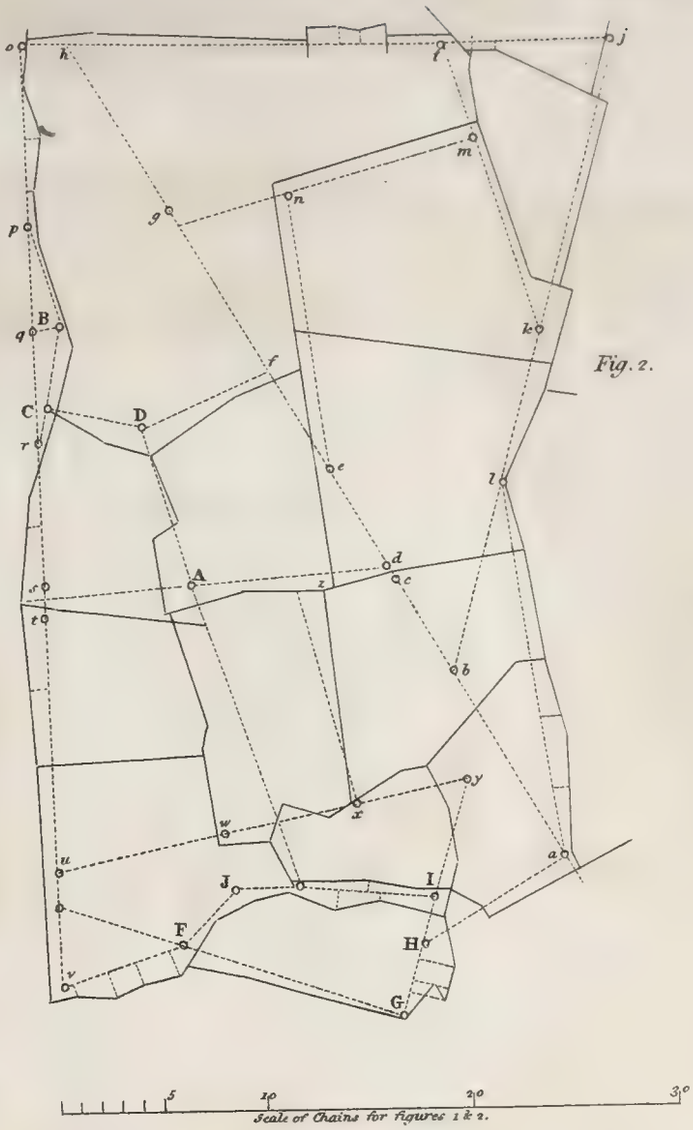
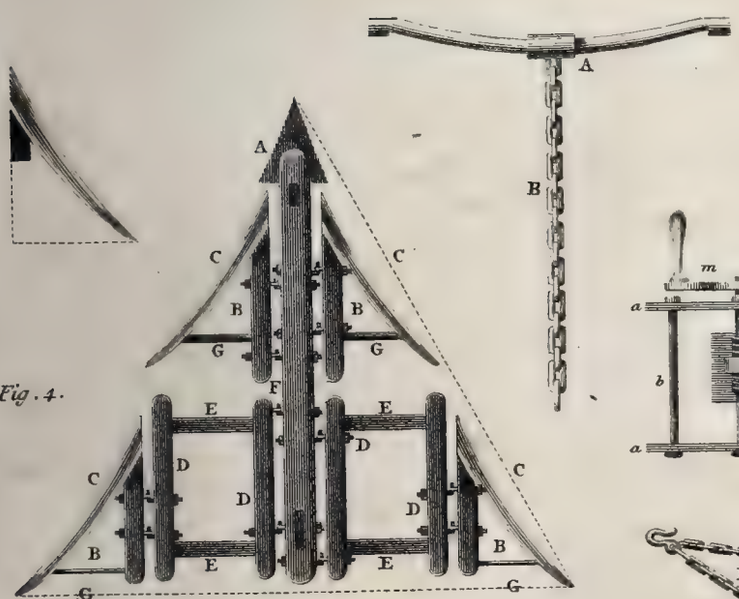


Fig. 2.

Scale of Chains for figures 1 & 2.



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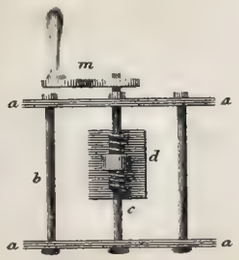

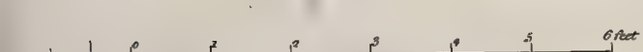

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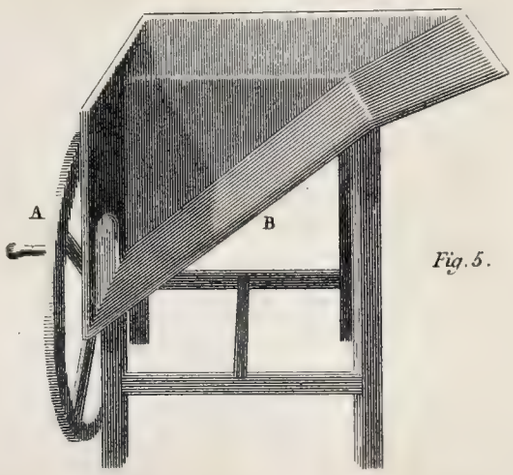

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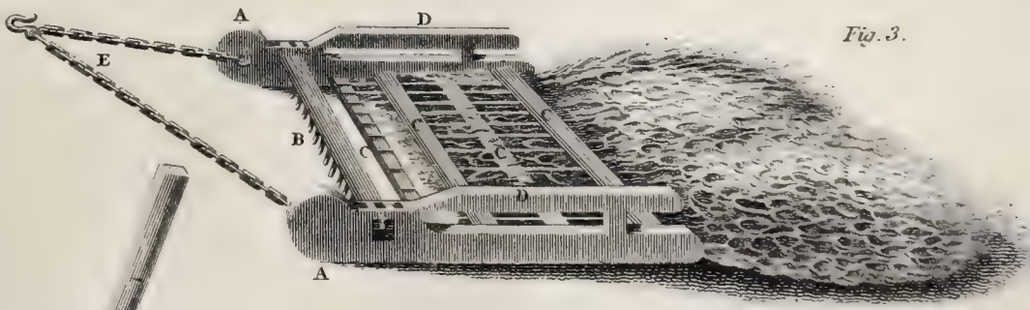

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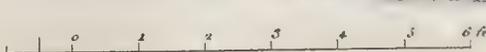

Scale for fig. 3.

J. Davis fc.

(1)

	1794	to l
	1464	22
109	1050	
	920	32
	650	60
	350	40
a	0	14

	3074	to b
	2494	
	2100	l
0	2072	
54	1730	
80	1530	
	1420	k
56 30	1170	
52	620	
j 32	280	40

	2574	j
	2494	
	2000	44
	1800	50
	1840	
50	1794	i
34 + 50	1464	
76	1328	
96	1240	
52 + 34	1130	
34	860	
h 66	190	

	4450	h
	3570	g
	2620	f
	2590	
	2210	
	2080	e
	1574	d
	1550	
	1510	c
	990	b
a	806	

(2)

30	1480	x
0	1320	
50	1110	
	1080	
	990	w
u	750	50

	4440	36
	4420	v
	3884	u
	3380	60
	2992	90
	2692	t
120	2624	
	2592	
	2500	s
	2070	56 leave off
	1900	
	1840	r
60	1770	
	1320	q
	800	p
leave off 40	650	
80	360	
o 20	170	

h produce by i	220	o
	100	46

	1310	56 to e
	836	56
n	684	50

	1480	90 to g
	960	24
	930	n
	700	48
m	400	30

	1430	to i
	1290	40
	1004	36
	980	m
	610	24
k	280	32

(3)

D	488	32

	2280	
	2270	E
20	2230	
56	2050	
	2030	

	1940	180 to w
	1552	180
	1380	96
	950	110
	860	24

	768	to A
	526	70
	496	
70	460	
40	124	
D	100	

	455	D
	400	76
C	48	0

	600	to r
	432	c
56	160	
B 44	36	

B	152	to q
p 24	480	B
	160	

0	1750	

	1600	44 to s
	1028	
	940	A
44	666	
70	310	
d 60	236	3

	2148	480 to b
	1950	y
128	1836	
	2724	
60	1600	

(4)

	580	to v
40	500	
76	300	
F 76	100	

	360	to F
J 20	150	

	954	J
15	850	

	730	to E
30	490	
	340	60
0	280	
I 20	170	50

	744	to H
	672	0
a 70	450	0

	1160	to y
32	1000	
	890	
	780	32
	590	40
	570	I
	530	40
	376	H
	256	150 leave off
	190	64
G	144	130

	1676	0
	1676	30
	896	24
	632	
	620	50
180 from u towards v	588	F

	1068	to x
0	1032	
28	850	
70 from z towards A 44	528	

	644	to f

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SWINE.

Fig. 1.

Fig. 2.

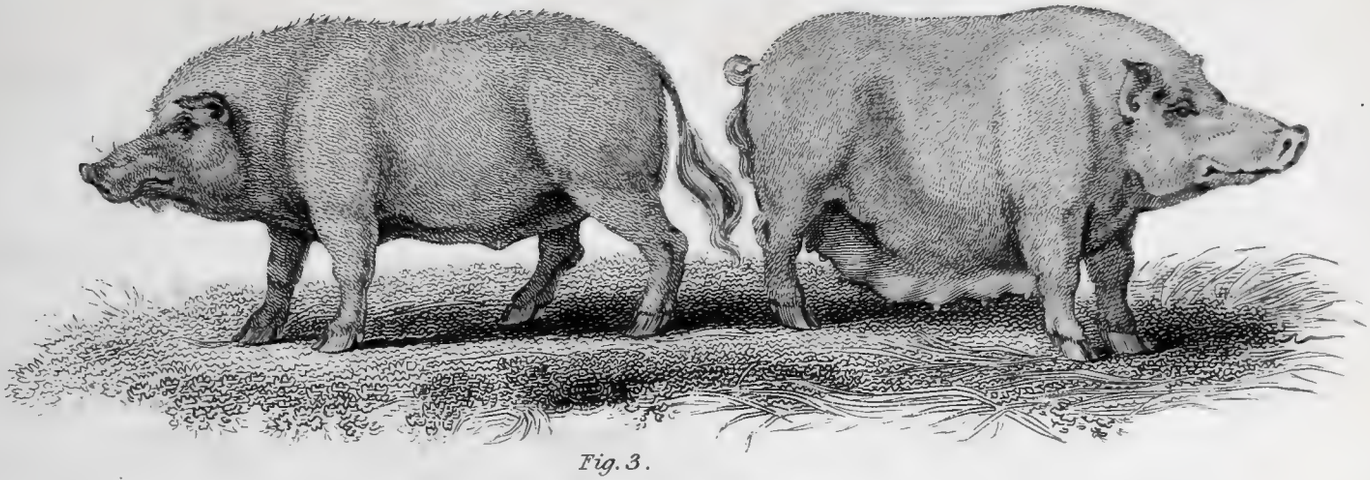
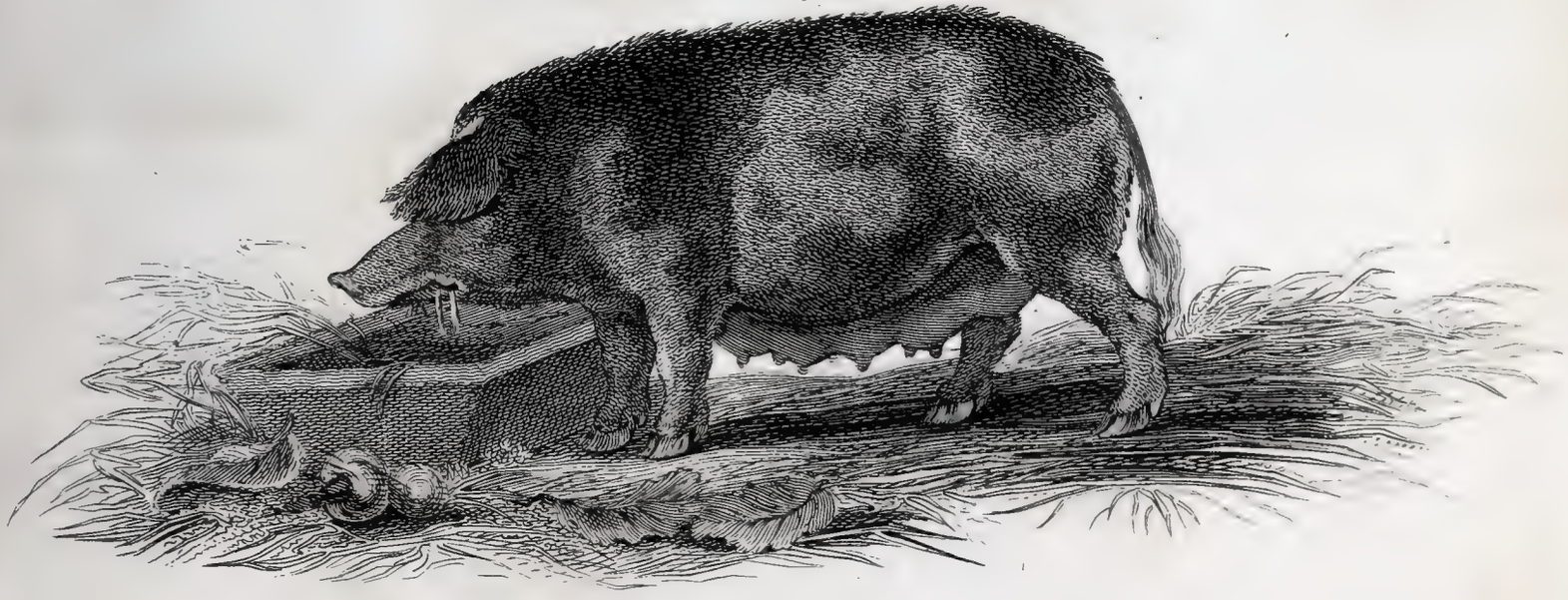
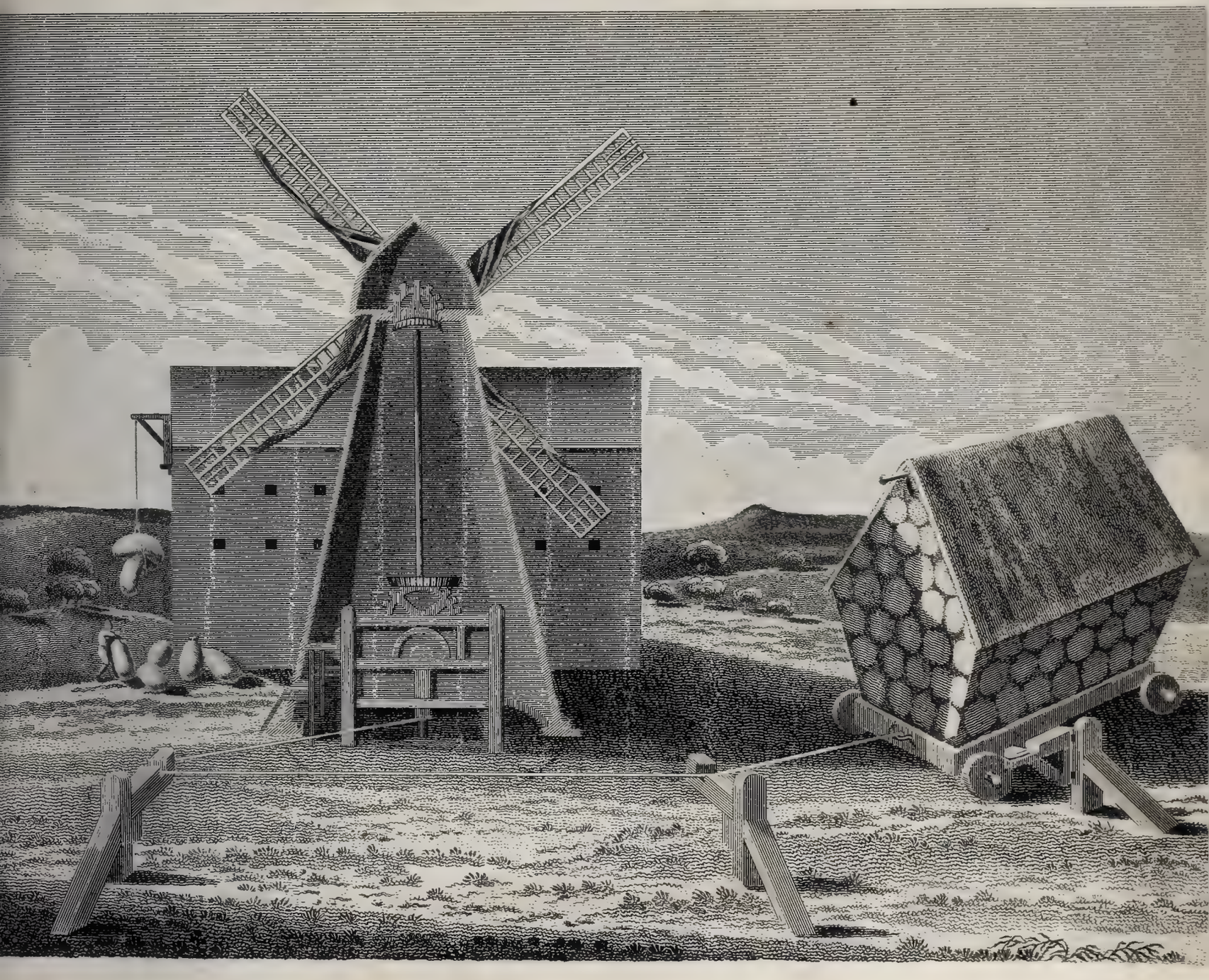


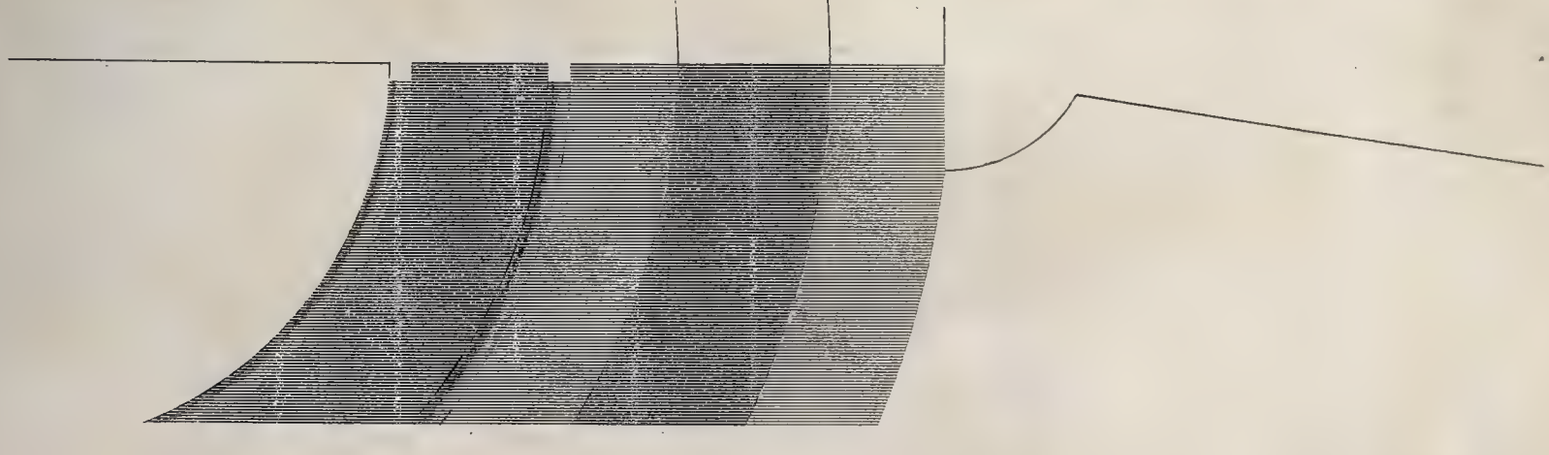
Fig. 3.

Fig. 4.



STACK AND THRASHING YARD.





J. Davis sculp

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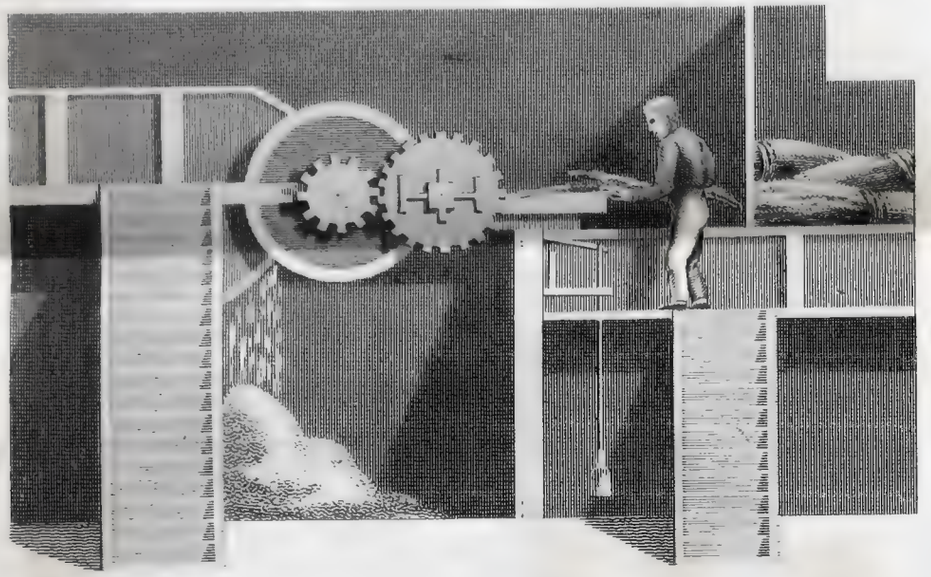
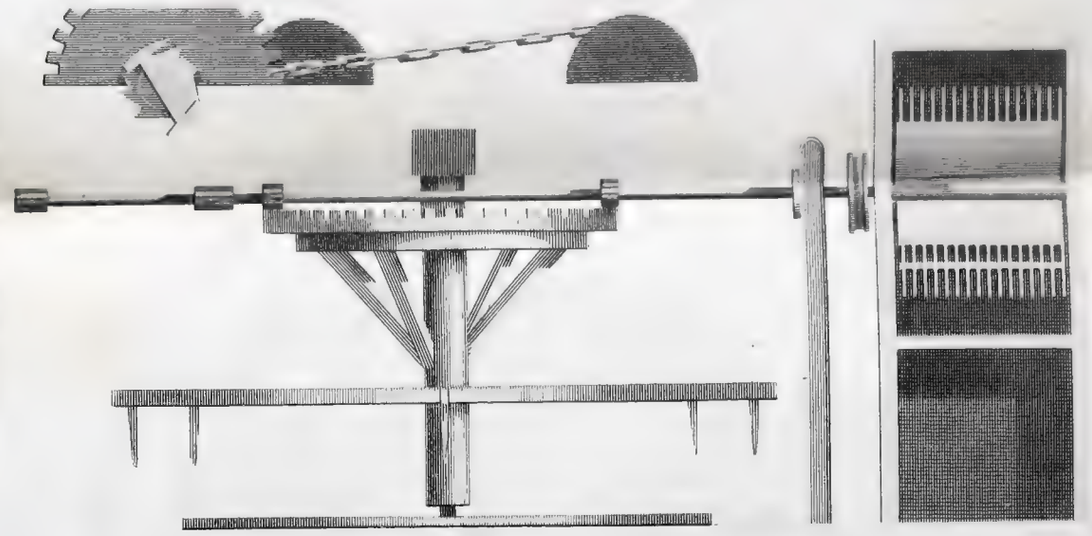
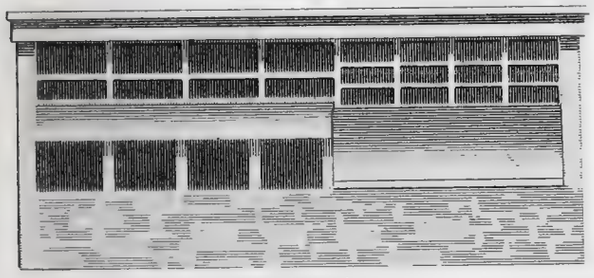




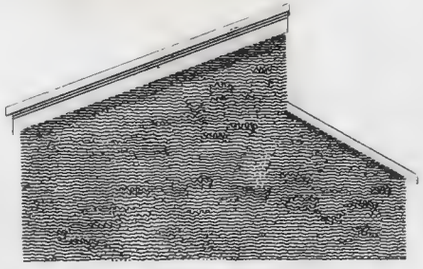
Swine Pen.

Fig. 4.



Back Elevation.

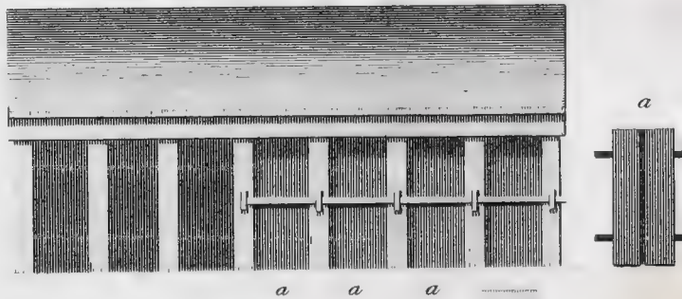
Fig. 5.



End Elevation.

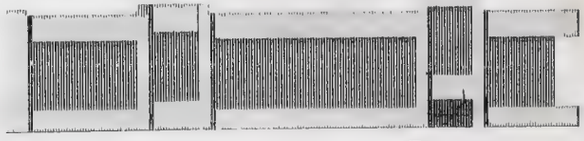
Front Elevation

Fig. 3



a a a

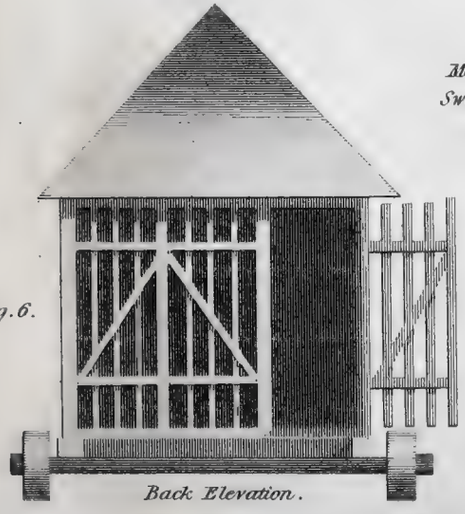
Fence for y^e Front.



Entrance Entrance

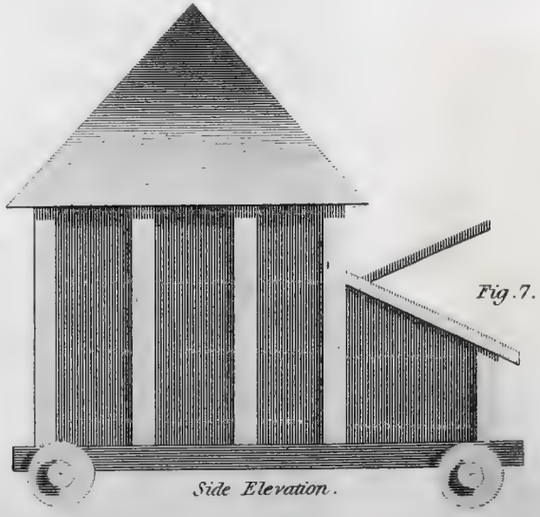
Moveable Swine Pen.

Fig. 6.



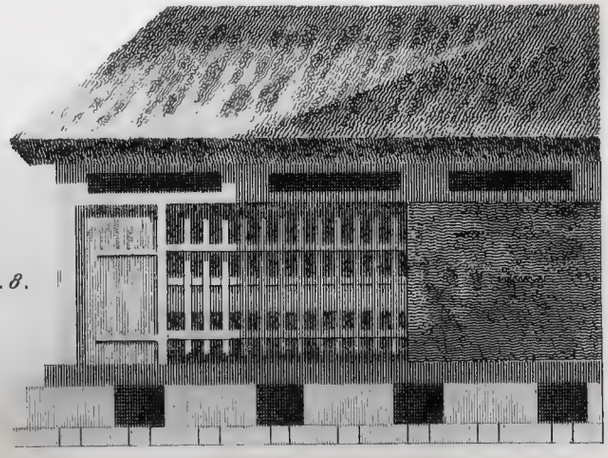
Back Elevation.

Fig. 7.



Side Elevation.

Fig. 8.



Calf Pen.

Fig. 9.

Floor of Calf Pen.

Scale for Figures 3. 4. & 5.

0 1 2 3 4 5 6. Feet.

J. Davis sculp^t

STACK AND THRASHING YARD.

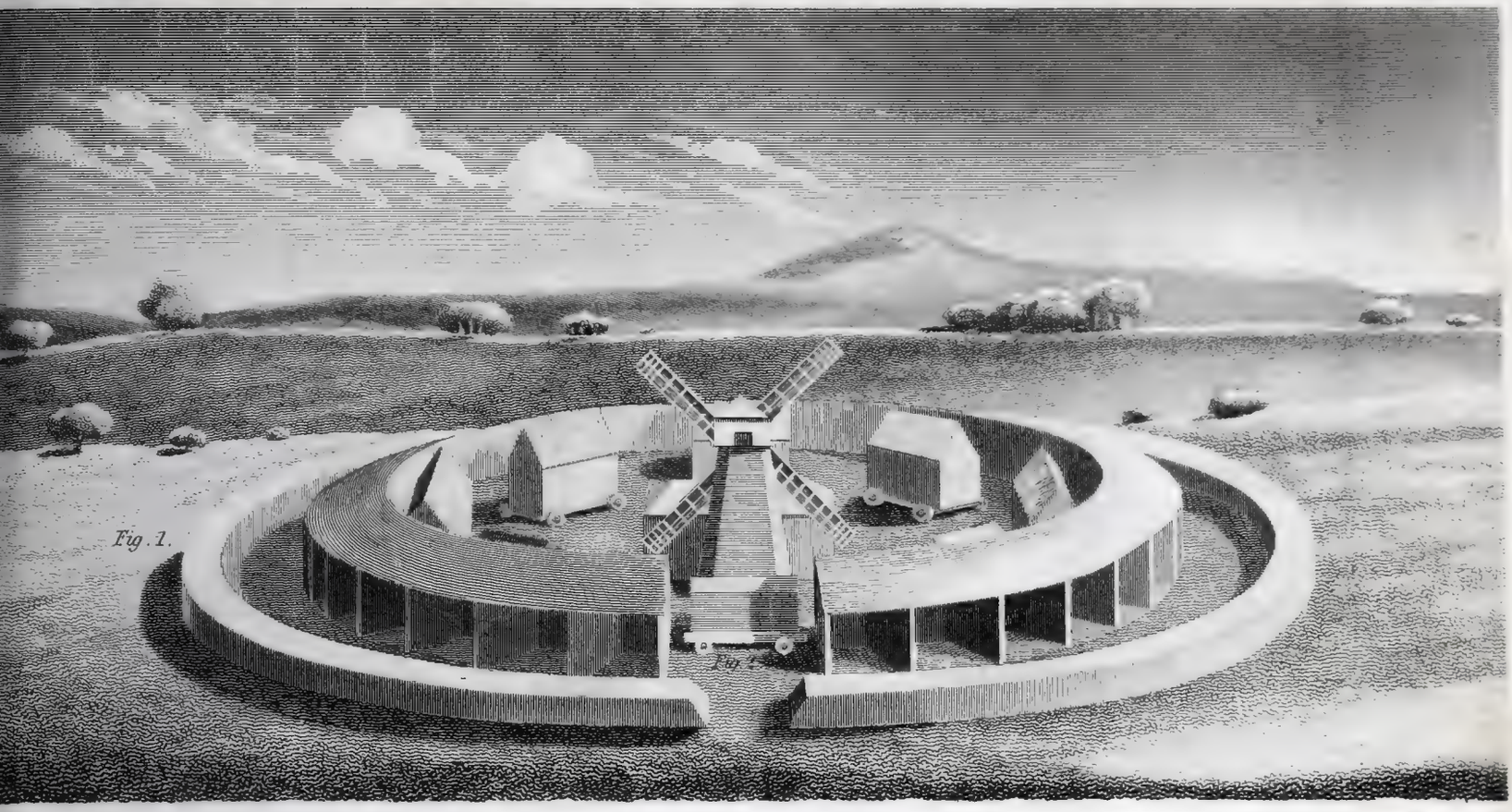


Fig. 1.

Fig. 2.

Fig. 3.

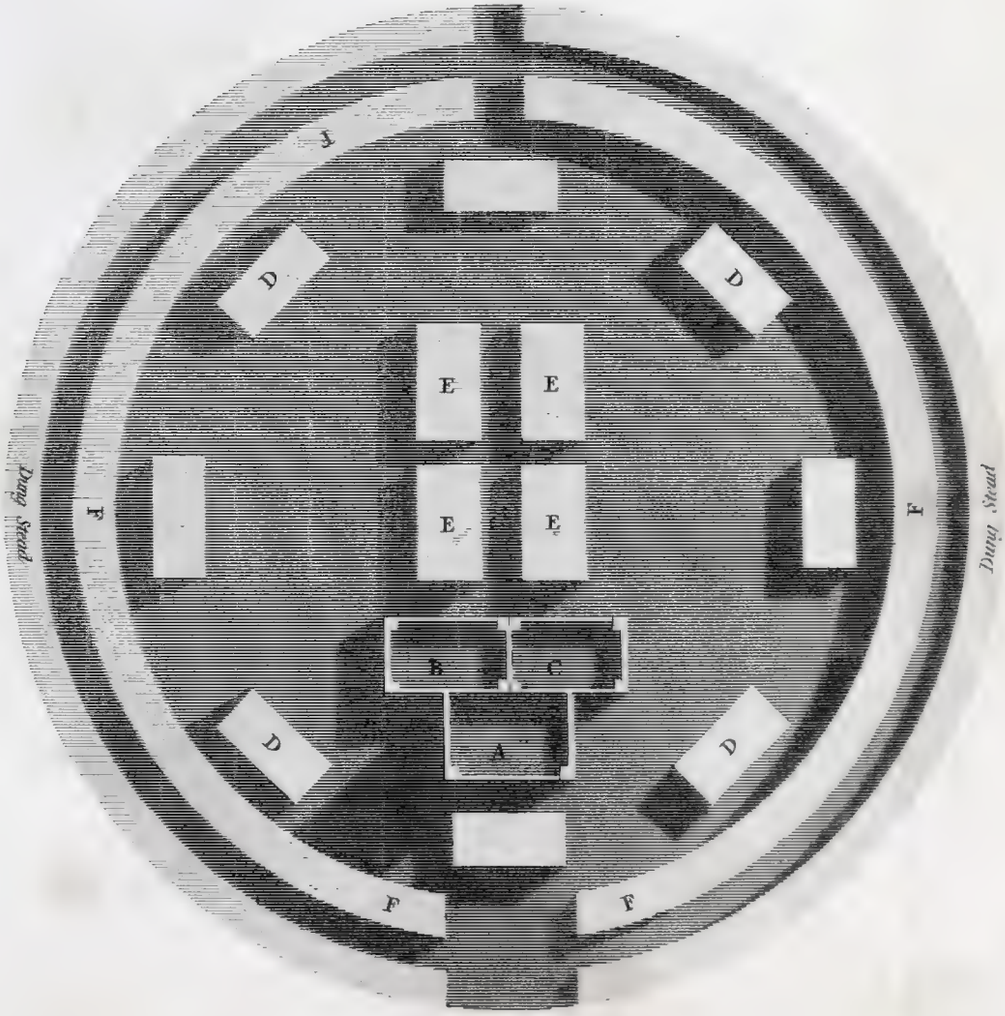
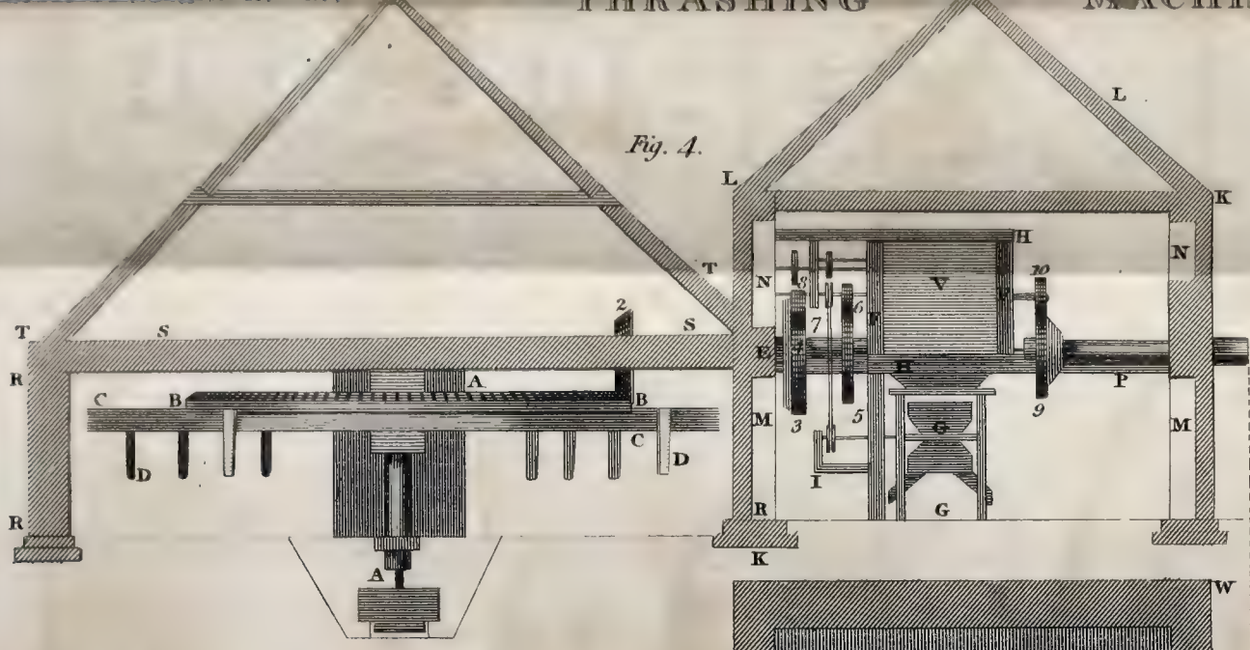
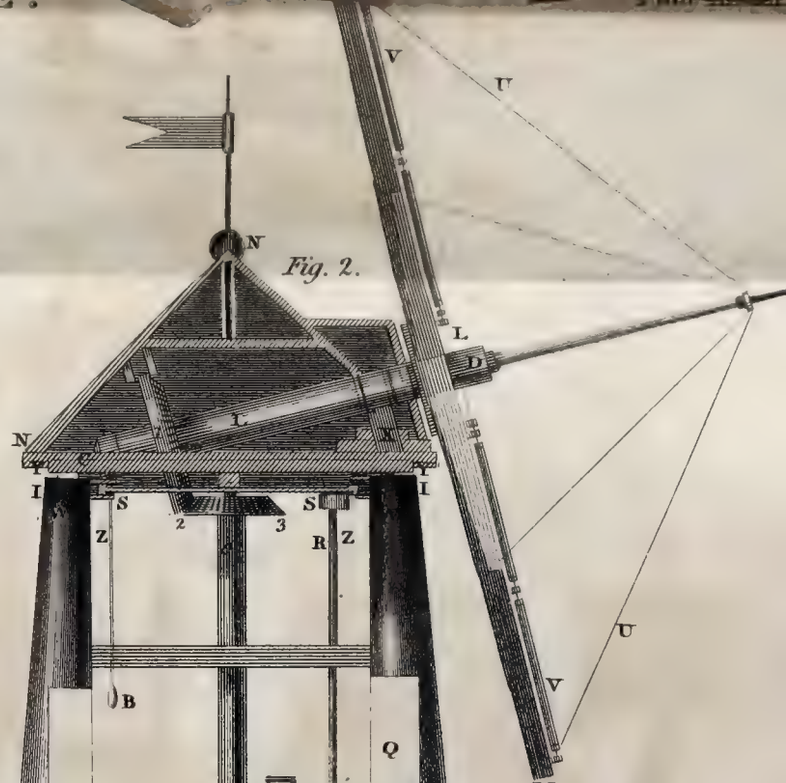


Fig. 4.

THRASHING MACHINE.





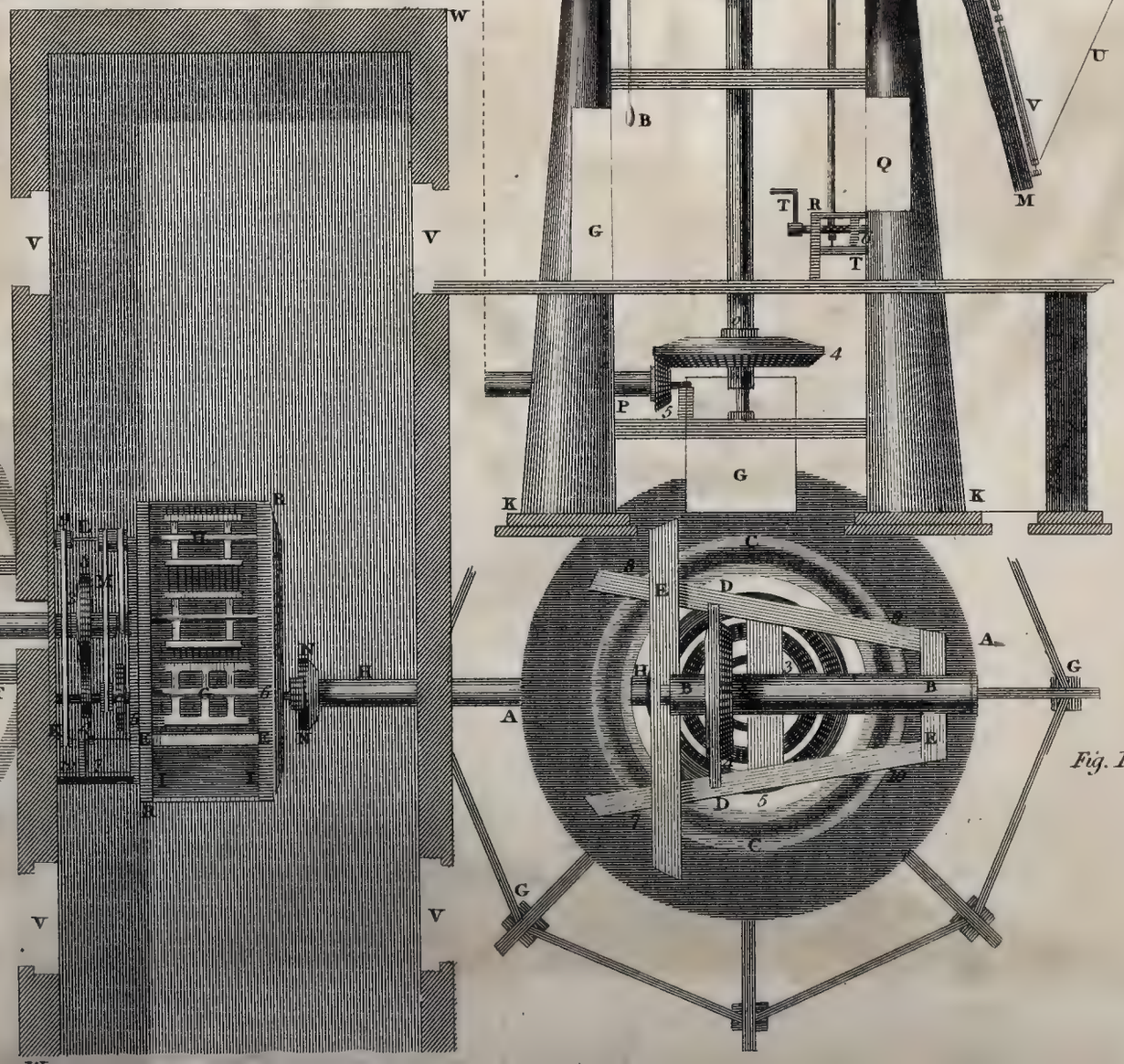


Fig. 1.

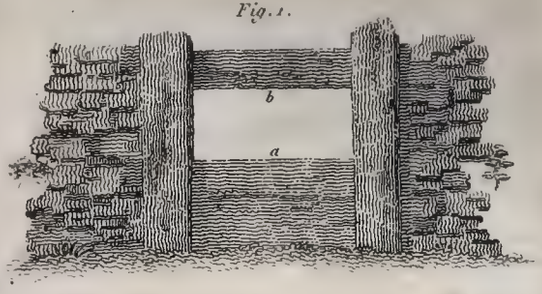
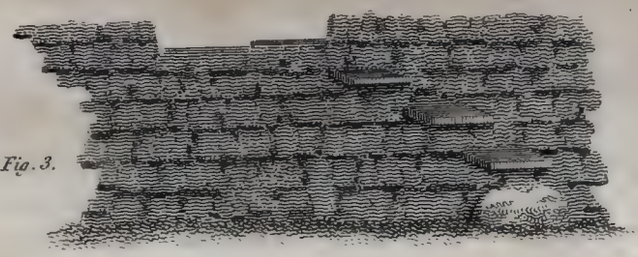


Fig. 3.



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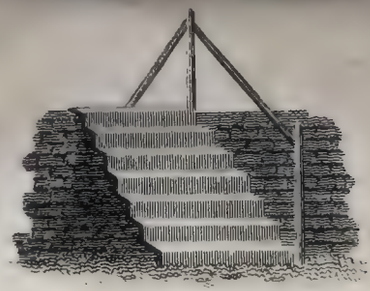

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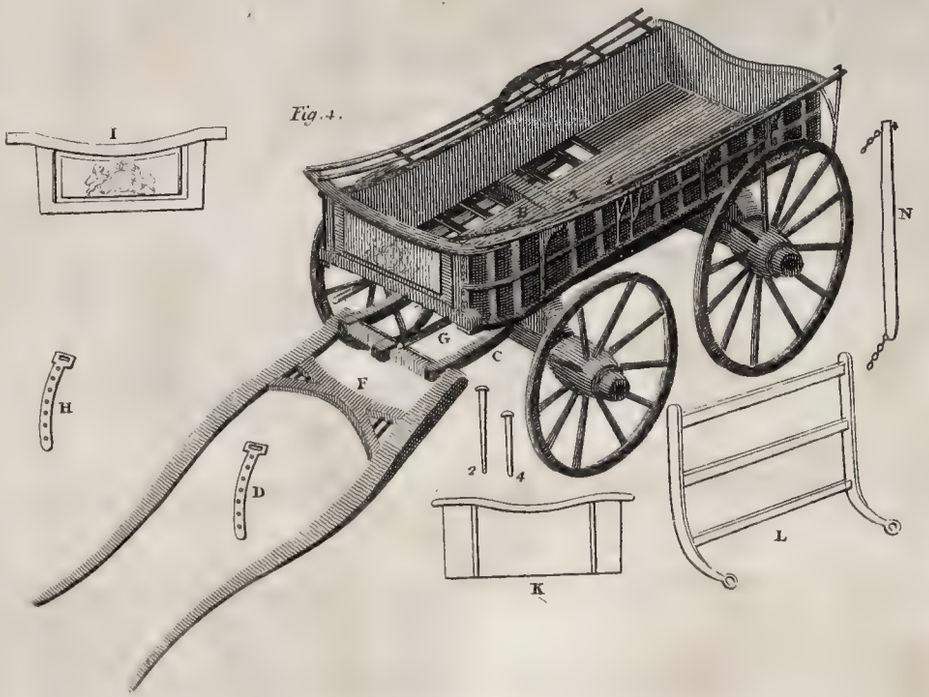

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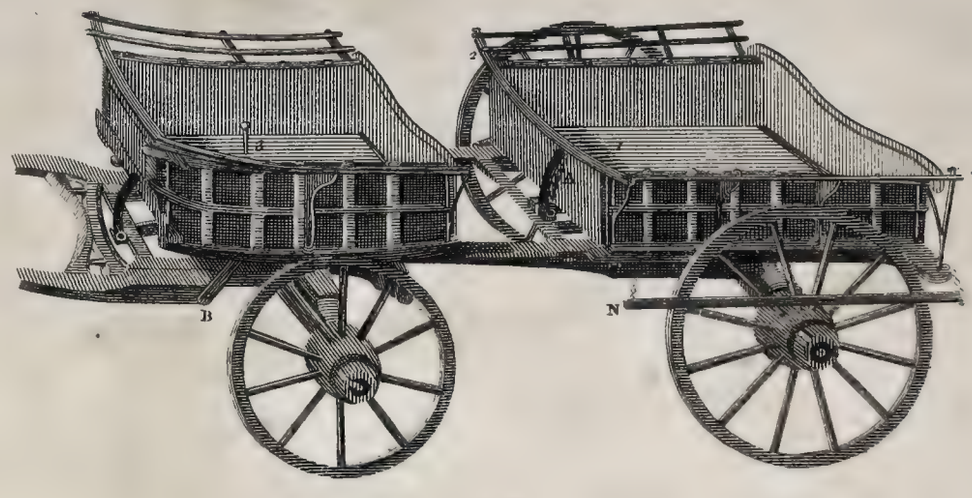

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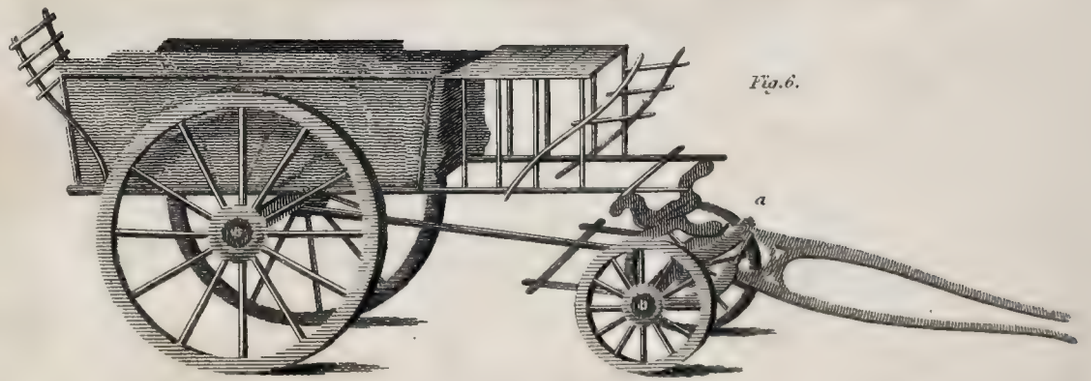

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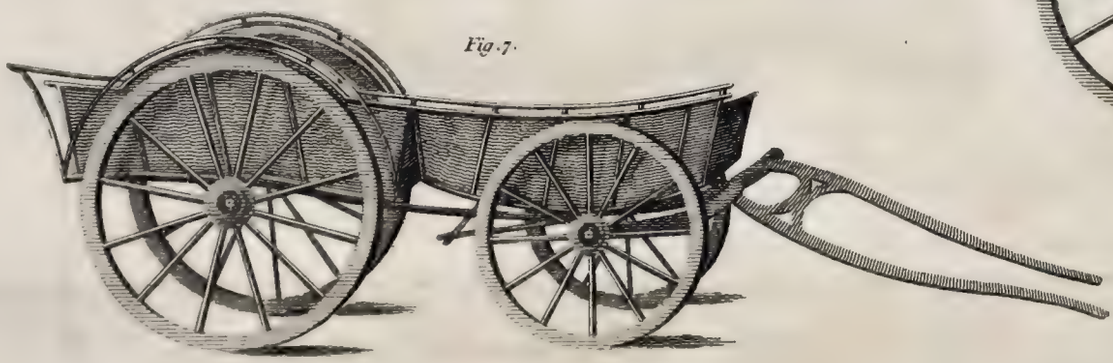

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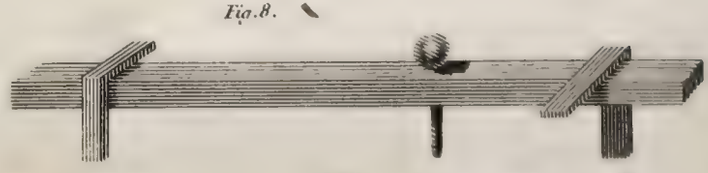

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WATERING.

Fig. 3.

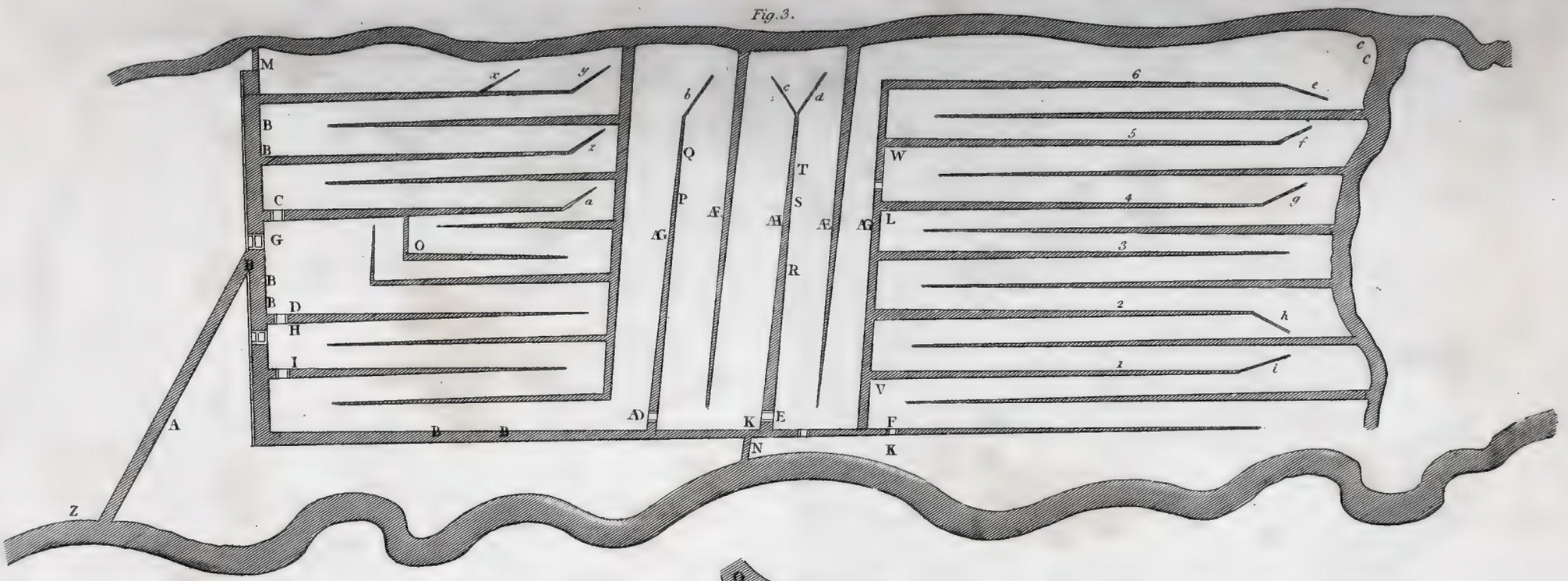
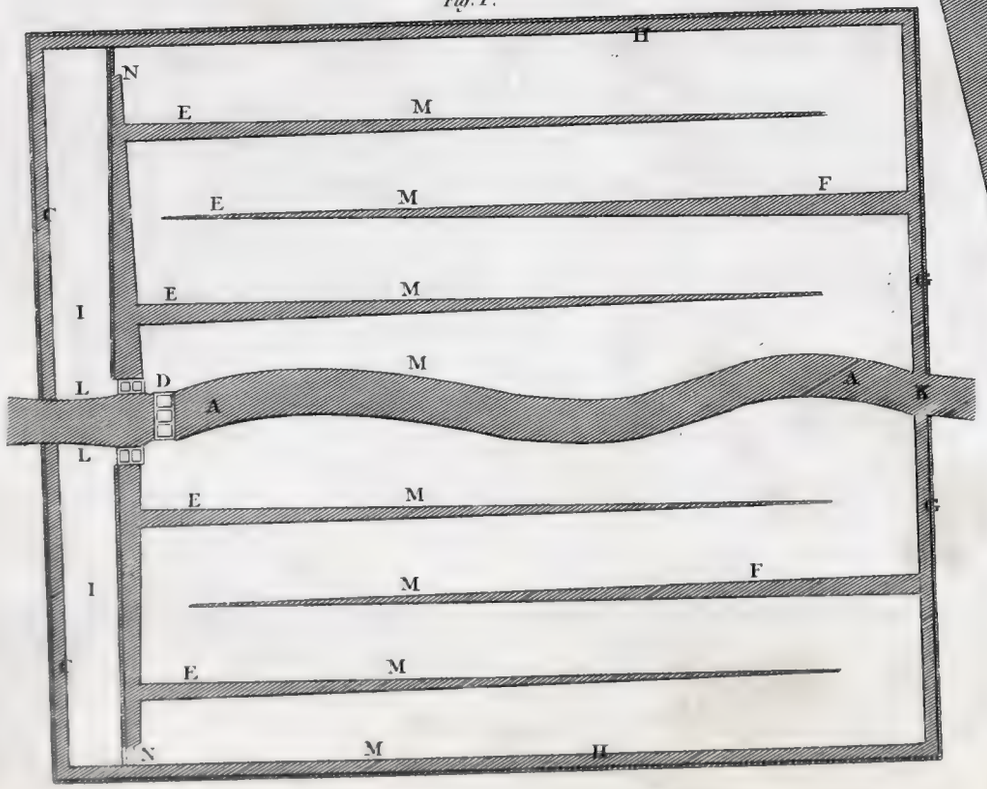


Fig. 1.



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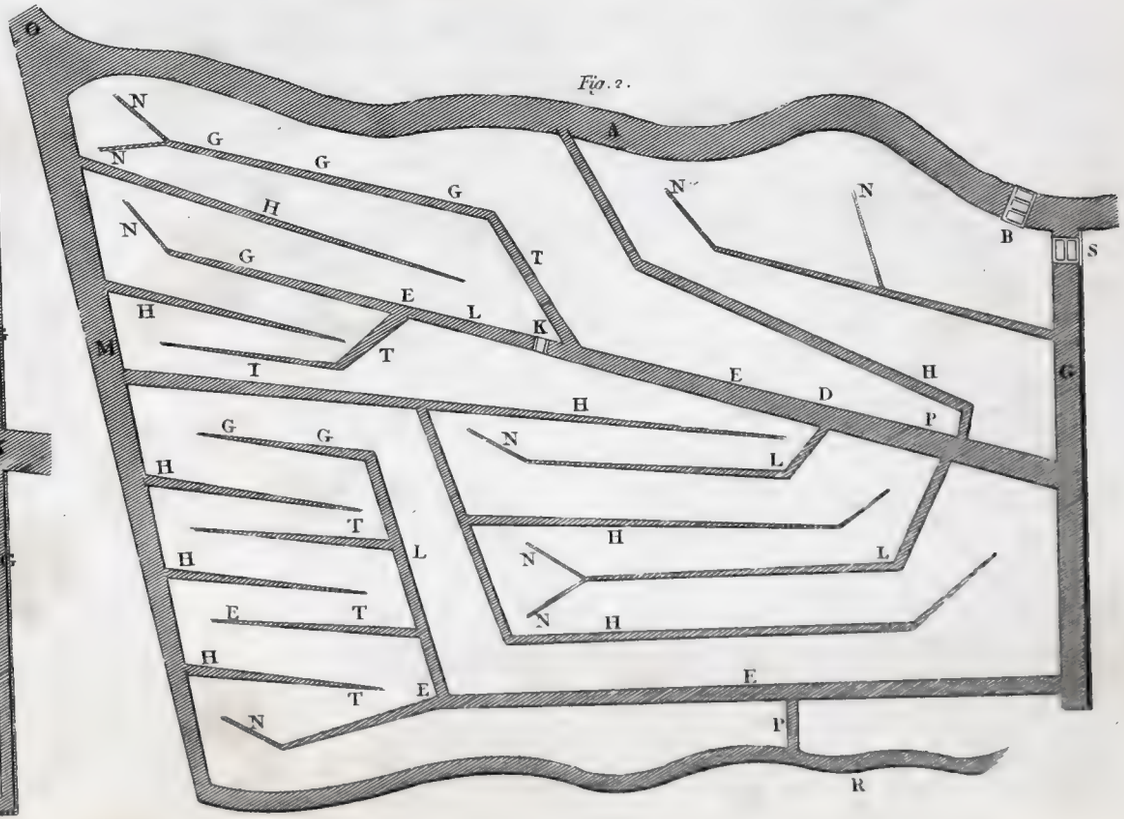

WATERING OF LAND.

(Plan of Watered Meadows in Wales.)

Plan of watered Meadow on the Duke of Bedford's Prisley Farm.

WEIGHING MACHINES.

Fig. 8.

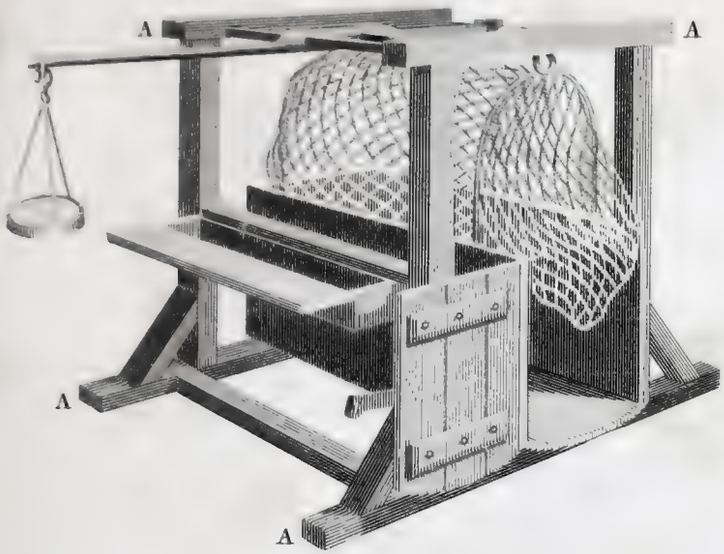

Fig. 7.

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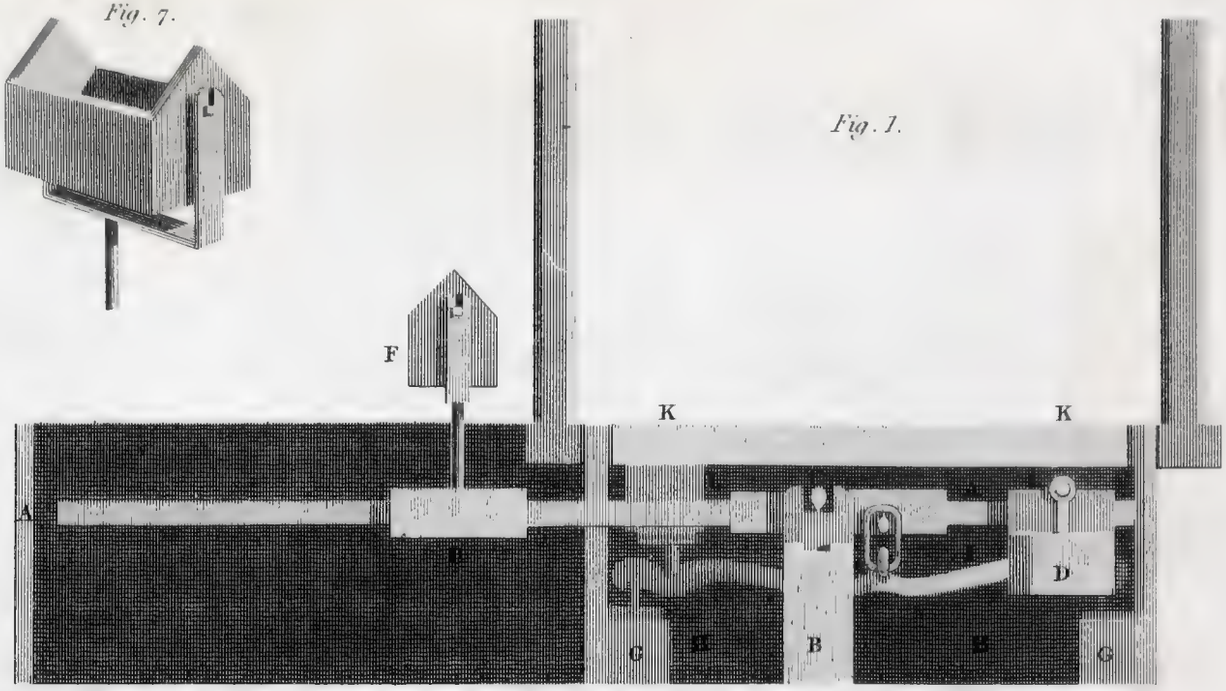
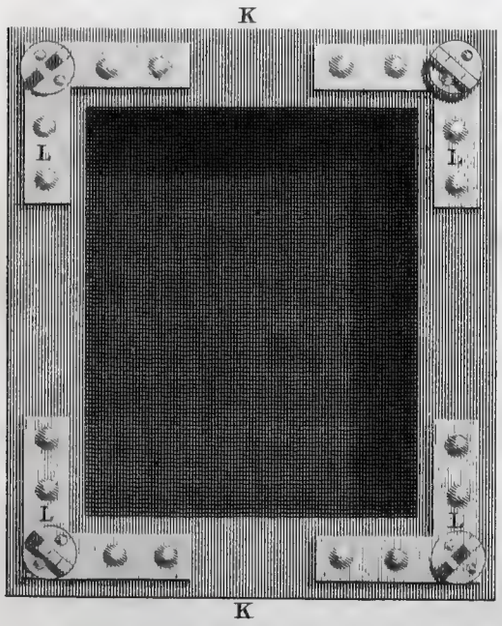


Fig. 3



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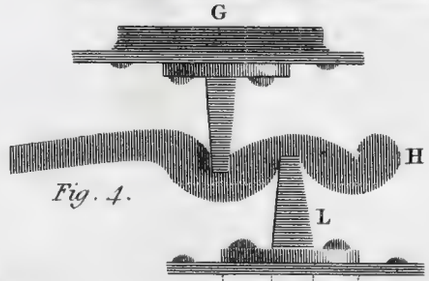

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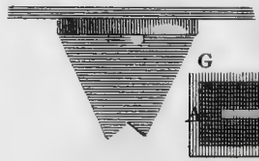

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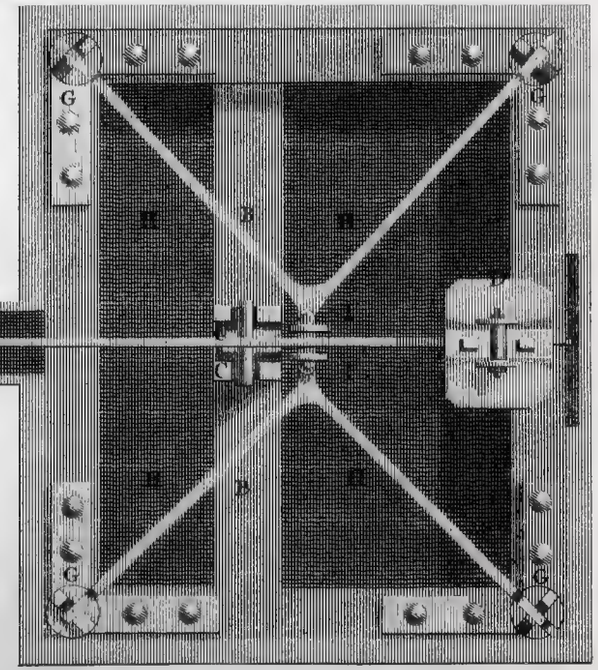

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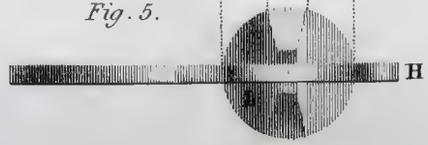

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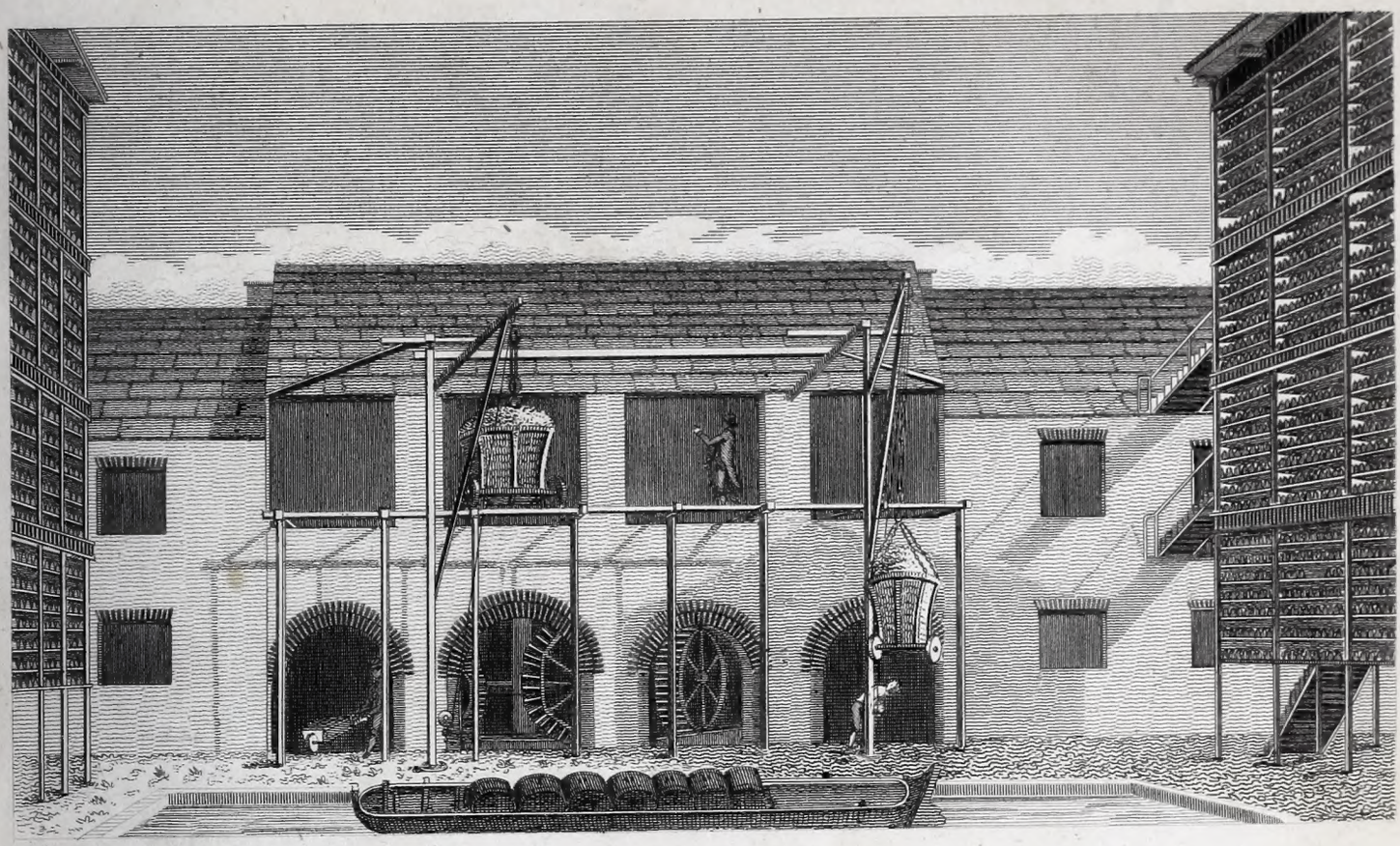
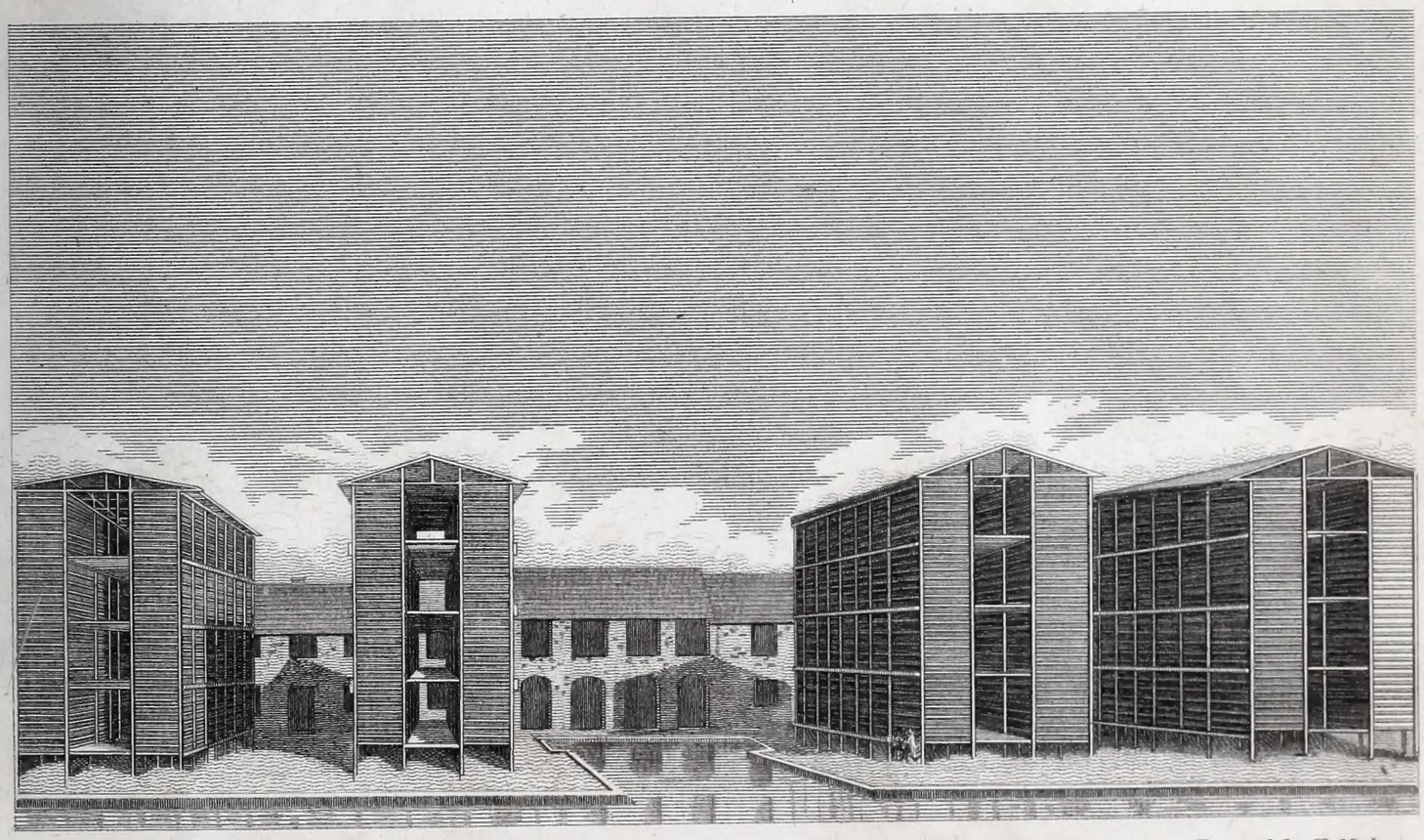
WOAD APPARATUS.





Engraved by H. Mutlow.

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